Table of Contents

Table of Contents

Foreword

Introduction to First Aid

Anatomy and Physiology

Infectious Diseases and Universal Precautions

Patient Assessment

Oxygen

Basic Life Support

Automated External Defibrillator (AED)

Chest Injuries

Shock and Severe Bleeding

Head Injuries

Spinal Injuries

Wounds

Dressings, Bandages and Slings

Fractures, Dislocations and Soft Tissue Injuries

Immobilizing Fractures, Dislocations and Soft Tissue Injuries

Medical Conditions

Environmental Injuries

Poisoning, Drug and Medication Abuse

Miscellaneous Treatments

Pediatric First Aid

Transporting Patients

Persons with Disabilities

Glossary

Foreword

The Canadian Ski Patrol Patroller's Manual is issued under the authority of the Canadian Ski Patrol (CSP) Board of Directors.

This edition of the manual is effective upon publication and supersedes all earlier editions. Suggestions for amendments should be forwarded to the National Office of the CSP.

Acknowledgements

The CSP expresses its appreciation to other organizations who have contributed information for use in this manual, to individuals outside of the CSP who have advised and assisted in its development and to many of its members who spent countless hours writing, illustrating, editing and proof reading the material. Without this devoted support this manual could never have been produced.

The skills performance guidelines for basic life support (BLS) in this training program have been developed by the Canadian Ski Patrol in collaboration with the Heart and Stroke Foundation of Canada, the Canadian Red Cross Society, the Life Saving Society Canada and St. John Ambulance.

The continued funding of this manual is made possible by many zone, division and individual donations and the Sponsor-a-page program.

Preface

The CSP Patroller's Manual provides to patrollers and prospective patrollers the basic elements of patrolling and first aid essential to the effective and efficient conduct of their duties. The manual contains the basic information upon which system-wide membership examinations will be based. For ease of reading, the pronoun he, wherever used, refers to both the male and female person without discrimination.

This manual is not to be construed as all encompassing. It is a uniform guide to a basic understanding of the CSP organization, first aid, procedures and programs. This information is based on the knowledge, expertise and accumulated experience of many people.

The CSP Patroller's Manual demonstrates one method of practice that is effective in the majority of situations encountered by patrollers. It does not purport to be the sole method. Patient safety is paramount at all times and in all practices.

The reader is encouraged to broaden his knowledge and skills by referring to other relevant reference material and by dedicated practice.

By proper use of this manual, an unsurpassed standard of proficiency can be achieved by the members of the CSP, which will permit the CSP to fulfill its objectives of safety and service to the skiing public of Canada in a competent manner.

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Many patrollers from across the country also helped to improve the CSP Patroller's Manual by submitting education change requests. Thank you!

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Special thanks to all the spouses, partners and friends that had the patience to endure the endless hours spent by the CSP members on the production of this edition and also to those who supported the continuous improvement of the CSP manuals by their contributions to previous editions.

About the Canadian Ski Patrol

The Canadian Ski Patrol is a non-profit corporation comprising highly-trained volunteer members. The organization is national in scope, and was formed to promote safe skiing and to provide assistance to injured skiers. The CSP provides a uniformly highly-skilled and responsible service to the snow sliding public.

Originally founded in 1941 by Dr. Douglas Firth, the corporation was constituted under the name of the Canadian Ski Patrol System as a non-profit corporation, without share capital, under letters patent issued under the seal of the Secretary of State of Canada, and dated the 20th of August 1962.

Fast facts

- The CSP is comprised of 4,396 volunteers from coast to coast to coast in Canada in 61 zones and nine divisions.
- The organization provides first aid services at 230 alpine and nordic ski areas across Canada.
- Members provided 260,000 hours of service to these ski areas last winter.
- Members provided 12,000 hours of first aid services at off-snow events which includes events such as marathons, mountain bike races, concerts, etc.
- Our patron is the Governor General of Canada, His Excellency the Right Honourable David Johnston.
- The majority of CSP members volunteer their time for the services they deliver. A number also become paid patrollers at ski resorts across Canada.
- The CSP also provides on-snow training, safety and accident scene management training to members.
- The basic, standard and advanced first aid courses are recognized by the federal government (HRSDC) and the majority of the provinces in Canada.
- Patrollers must recertify their first aid qualifications every year by taking a refresher course that is a minimum of 16 hours and passing a written, skills and diagnostic exam.
- The CSP medical advisory committee is comprised of five physicians and the pre-hospital care advisory committee is comprised of six pre-hospital care or hospital emergency workers.
- Provides insurance coverage for each member for the first aid services provided.
- Is a founding member of the Fédération Internationale des Patrouilles de Ski (FIPS), an international corporation made up of ski patrol organizations representing ski patrollers and ski safety bodies in their respective countries.

For more information or to join, please visit the Canadian Ski Patrol website at http://www.skipatrol.ca.

CSP course offerings

This table lists all of the course offerings provided by the Canadian Ski Patrol.

Product name	Purpose
Advanced First Aid (AFA)	Candidates wishing to become an advanced medical responder and Regular Member of the CSP to provide patrolling services at snow resorts across Canada.
Advanced First Aid- Modified (AFA-M)	To allow medical professionals trained by their profession to take a condensed version of our AFA course, recognizing their higher level of medical knowledge when they begin the course.
Wilderness First Aid (WFA)	To enable CSP instructors to teach Wilderness First Aid courses to Parks Canada personnel. Specifically, to Parc de la Mauricie personnel (Mauricie Zone) Québec Division.
Basic First Aid (BFA) * pilot in approved zones only 2010-2013	To provide first aid training to the general public to meet the requirements of Ontario Regulation 1101 for employers with up to 5 employees.
Standard First Aid (SFA) * pilot in approved zones only 2010-2013	To provide training to non-ski patrol staff at ski resorts across Canada which will allow them to provide first aid services until more qualified individuals arrive. Meets the requirements of Ontario Regulation 1101 for employers with up to 200 employees.
CPR / AED * pilot in approved zones only 2010-2013	To provide CPR and AED training to the general public.
Extended Protocols (EP) * pilot in IMZ at Silver Star, Hemlock and Manning Park only 2009-2013	Focus on patient care where distance and time to higher level care may be extensive. At areas where the time and distance are involved in getting the injured to a higher level of care in the time before they are transferred to the EMT.
On Snow Alpine – alpine ski, telemark ski, snowboard Nordic	To provide Regular Members of the CSP with the skills necessary to provide alpine and/or nordic on snow rescue and evacuation procedures.

Product name	Purpose
Avalanche Skills Training 1 (AST 1)	To provide knowledge of avalanches and to develop avalanche rescue skills for ski patrollers at areas with avalanche terrain and avalanche danger.
Avalanche Skills Training 2 (AST 2)	To provide an intermediate level decision-making framework for travel in avalanche terrain. To build intermediate avalanche skills for patrollers at ski areas with avalanche terrain and avalanche danger.
Companion Rescue Skills Course	To update and improve upon search and rescue abilities learned in the AST Level 1 course.
Instructor Certification Program (ICP) Assistant Instructor (AI) Course	Focus is on general principles of adult learning. Preparation to assist instructors.
Instructor Certification Program (ICP) Instructor (I) Course	Focus is on more advanced teaching principles. Preparation to develop and run AFA; AFA-M; EP and On Snow programs. Preparation to instruct and evaluate patrollers.
Instructor Certification Program (ICP) Instructor Trainer (IT) Course	Focus continues with advanced teaching principles. Preparation to develop and run complete instructor education programs. Preparation to instruct and evaluate instructors.

For more information on any of these course offerings, please visit the Canadian Ski Patrol website at http://www.skipatrol.ca.

Introduction to First Aid

Upon completion of this chapter the student will be able to:

1. Define first aid.
2. List the qualities of a good first aid provider.
3. List the seven steps of responsibility of a patroller.
4. Differentiate between actual consent and implied consent.

Learning outcome

Identify and show understanding of the role and responsibilities of the first aider, and the qualities needed to be effective in this role.

What is first aid?

First aid is the initial emergency care provided to a person suffering from trauma or sudden illness until professional medical assistance is available to take over the care of the injured person.

The aim of first aid is to:

- Save lives.
- Prevent a patient's condition from worsening.
- Alleviate or minimize suffering until professional medical care becomes available.

First aid is the first link in the emergency medical services (EMS) system.

What makes a good first aid provider?

A good first aid provider is someone who:

- Has technical knowledge by virtue of their training and learning.
- Holds a current first aid certificate.
- Is able to use their knowledge to assess the situation and administer first aid as needed.
- Is able to react confidently under pressure.
- Presents and maintains a professional appearance.

First aid provider responsibility

A first aid provider's responsibility is to take charge of an emergency situation through definitive command and confident action. Below is a description of your responsibilities as a first aid provider when handling an emergency situation.

Survey the scene

Evaluate the overall situation to determine the nature of the emergency and extent of the injuries. Assess the scene for danger to yourself, bystanders and the patient. If it is safe to do so, remove the danger. If not, move the patient and bystanders away from the danger.

Evaluate signs and symptoms

Both signs and symptoms are important. A sign is something you observe or detect, such as bleeding or shortness of breath. A symptom is a feeling that the patient experiences and reports to you, such as: *"I have a pain in my chest," or "I'm dizzy."*

In assessing an injured person, consider the signs and symptoms to determine the problem and respond to the emergency.

Gather information about the incident and the injured

As a trained first aider, your arrival on the scene is usually all that's needed to provide a sense of comfort and security to the injured. *"I am a member of the Canadian Ski Patrol trained in first aid. May I help you?"* is often very welcome.

After you have been given consent to help, "What's wrong?" is the obvious question. Frequently, though, the patient is confused and upset. Your best source of information may come from witnesses, friends or MedicAlert tags.

This information, together with the signs and symptoms, enables you to best assess and evaluate the situation.

Be professional

Calm and reassure the injured person. Words of comfort are an important first aid measure to the injured person; they prevent anxiety-induced complications and help simplify examination and handling of injuries.

Keep curious bystanders out of the area or assign them to non-critical tasks. This will help keep them out of your way, occupied and safe.

If you delegate responsibilities to others, ensure that assigned actions are carried out.

Prompt and effective care

This manual and the training given by the Canadian Ski Patrol will provide you with the knowledge and necessary training to deliver prompt and effective care to the injured person.

Communicate with appropriate personnel

Establish and maintain communication links with medical services to ensure prompt action is undertaken. Seek competent help wherever possible and as soon as you can.

This page is sponsored by the 2014-2015 members of the Board of Directors - Richard Crooks, Denis Dion, Ross Forbes, Anne Haley-Callaghan, Al Knott, Clifford Leigh-Mossley, Jeffrey Reath, and Colin Saravanamuttoo.

Transport the injured person to medical assistance

First aid provides immediate and temporary care. It is the first link in the emergency medical services (EMS) system.

It is your responsibility to be that first link and to pass your patientn to professional medical services.

Communicate and report incident details

It is good practice to record in writing the details of any first aid you provide at an incident as well as any observations. This information will be invaluable to the medical personnel who will subsequently treat or deal with your patient. It may also be necessary if the incident is brought to court.

Legal considerations

There are legal aspects that must be considered when administering first aid. Each province has its own laws which you must consider.

It is the duty of all patrollers to apply their first aid knowledge and skills to the best of their ability. If the care provided follows the standards set by the Canadian Ski Patrol and the training received at the first aid course, there should be no fear of legal repercussions. Most provinces have Good Samaritan laws, which generally protect you from legal liability.

Possible provincial treatment restrictions

This CSP Patroller's Manual provides medical and first aid information, treatment protocols and techniques to meet the national standards of the CSP Advanced First Aid course. Candidates must be trained in, and meet, all requirements to be certified. However, each province may have legislative requirements that limit or restrict the application of some CSP protocols in that province. Where present, these restrictions will be identified during training and those restricted protocols will not be used in that province. When visiting a different province to patrol, members are reminded to inquire if there are any provincial restrictions regarding any CSP treatment protocols.

Legal protection

Your best protection is to be properly trained and qualified to a recognized set of standards. When administering first aid, you must adhere to those standards and only provide care to the level you have been trained and qualified in.

Consent

Before giving first aid to an injured person, it is necessary to ask for their permission to do so. Identify yourself and ask, *"May I help you?"*

Actual consent

If the patient is an adult, conscious and mentally competent, they need only respond yes or no. This verbal consent is all that is required.

Implied consent

If the injured person is unable to respond, that is they are unconscious, the law assumes they would have provided consent in an emergency situation where there is a risk of further injury. If they become conscious, you must obtain their actual consent to continue assisting them.

In cases where ego or pride result in the injured person refusing assistance, ensure that they can in fact function safely without assistance. If not, repeat the offer to assist them.

If the injured person is a child, clearly explain what you are going to do to help them and obtain their consent. If a parent or guardian is available, you must ask for their consent.

Conclusion

The success of a first aid provider's efforts to assist an injured person depends largely upon an organized application of learned skills. As a patroller, your thoughts, decisions and actions in an emergency situation can mean the difference between life and death.

Notes...

Anatomy and Physiology

Upon completion of this chapter the student will be able to:

1. Define the terms anatomy and physiology.
2. List the major systems in the body.
3. Define commonly used anatomical terms.
4. Describe the purpose and components of the musculoskeletal system.
5. Describe the structure and function of the various systems of the body.

Learning outcome

Describe and understand the anatomy and function of the systems of the body.

As a first aid provider, your responsibility is to assist an injured or sick person. A basic understanding of human anatomy and physiology is essential. Because you will communicate with other pre-hospital care workers, it is important to know the terminology used to describe aspects and components of the human body.

The body

The human body is a complex organism composed of billions of cells working together in an organized manner for the benefit of the whole system.

The cell is the fundamental unit of structure and function. Cells are grouped into tissues, tissues into organs, and organs are grouped into systems. The entire collection of systems becomes the organism known as a human being.

Cells

Cells use oxygen (O_2) and glucose (sugar) to produce the energy they need to survive, function and produce heat. Glucose penetrates the cell membrane with the help of insulin. Insulin is a hormone produced by the pancreas. Without sufficient insulin, glucose fails to penetrate the cell membrane; less energy is produced and cells cannot function as they should.

Brain cells are an exception: glucose can penetrate these cells without insulin.

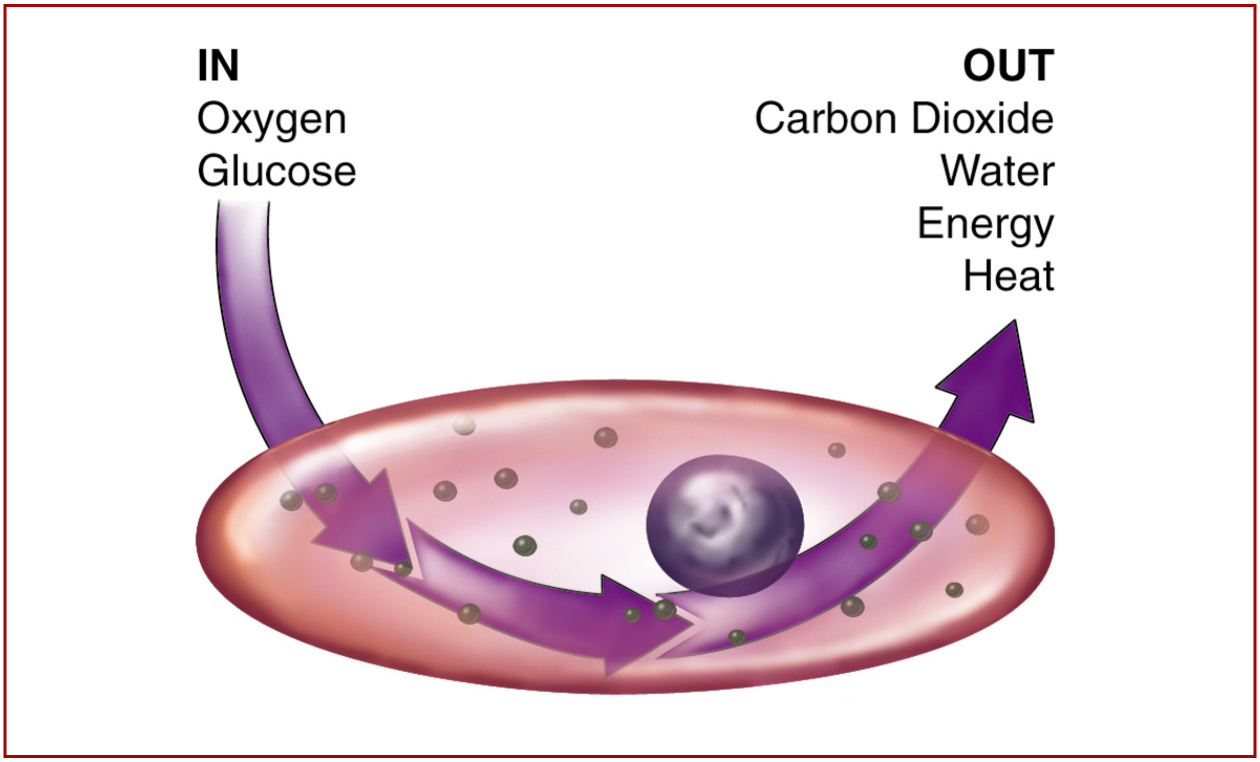

Figure 1: Cell function (metabolism)

Anatomy

Anatomy is the study of the body's structure describing the size, shape, construction and positions of its various parts.

The reference point for describing structures of the body is called the anatomical position. Picture the body facing forward, feet together, arms to the side, and the head, eyes and palms facing forward.

Anatomical terms are always referenced to the patient's left or right side.

Midline: an imaginary line dividing the body into two mirror image halves.

Lateral: body parts farthest from the midline.

Medial: body parts closer to the midline.

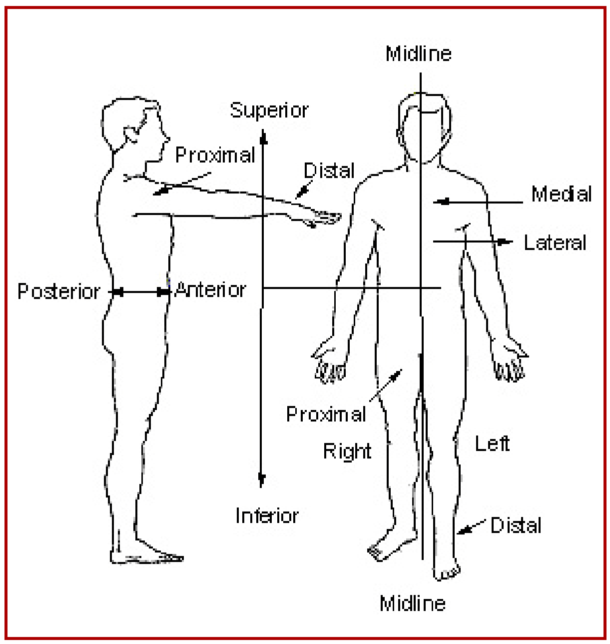

Figure 2: Anatomical terms

Superior: a part of the body closer to the head.

Inferior: a body part towards the feet.

Anterior: anything towards the front of the body.

Posterior: anything towards the back of the body.

Proximal: closer to the heart.

Distal: farther from the heart.

Prone: lying face down on the chest.

Figure 3: Prone position

Semi-prone (also known as three-quarters prone or recovery position): lying face down, on one side.

Figure 4: Recovery position

Supine: lying face up on the back.

Figure 5: Supine position

Physiology

Physiology is the study of how the body's systems function and their relationship to the whole. In many cases, systems are closely related. Damage to one often affects others.

Seven major systems of the body

- Musculoskeletal (page 2-3)
- Respiratory (page 2-11)
- Circulatory (page 2-14)
- Nervous (page 2-19)
- Digestive (page 2-22)
- Urinary (page 2-25)
- Endocrine and Reproductive (page 2-25)

Musculoskeletal System

The musculoskeletal system represents the human skeleton consisting of bones, joints, muscles and connective tissues. Bones provide the framework and support for the body; muscles provide the motor power. Bones are connected to each other by joints and ligaments. Skeletal muscles are attached to the bones by tendons.

Bones

There are 206 bones in the normal skeleton. They:

- Protect internal body organs.
- Provide shape or a framework to keep the body supported.
- Produce red blood cells.
- Provide storage for mineral salts, such as calcium.

Types of bones

The four principal bone types are long, short, flat and irregular.

Long or tubular bones are found in the arms and legs. They act as levers and support movement.

Short bones are found in the wrists and feet. They permit flexibility and movement without loss of strength.

Flat bones such as the sternum and ribs, protect cavities containing body organs.

Irregular bones do not fit into the above categories, such as vertebrae and the jawbone. They serve complex roles in muscle attachment and movement.

Structure

Bone is constructed of several different cell layers.

Periosteum

The outer layer, the periosteum, is a thin, tough membrane of fibrous tissue that covers the outer surface of a bone except at the joint ends where there is a layer of cartilage.

The periosteum serves as a protective sheath for the bone and provides an anchoring surface for the tendons.

> The periosteum has many nerve fibres. Consequently, when it is injured, the patient experiences intense pain.

Cartilage

Cartilage is a type of connective tissue. It is a smooth, firm cushion that allows the joints to move without friction. Cartilage lacks direct blood supply and derives nutrition from joint fluids. It is compressible.

Cortical and cancellous bone

Beneath the periosteum lie dense, hard layers of bone tissue called cortical or compact bone. This tissue has a complex structure (it is not simply solid) and gives bone its resilience. Underlying the cortical bone, there is a latticed layer called cancellous bone. The innermost portion of the bone is a hollow cavity containing marrow.

Marrow

Marrow is a network of blood vessels and special connective fibres holding together a composite of fat and blood cells.

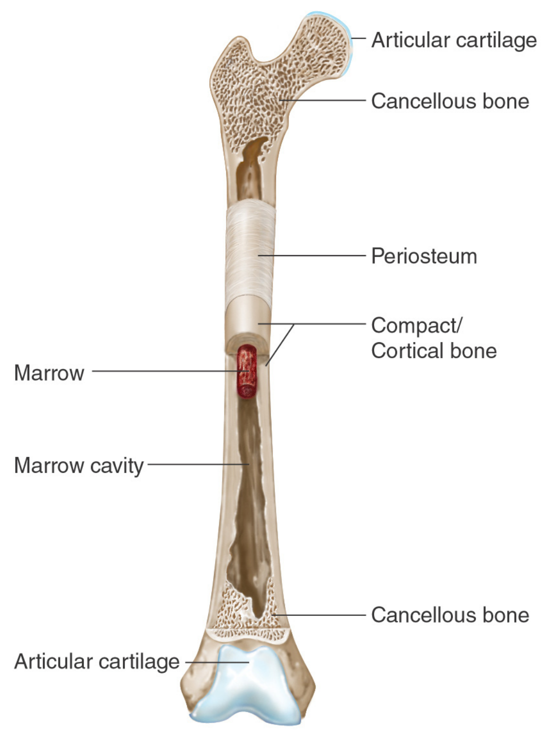

Figure 6: Bone structure

Red blood cells, white blood cells and platelets are formed in the red marrow. Yellow marrow, common in the central cavity of adult long bones, has no blood-producing function.

Skeleton

The skeleton is made up of the following groups:

- Skull
- Spine
- Shoulder girdle
- Rib cage
- Upper extremities
- Pelvis
- Lower extremities

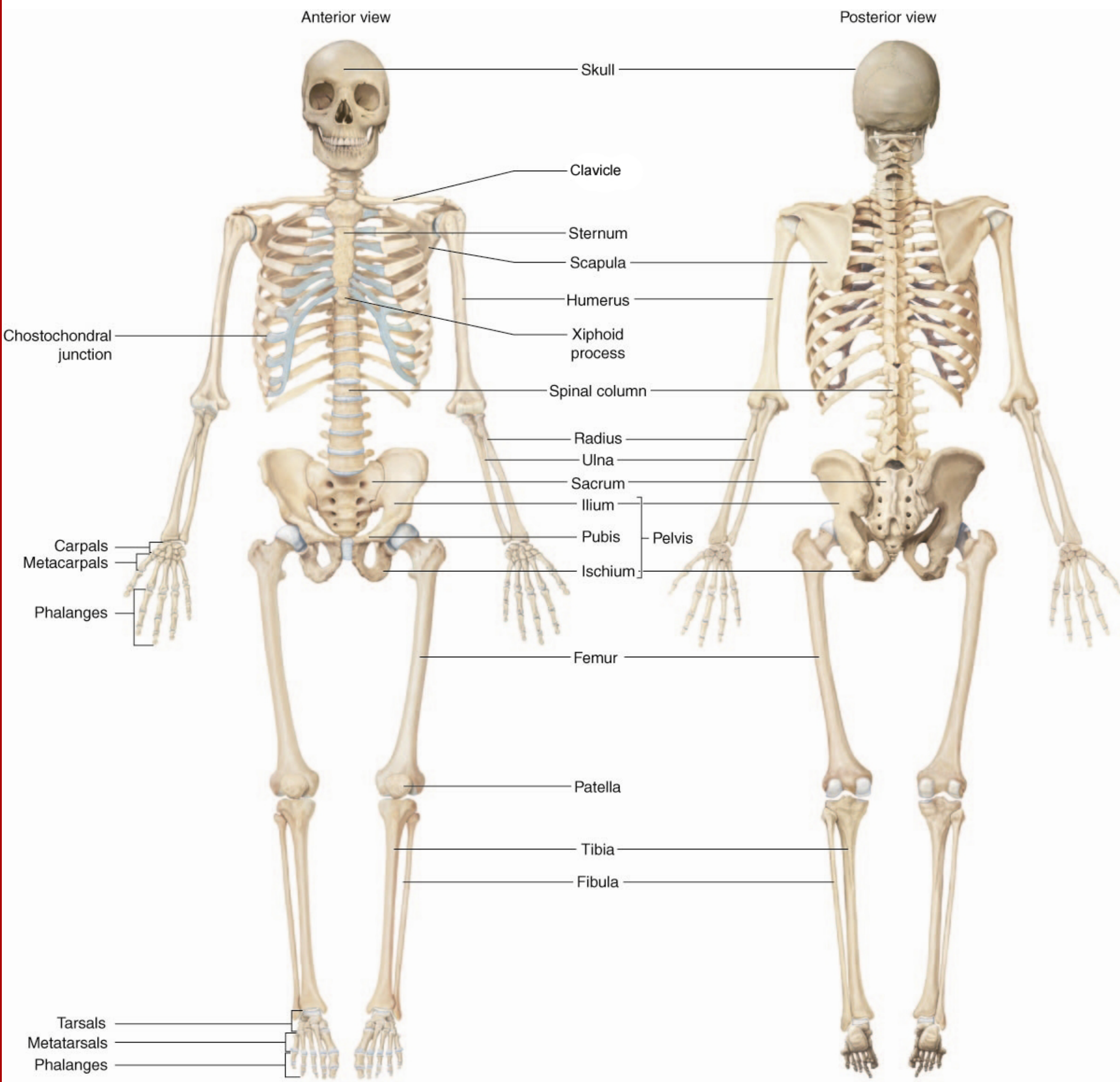

Figure 7: Skeleton

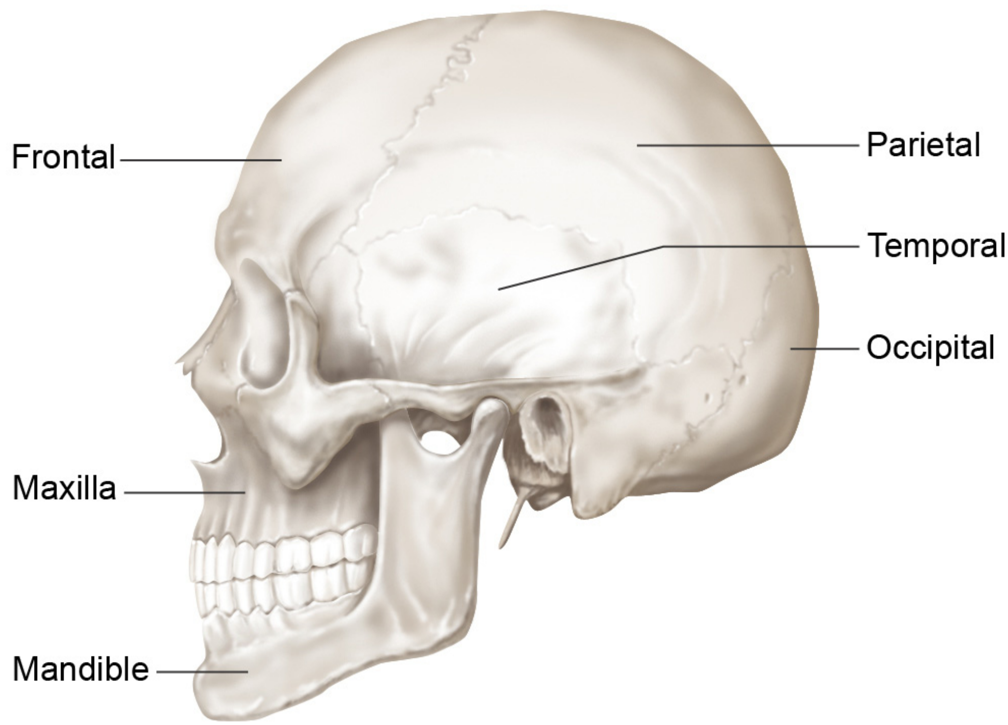

Figure 8: Skull

Skull

The skull is made up of 22 bones and consists of two parts, the cranium and the face. The cranium encloses the brain and protects it from injury. It also serves as an attachment for muscles. Facial bones form the upper jaw and cavities for the nose and eyes; the lower jaw is moveable and is connected to the skull by strong ligaments.

Spine and vertebrae

The spine is the principal support of the body: ribs extend from it, and the rest of the skeleton is directly or indirectly attached to it. The spine is composed of 33 bones, called vertebrae. Vertebrae as classified from top-to-bottom are:

- Cervical (7)
- Thoracic (12)
- Lumbar (5)
- Sacral (5)
- Coccyx (4)

Individual vertebrae are separated by discs. They serve as shock absorbers and allow for limited movement. The spinal column provides protection for the spinal cord.

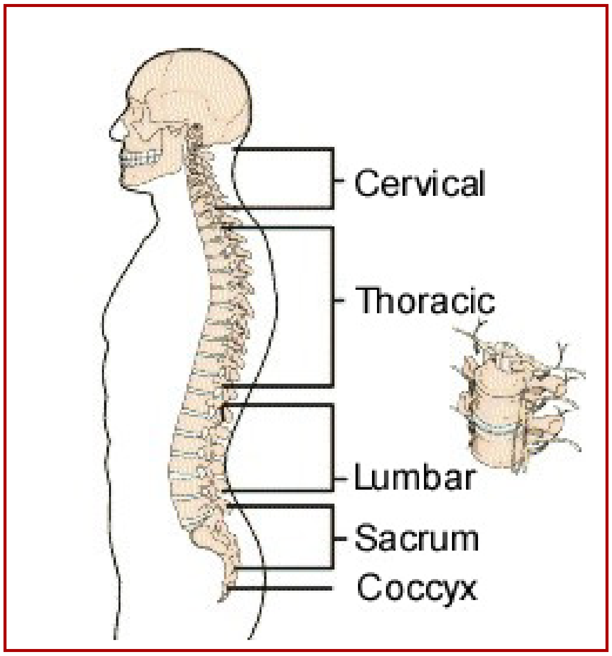

Figure 9: Spinal column

Shoulder girdle

The shoulder girdle is composed of the:

- clavicles (collarbones), and
- scapulas (shoulder blades).

Rib cage

Ribs are flat bones attached to the spinal column. They form a cavity (cage) to protect the heart and lungs.

Rib attachment, spinal column, sternum and xiphoid process

Every rib is attached to the spinal column at the thoracic vertebrae.

The highest seven pairs of ribs are attached to the sternum by cartilage (costochondal junction). The next three pairs of ribs are joined by a common cartilage attached to the seventh rib cartilage, which is in turn attached to the base of the sternum.The lowest two pairs of ribs are floating ribs. They are the shortest ribs and have no attachment to the sternum.

The sternum - breast bone - forms the middle part of the front of the rib cage. The xiphoid process forms the inferior end of the sternum.

Upper extremities

The upper extremities consist of the:

- upper arms,
- lower arms (forearms), and
- wrists, hands and fingers.

The **upper arm** consists of a single long bone called the humerus.

The **lower arm** (forearm) consists of two long bones:

- the radius, on the thumb side of the lower arm, and
- the ulna, on the little finger side.

The **wrists, hands and fingers** are composed of short and irregular bones. Respectively, they are the:

- carpal,
- metacarpal, and
- phalanges.

Pelvis

The pelvis serves as an attachment for muscles, supports body weight and protects major organs. The pelvis is composed of two pelvic bones.

Each pelvic bone has three parts:

- the ilium,
- the ischium, and
- the pubis.

The bones are held together in the front and connected to the sacrum in the back by very strong ligaments.

Lower extremities

The lower extremities consist of the:

- thigh bones (femurs),
- knee caps (patellas),
- long lower leg bones (tibias and fibulas), and
- ankles, feet and toes.

The **thigh bone** (femur) is the longest bone in the body and forms the upper leg. Proximally, its head fits into a socket in the pelvis to form the hip joint. The shaft of the bone is strong and surrounded by heavy muscles. Distally, the femur broadens to form the upper part of the knee joint.

The **knee cap** (patella) is a flat, triangular shaped bone. The patella lies in front of the knee joint and helps protect it.

The **lower leg** bones (tibia and fibula) are the long bones that form the lower leg. The fibula is the smaller bone which distally forms the lateral prominence of the ankle joint.

The **tibia** is the larger, stronger bone which forms the lower half of the knee joint, the shin and the medial prominence of ankle joint.

The **ankle, foot and toe** bones are composed of short and irregular bones. Respectively, they are the:

- tarsals,
- metatarsals, and
- phalanges.

Joints

Joints occur where two or more bones come together. They are classified according to their structure and the amount of movement they permit. Bones are held together at a joint by fibrous bands called ligaments. (See “Ligaments” on page 2 - 10.)

Every joint has a capsule surrounding it and an inner lining called synovial lining.

Movable joints allow for change of position and motion. The two most common are the **ball and socket joint**, found in the shoulder and hip and the **hinge joint**, found in the elbow, knee or finger.

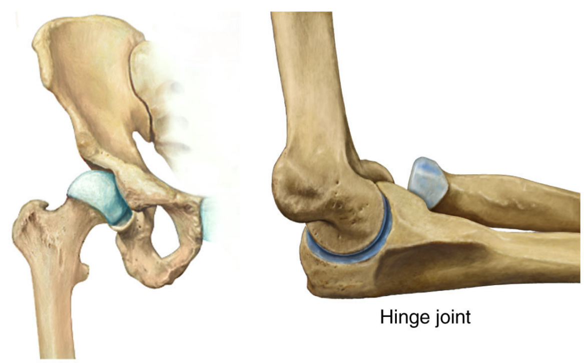

Figure 10: Movable joints

Muscles

Muscles provide movement, maintenance of posture, production of heat and protection to internal organs. They have the ability to contract and relax. They must have oxygen and glucose to function. Muscles are attached to bones by tendons.

Muscles are divided into three groups:

- Skeletal (voluntary),
- Smooth (involuntary), and
- Cardiac.

Skeletal or voluntary muscles are attached to the bones by tendons. Muscles of this group, such as arms and legs, contract under conscious, voluntary control.

Smooth or involuntary muscles are made of longer fibres and are under the control of the autonomic nervous system. Muscles of this group are found in the walls of tube-like organs, ducts and blood vessels.

The **cardiac muscle** is also an involuntary muscle. It is a special type of muscle that is only found within the heart. The cardiac muscle is the only muscle that can contract on its own, that is, without a signal from the brain.

Connective tissues

The connective tissues main functions are:

- structural support,
- immunological barrier,
- energy storage, and
- water storage.

Connective tissue comes in different forms and configurations throughout the body. It is made up of the following components:

- cells,
- fibres, and
- ground substance.

Together, fibres and ground substance make up what is known as the extracellular matrix. The extracellular matrix makes up most of the volume of connective tissue.

Types of connective tissues

Fascia

An individual skeletal muscle is separated from adjacent muscles and held in place by layers of fibrous connective tissues called fascia. This connective tissue may project beyond the end of its muscle fibres to form a cord-like tendon.

Fibres in a tendon intertwine to attach the fibres of the muscle to the bone. In other cases, the fascia associated with a muscle may form broad, fibrous sheets called aponeuroses, which may be attached to the coverings of the adjacent muscles.

Each muscle fibre within a fascicle is surrounded by a layer of fascia in the form of a thin, delicate covering. Thus, all parts of a skeletal muscle are wrapped in layers of fascia, allowing parts to have independent movement. Many nerves and blood vessels also pass through the layers.

Tendons

A tendon is a durable, fibrous connective tissue. It attaches muscles to bones and other structures. For example, fingers do not have any muscles within them; their movements are effected by tendons, which extend back to muscles within the forearm.

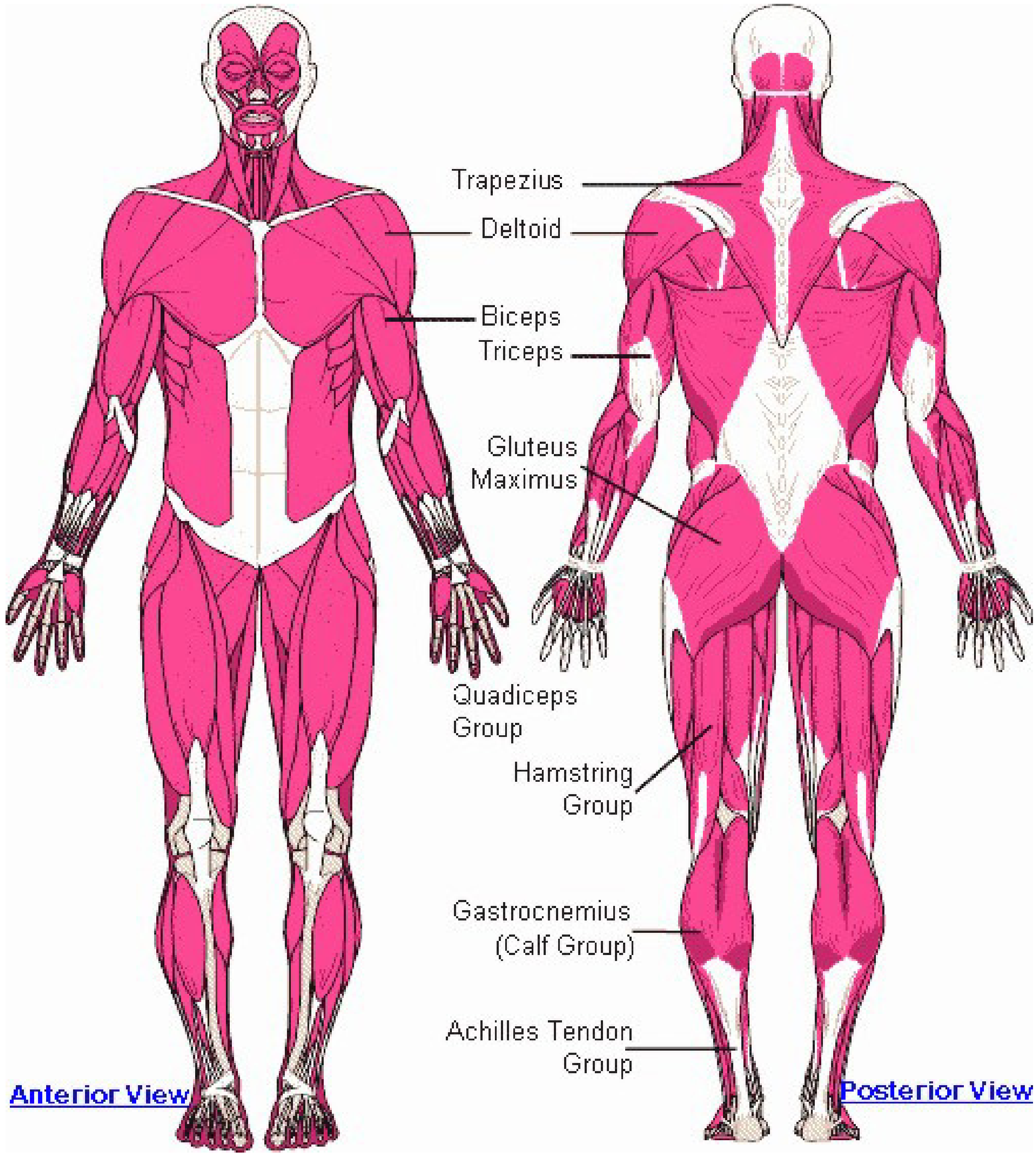

Figure 11: Muscles of the body

Ligaments

A ligament is a tough band of white, fibrous, slightly elastic tissue. Ligaments are an essential part of the skeletal joints, binding the bone ends together to prevent dislocation and excessive movement that might cause breakage.

Ligaments also support many internal organs, including the uterus, the bladder, the liver and the diaphragm. Ligaments also help shape and support the breasts.

The respiratory system

The respiratory system is responsible for the exchange of gases between the body and the environment. In conjunction with the circulatory system, it supplies oxygen to the body tissues, and helps in the removal of carbon dioxide, which is a waste product, from the body's tissues.

Normal respiration requires five conditions:

1. A supply of normal air
2. A clear airway
3. The mechanical bellows function of the rib cage and diaphragm must be intact and contain at least one functioning lung
4. The control system, including the brain, must be intact and able to respond to changing carbon dioxide levels in the blood stream
5. An adequate blood supply with proper circulation by the heart

Anatomy of the respiratory system

The anatomy of the respiratory system consists of the lungs and the airway. The airway consists of the:

- nose,
- mouth,
- pharynx,
- larynx,
- trachea, and
- bronchi.

The pharynx and larynx are located in the top and centre of the throat, respectively.

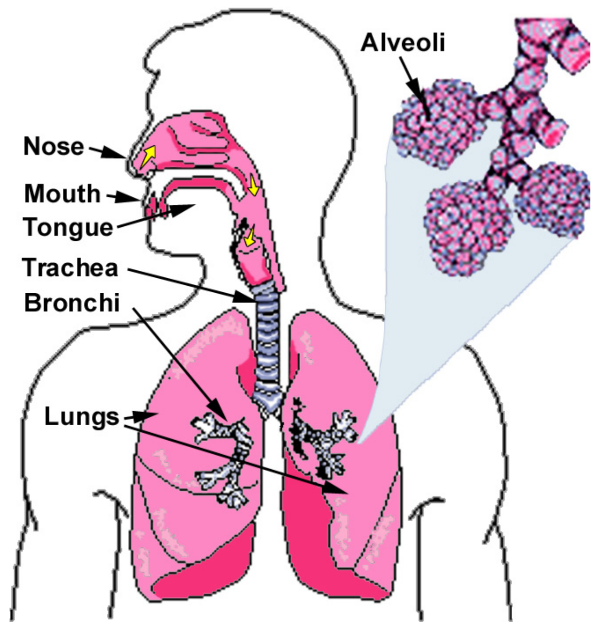

Figure 12: Respiratory System

This page is proudly sponsored by
Carey Rowntree, Mountain Division Life Member #11.

What does the respiratory system do?

Breathing is a gaseous exchange. The air we breathe in and out is made up of several gases as described below:

We inhale	We exchange	We exhale
78% nitrogen	0%	78% nitrogen
21% oxygen	5%	16% oxygen
0.03% carbon dioxide	4%	4.03% carbon dioxide
Trace water vapour	<1%	<1% trace water vapour
<1% noble (inert) gases	0%	<1% noble (inert) gases

Mechanics of breathing

The exchange of oxygen and carbon dioxide in the body's cells and the passage of air in and out of the lungs is called respiration. Breathing in is called inspiration or inhalation; breathing out is called expiration or exhalation.

Breathing is an active function that requires muscle action. Without brain function no breathing is possible except by an artificial method.

The act of breathing may be compared to the action of a bellows with a partially filled balloon inside. The rib cage and diaphragm act as the bellows. The lungs respond passively, acting as the partially filled balloon inside the bellows.

The lungs are surrounded by a double-layered sac called the pleura. The pleura's outer layer is attached to the ribs and completely lines the chest cavity. The inner layer surrounds and is attached to the lungs. Maintaining a vacuum in the space between these layers - the pleural space - is critical to respiration.

Inspiration

Inspiration (inhalation) is an active function. The rib muscles contract raising the ribs and expanding the chest. The diaphragm muscle also contracts and flattens out resulting in an enlarged chest cavity. As the chest cage becomes larger, the lungs expand.

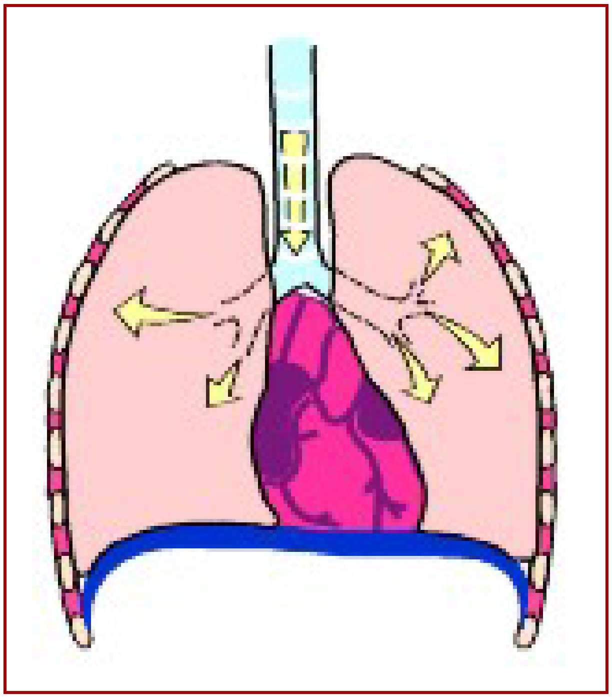

Figure 13: Inspiration (inhalation)

Of the air exchanged in the lungs, two-thirds is caused by the movement of the diaphragm muscle, one-third by the muscles that move the ribs.

During inspiration:

1. The chest cavity enlarges.
2. The air pressure within the chest falls, and more air rushes into the lungs.

Expiration

Expiration (exhalation) is a passive function and normally requires no muscular exertion. On expiration, the rib muscles and diaphragm relax, the chest contracts and air is expelled from the lungs.

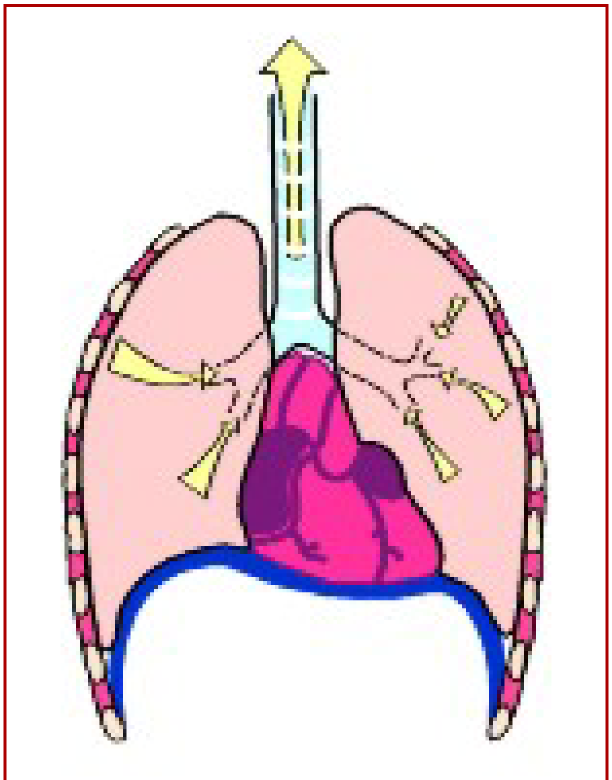

Figure 14: Expiration

Any hole in the chest wall will destroy the vacuum inside and the lung will collapse because of its elastic nature and the effects of the pressure differential. (See “Chest Injuries” on page 8 - 1.)

The mechanics of breathing are under the autonomic control of the brain.

Signs of normal breathing

There are three key signs of normal breathing:

- the rise and fall of the chest or abdomen,
- evidence of air moving in and out of the lungs, and
- a regular rate and rhythm.

Average resting respiratory rates for various ages

Age	**Average rate** (breaths / minute)
Infant (up to one year)	30 to 50
Toddler (one to four years)	20 to 30
Child (five to 12 years)	12 to 20
Adult	12 to 20

Circulatory system

The circulatory system has two major fluid transportation systems:

- the cardiovascular system, and
- the lymphatic system.

The **cardiovascular system**, which includes the heart and blood vessels, transports blood to all parts of the body.

Blood flowing through this circuit brings oxygen, nutrients and other chemical elements to tissue cells. It also removes carbon dioxide and other waste products resulting from cell activity.
(See “Cardiovascular system” on page 2 - 14.)

The **lymphatic system** provides drainage for tissue fluid found outside the cardiovascular system. It is an auxiliary part of the circulatory system; it returns an important amount of tissue fluid to the bloodstream through its own system of lymphatic vessels.

The lymphatic system is also active in the control of infection. (see "The lymphatic system" on page 2-17).

Cardiovascular system

The cardiovascular system consists of:

- the heart, and
- blood vessels.

The heart

The heart is a muscular organ that acts as a pump to maintain circulation of blood throughout the body.

It is situated just above the diaphragm, in the front of the chest, just behind and to the left of the sternum. It lies in front of the esophagus and trachea – the tubes that lead to the stomach and the lungs – and is protected by the rib cage. The heart is surrounded by a membrane, called the pericardium.

Blood vessels

The body of an average adult contains approximately 100,000 km of blood vessels. These blood vessels are divided into three types:

- Arteries,
- Capillaries, and
- Veins.

Arteries

The arteries are thick-walled, elastic vessels which carry blood away from the heart. The elastic nature of these vessels helps to even out the blood pressure between heart beats and also causes them to retract and constrict when severed.

Arterial blood is usually bright red as a result of the presence of oxygen which has combined with the hemoglobin in the red blood cells. Arterial bleeding flows in spurts and may be profuse.

Capillaries

Arteries subdivide into smaller vessels called arterioles which in turn subdivide into very small, thin-walled vessels called capillaries. The exchange of oxygen, carbon dioxide and other materials to and from the cell takes place through these thin walls.

Capillary blood will ooze very slowly from a superficial wound, such as an abrasion. It is seldom life-threatening.

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Veins

Veins are thin-walled vessels that return the blood to the heart through gravity or muscle action. The pressure of the blood in veins is lower than in arteries. Veins have one-way valves within them so that blood cannot flow backward.

Venous blood has a darker, more purplish hue since some of the oxygen has been exchanged for carbon dioxide and other wastes. Venous blood tends to flow in a steady stream from a wound. Bleeding may be very heavy if a large vein is cut.

Circulatory and cardiac cycle

The circulatory cycle is made up of two independent systems:

- pulmonary circulation, and
- systemic circulation.

Pulmonary circulation provides circulation through the lungs whereas **systemic circulation** provides circulation through the rest of the body. In both systems, blood flows from the heart, through arteries, into capillaries then veins and finally returns to the heart.

Pulmonary circulation

Pulmonary circulation starts with the contraction of the right atrium of the heart, forcing blood into the right ventricle. Contraction of the right ventricle forces blood into the pulmonary artery and through the lung capillaries. In the lungs, carbon dioxide in the blood is exchanged for oxygen from the inhaled air.

Once enriched with oxygen, the blood returns via the pulmonary vein to the left atrium of the heart to begin the systemic circuit. The blood is now bright red.

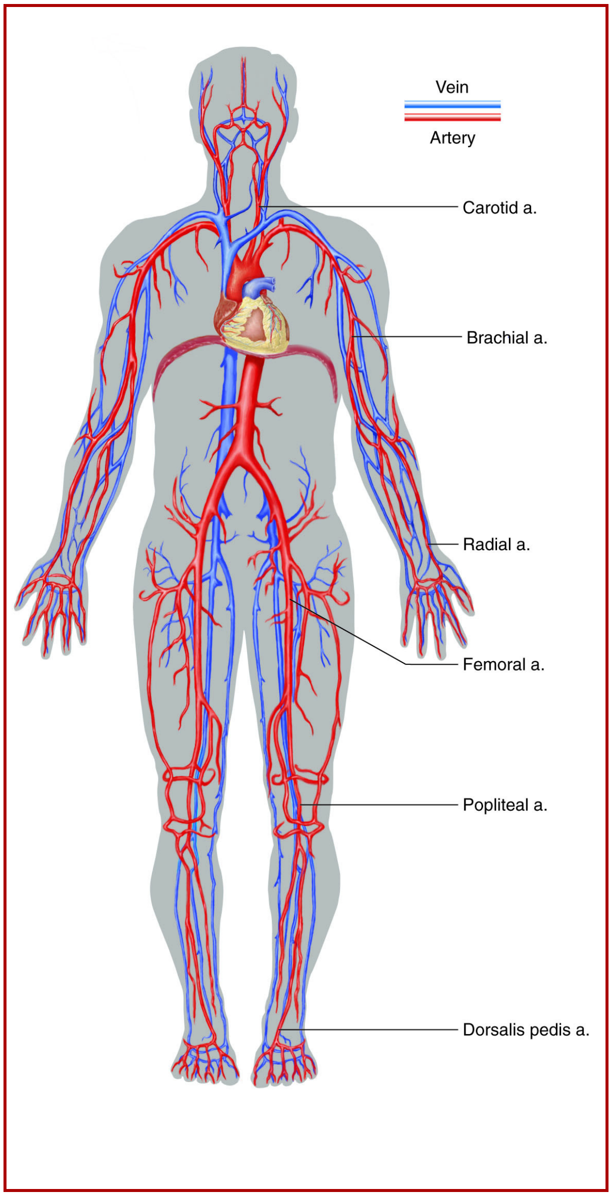

Figure 15: Circulation system

Systemic circulation

Systemic circulation starts with the contraction of the left atrium of the heart, forcing blood into the left ventricle. Contraction of the left ventricle causes the blood to flow through the aorta into the arteries of the body. The arteries divide into smaller and smaller branches, finally forming the thin-walled tiny capillaries. The capillary walls readily allow interchange between the blood and body cells. Oxygen, water and nutrients pass from the blood into the cells of the body. Carbon dioxide and other waste products are passed from the cells into the blood to be carried away for elimination.

Pulse

The pulse is the pressure wave caused by the contraction of the heart which forces the blood through the arteries. The best points at which to feel the pulse are where the arteries lie near the surface of the body, and near a bone or hard surface against which pressure may be applied.

The most frequent site for taking a pulse is the inside of the wrist using the radial artery. The most dependable site to take a pulse is either side of the larynx. The carotid artery can easily be felt here because it is very large and close to the heart.

Pulse rates vary considerably as a result of different factors such as age, activity, emotional response, injury, physical conditioning, disease, medication, or environmental conditions.

Average resting pulse rate

Age	Pulse rate (beats per minute)
Infant (up to one year)	80 to 160
Toddler (one to four years)	80 to 120
Child (five to 12 years)	60 to 110
Adult	60 to 100

Blood pressure

At each heart contraction, the arteries expand and absorb the momentary increase in blood pressure. As the heart relaxes in preparation for another beat, the aortic valves close to prevent blood from flowing back to the heart chambers and the arterial walls spring back, forcing the blood through the body between contractions.

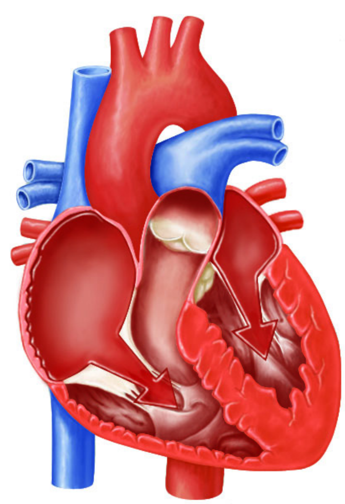

Figure 16: Atrial contraction

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In this way the arteries act as dampers on the pulsations and provide a steady flow of blood through the blood vessels. Because of this, there are actually two blood pressures within the blood vessels during one complete heartbeat:

- The systolic or higher pressure upon ventricular contraction.
- The diastolic or lower pressure during cardiac relaxation.

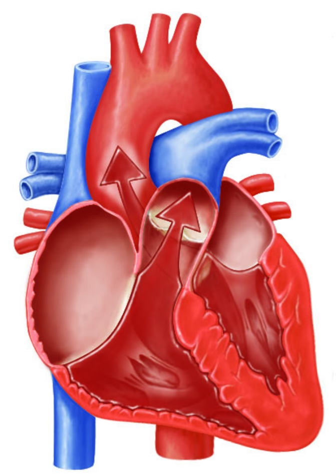

Figure 17: Ventricle contraction

Blood pressure is usually referred to as the systolic value over the diastolic in millimetres of mercury. For example, a typical adult blood pressure reading might be "120 over 80." Blood pressure can vary considerably between individuals depending on the time of day it is measured, activity or emotions the individual is experiencing.

A systolic pressure of at least 80 is assumed when a radial pulse can be felt, 70 with a femoral pulse, and 60 with a carotid pulse.

The lymphatic system

The lymphatic system consists of lymphatic capillaries, vessels, glands, ducts, and spleen. From a first aid standpoint, the most important of these organs is the spleen.

Spleen

The spleen is located under the ribs in the upper-left quadrant of the abdomen. It is an encapsulated, oblong, flat, dark red organ that is smaller than the liver.

One major function of the spleen is to act as a storage reservoir for blood cells. If it is ruptured a massive blood loss – hemorrhage – will occur and can be life threatening.

During the circulatory process, plasma – a component of the blood – escapes through the capillary walls carrying food and oxygen to the body cells. After the plasma (see Blood, below) has completed its function, most of it passes back through the capillary walls into the blood stream. However, some plasma – the lymph – is collected in a second set of vessels which make up the lymphatic system.

Composition of blood

Blood is a red fluid composed of four elements:

plasma	55%
Red blood cells (99%), white blood cells and platelets (1%).	45%

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Red blood cells are formed in the red bone marrow and contain hemoglobin. Hemoglobin transports oxygen from the lungs to other organs throughout the body. Red blood cells are found in the spleen which acts as a reservoir for the blood system and discharges the cells into the blood as needed.

White blood cells are the body's primary defence against infection. They can move under their own power, are larger than red blood cells and fewer in number. White blood cells rapidly increase in number when bacteria and viruses invade the body. They migrate quickly to the site of infection where they attack and attempt to overwhelm the bacteria.

Platelets are tiny, about one-third the size of red blood cells. They are disk like in shape and are responsible for the initiation of clotting.

Plasma is a proteinaceous substance in which the other three elements circulate. It constitutes over half the blood volume. In itself, plasma is comprised of about 92% water, 7% protein, and 1% other substances.

The "other substances" in plasma have functions related to:

- nutrition of cells,
- disposal of wastes,
- transport of gases,
- glandular secretions, and
- the transport of cells that fight disease.

Functions of blood

The primary functions of blood are to:

- Transport nutrients from the digestive system to all other parts of the body
- Transport oxygen from the lungs to cells and carbon dioxide from cells to the lungs
- Help the body get rid of other wastes from cells through the kidneys
- Regulate and coordinate body processes through the transportation of hormones
- Aid in the regulation of water distribution throughout the body
- Maintain the body's temperature by circulating heat
- Defend the body against infection via the white blood cells and antibodies

Blood clotting

The purpose of blood clotting is to plug ruptured blood vessels thus preventing excessive loss of blood.

Platelets trigger clotting by disintegrating as they pass over rough places on the injured surface. The disintegration process releases specialized proteins which form a jelly-like substance over the ends or within the walls of an injured vessel.

A clot will usually form within five minutes after a blood vessel wall has been damaged. If blood does not clot, a patient may bleed to death from injury.

Some males have hemophilia, an inherited condition that reduces the ability of the blood to coagulate. Other patients may take medication to deliberately retard the coagulation process (e.g. blood thinners to avoid cardiovascular events).
One of these conditions should be suspected when blood fails to clot after five to 10 minutes. If the patient has a significant bleed that does not clot, activate EMS and treat as a load and go.

ABC summary: airway, breathing, and circulation

With a clear airway, breathing (respiration) exchanges carbon dioxide for oxygen. Circulation transports these gases around the body's tissues.

Oxygen and glucose are brought to the body's cells by the blood. Blood is circulated through the body by the pumping action of the heart.

The brain controls breathing. While the heart does beat by itself, the brain controls the speed. Without brain function the heart may still beat by itself as long as it receives oxygenated blood.

Blood pressure in the vessels is ensured by the pumping action of the heart, the volume of blood in the vessels and by the resistance of the blood vessels to the circulation.

The intimate interrelationship between airway, breathing, and circulation is essential to life.

Remember your ABCs: an injury to any one of these systems requires immediate action.

The nervous system

The nervous system is the major controlling, regulatory, and communication system in the body. Together with the endocrine system, it is responsible for regulating and maintaining the internal conditions of the human body. The nervous system provides precise, rapid control of muscles, organs and glands and receives tactile sensations.

The nervous system is divided into three systems:

- The central nervous system,
- The peripheral nervous system (see "Peripheral nervous system" on page 2-20), and
- The autonomic nervous system (see "Autonomic nervous system" on page 2-21)

Central nervous system

The central nervous system consists of two joined organs, the brain and the spinal cord.

Brain

The brain is the ultimate control centre for all functions. It is a very soft organ richly supplied with blood. The brain consists of three parts:

- the cerebrum,
- the cerebellum, and
- the brain stem.

Cerebrum

The cerebrum forms the bulk of the brain, and is composed of a large number of nerve fibres (white matter) and cell bodies (grey matter).

It is easily depressed by alcohol, trauma or drugs.

Cerebellum

The cerebellum is the second-largest portion of the brain. It is located below the cerebrum toward the back of the head. It is responsible for the regulation and coordination of complex voluntary muscular movement as well as the maintenance of posture and balance.

Damage to the cerebellum results in the loss of muscular coordination.

Brain stem

The brain stem is located below the cerebrum and leads to the spinal cord. It controls involuntary (autonomic) actions such as breathing, heart rate and body temperature.

Trauma, serious alcohol or drug abuse can severely damage the brain stem resulting in behavioural and functional abnormalities.

Spinal cord

The spinal cord provides two way communication between the brain and other parts of the body. The nerve bundles that make up the spinal cord cannot be repaired by the body or surgery after being severed.

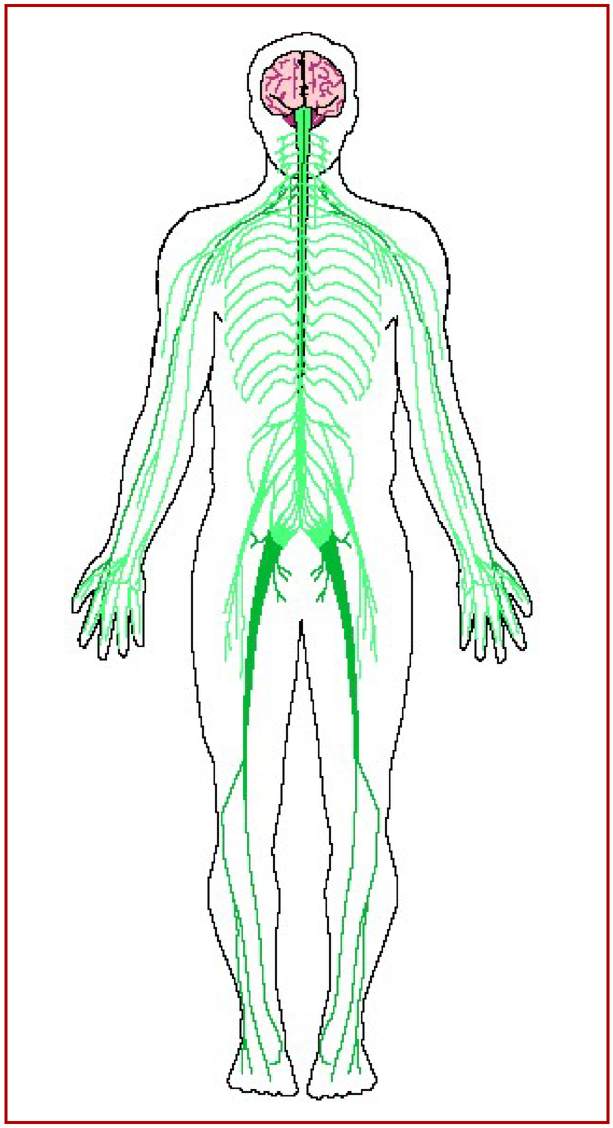


Figure 18: Nervous system

Peripheral nervous system

The peripheral nervous system is made up of motor nerves, sensory nerves and autonomic nerves of which some fulfill both functions.

The **motor nerves** transmit commands from the central nervous system to the muscles of the periphery.

The **sensory nerves** transmit information from peripheral receptors to the central nervous system.

The autonomic nervous system regulates body functions.

Pain

Pain can be felt both on the surface of the body and internally. Pain sensation is transmitted to the brain via sensory nerves and the spinal cord. It is only when this information reaches a functioning brain that the pain may be felt by the individual. Pain varies in intensity depending on the individual and the degree to which the patient has been injured.

Autonomic nervous system

The autonomic nervous system is a group of sensory and motor nerves primarily concerned with the functioning of the organs within the chest and abdomen.

These nerves come under some control of the higher brain but normally the activity of this system does not intrude on the level of conscious awareness.

Fight or flight

The autonomic nervous system is closely associated with certain glands in the body, including the adrenal glands, that make up the endocrine system (See “The endocrine and reproductive systems” on page 2 - 25.).

In response to a challenging or threatening situation, the adrenal glands release adrenalin into the blood stream. The blood stream transports adrenalin to all organs in the body where it has a wide range of effects including increased heart rate, increased blood pressure and dilated pupils.

This is sometimes referred to as the "fight or flight response." This explains some of the changes that are seen as the body is injured or is fighting off shock (see "Shock" on page 9-1).

Sense organs

Humans have five senses, with an organ responsible for each.

Sense and Associated Organ

Sense	Organ
Sight	Eyes
Hearing	Ear
Touch	Skin
Smell	Nose
Taste	Tongue

Eye

The eyes are sensitive indicators of oxygen supply to the brain. However, the effect of drugs or head injury can change the size and reaction of the pupils. The iris – the coloured muscles surrounding the pupils – needs the action of the brain to contract. Complete relaxation of the iris occurs when the brain lacks oxygen or has been severely injured; this is observed as a dilated pupil that does not react to light.

Tear glands beneath the upper eyelid provide tears which lubricate the eye. The tears drain through tear ducts located on the inner corner of the eye near the lower lid.

Ear

The ear has three parts: the visible outer ear, and the middle and inner ear within the skull.

The outer ear is formed entirely of cartilage with a skin covering. It focuses and directs sound into the middle ear. The middle ear transmits sound waves to the inner ear where the hearing organ is located. The inner ear also contains the organ of balance.

Skin

The skin is the largest organ of the human body. It serves three main functions:

- Protects the body from the environment.
- Maintains nerves that convey information about the environment to the brain.
- Regulates body temperature.

Nose

The olfactory sense – smell – uses the nose as a collector of airborne aromas. The sensitivity of this sense varies between individuals. The combination of smell and taste primes the digestive system during ingestion.

The nose is a triangular-shaped cartilage supported by the nasal bones. It protects the olfactory organs. The nose has the unfortunate combination of a rich blood supply and a prominent location on the face. The latter results in an easily injured protuberance and the former makes the misfortune obvious. Blood loss may occur externally or internally into the upper airway which may compromise breathing.

Tongue

The sense organs of taste are on the upper surface of the tongue. There are specific receptors for the qualities of sweet, bitter, sour and salty.

The tongue is richly supplied with blood vessels, which can lead to heavy bleeding if injured.

> In the absence of an intact and functioning nervous system (i.e. unconsciousness), the tongue can obstruct the upper airway.

The digestive system

The main function of the digestive system and its accessory organs is to take in food and break it down into simpler molecules which can be absorbed and distributed throughout the body.

The system involves two types of processes:

- The mechanical process involves chewing, swallowing and defecation of food
- The chemical process breaks up food by various chemical reactions into simpler components for absorption and use by the body

Anatomy of the digestive system

The digestive system contains four main organs:

- Esophagus,
- Stomach,
- Small intestine,
- Large intestine.

Other organs associated with the digestive system are the liver, pancreas, gallbladder and appendix.

Each part of the system has a rich blood supply and injury may result in severe internal bleeding.

Esophagus

The esophagus is a flexible tube leading from the pharynx in the upper throat to the stomach.

The average esophagus is about 25 cm (10 inches) long. Its wall is made of muscle fibres that contract in waves to push chewed food down to the stomach.

Stomach

The stomach is a curved, muscular, sac-like structure that is an enlargement of the alimentary canal between the esophagus and the small intestine. It is located in the upper left quadrant of the abdomen below the diaphragm, to the right of the spleen and partly under the liver.

The stomach empties its contents in about one to four hours, depending on the type of food eaten. When empty, the stomach has practically no volume; when full, it holds about 1.5 litres.

When food enters the stomach, wavelike muscular contractions, progressing from the upper end to the lower end, mix the partially digested food with stomach secretions to the consistency of thick soup. The contractions then push the mixture into the small intestine.

Small intestine

The small intestine is about seven metres in length and 2.5 cm in diameter. Its coiled loops fill most of the abdominal cavity.

The small intestine finishes the process of digestion, absorbs the nutrients, and passes the residue on to the large intestine.

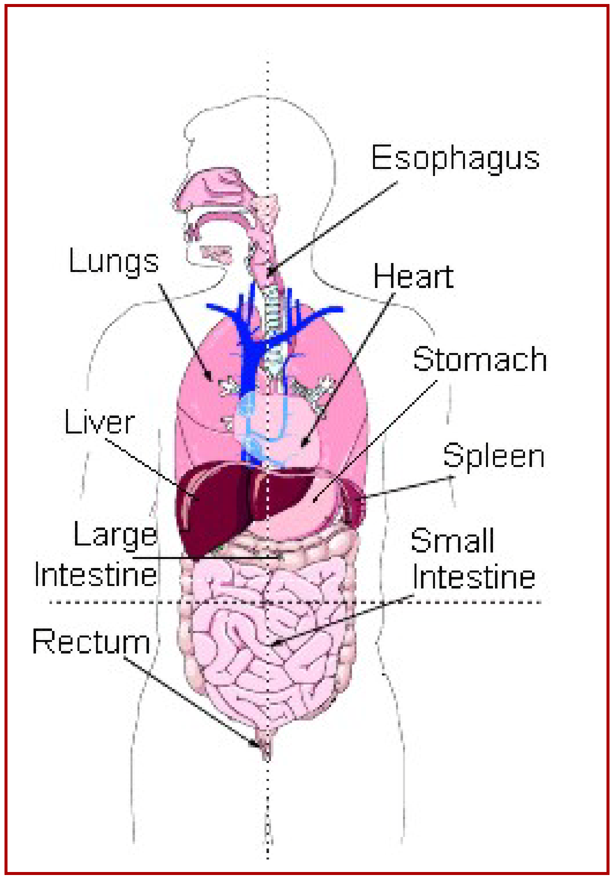


Figure 19: Internal organs

Large intestine

The large intestine forms a complete arc over and around the small intestine. It is about two metres in length and seven cm in diameter.

Liquid from the wastes reaching the large intestine is absorbed back into the body through the intestinal walls. The waste itself turns into solid feces and is pushed down the rectum for elimination.

Associated organs

Liver

The liver is a large brown gland located mainly in the upper-right quadrant of the abdomen, just beneath the diaphragm.

The liver plays a vital role in the maintenance of normal blood sugar and the conversion of food into energy. It manufactures substances important in the blood clotting process and also bile - a greenish brown fluid aiding the digestion of fats.

The liver rids the body of harmful substances in the blood and stores nutrients.

It is fragile and if lacerated, bleeding can be severe.

Pancreas

The pancreas lies in a horizontal position in the upper quadrants below and behind the liver and the stomach. It is tubular in shape and is straw coloured.

The pancreas has two main functions:

- It secretes into the blood the hormones insulin and glucagon which are important in the control of blood sugar level
- It secretes into the duodenum digestive enzymes and pancreatic juices which aid in digestion.

The pancreas is one of the better protected organs. If it is ruptured, painful inflammation of the peritoneum (see below) and other organs can occur.

Gallbladder

The gallbladder is a pear-shaped sac attached to the underside of the liver in the upper right quadrant. It is ten centimetres long and three cm wide.

The gallbladder serves as a storage reservoir for bile, which is used in the digestive process. It is joined to the small intestine by the bile duct.

Appendix

The appendix is a small, blind pouch near the junction of the large and small intestines, in the lower right quadrant. It is a common source of inflammation and when ruptured, becomes a medical emergency.

Peritoneum

The peritoneum is the inside lining of the abdominal wall. It is very sensitive to irritation from blood or other bodily fluids released by injury to an abdominal organ. When irritated, the peritoneum causes a guarding response of the entire abdominal wall - this indicates a potentially life-threatening injury.

Guarding can be detected by:

- Non-voluntary rigidity of the abdominal wall when palpated, i.e. when examined carefully with the pads of the fingers
- Pain in response to jarring movements including coughing or transportation.

For example, a person with appendicitis resulting in inflammation of the appendix and nearby peritoneum, may initially have pain and guarding in the right-lower quadrant of the abdomen near the appendix. With time, this guarding will be generalized to the whole abdomen.

The urinary system

The urinary system filters and excretes wastes from the blood. It also helps maintain the balance between water and various chemicals in the body.

The urinary system consists of:

- two kidneys,
- two ureters,
- one urinary bladder, and
- one urethra.

Kidneys

The kidneys are two bean-shaped organs that lie on each side of the posterior abdominal cavity and are partially protected by the lower or floating ribs of the rib cage. They are described as retroperitoneal, that is, lying behind the peritoneum. Average sized kidneys are approximately 12 cm in length, five cm in width and three cm in thickness.

Kidneys regulate fluid volume and other substances in the blood, and remove wastes from the blood. The kidneys are connected to the bladder via tubes, called ureters.

Suspect kidney injury if the patient has bloody or smoky urine.

Ureters

The ureters carry urine away from the kidneys to the urinary bladder for excretion.

Urinary bladder

The bladder is an expandable and contractible sac located behind the pubic bone. The bladder is infraperitoneal, i.e. below the peritoneum.

It serves as a reservoir for urine before it leaves the body via the urethra.

Urethra

The urethra is the final passageway for the flow of urine. It is a small tube leading from the floor of the bladder to the outside of the body.

Because the urinary system organs lie outside the peritoneum, they do not trigger peritoneal irritation when injured. They can lose a significant amount of blood without generating the signs and symptoms specific to abdominal injuries: guarding, rigidity, and distention.

Carefully monitor vital signs when injuries to these structures are suspected.

The endocrine and reproductive systems

The endocrine system is a group of glands which secrete hormones into the blood. Hormones regulate metabolism, growth, reproduction and other body functions.

The endocrine system includes the:

- pituitary gland,
- thyroid gland,
- parathyroid glands,
- adrenal glands,
- ovaries,
- testes, and
- pancreas.

These glands are very well protected and are normally of no concern to the first aider.

In the case of the reproductive system, emergency childbirth may be encountered (see "Childbirth" on page 19-7).

Conclusion

This chapter has introduced you to basic anatomy and physiology.

You now have an understanding of the body, its component parts and the interrelationship and interdependency between those parts.

This information will help you:

- determine the nature of the injuries,
- accurately pinpoint medical problems that require immediate medical attention,
- communicate with emergency medical technicians efficiently, and
- make appropriate transport decisions (see "Stages in assessment" on page 4-1).

Notes...

Infectious Diseases and Universal Precautions

Upon completion of this chapter the student will be able to:

1. Describe the most common exposures to infectious diseases encountered by patrollers.
2. Know how to reduce the risk of transmitting dangerous infections and the steps a patroller should take if an exposure occurs.
3. List the personal protective equipment patrollers should carry with them and use.
4. Demonstrate the removal of gloves to avoid contamination of the skin underneath.
5. Describe the safe disposal of contaminated materials.

Learning outcome

Recognize the risks of infectious diseases and how to protect against them.

Infectious diseases

Infectious diseases include conditions that are blood borne, such as HIV (human immunodeficiency virus) - which can progress to AIDS (acquired immunodeficiency syndrome) - and hepatitis as well as those diseases that are airborne, such as influenza, measles, mononucleosis, meningitis and tuberculosis.

Airborne diseases are generally curable and pose no real threat to life. Blood-borne diseases transmitted by direct contact with infected blood or other body fluids are presently incurable and frequently fatal. They pose a particularly high risk to first aid providers.

Although the likelihood of a first aid provider contracting an infectious disease is slim, the risk still exists. To reduce the risk, first aid providers must take "universal precautions".

Universal precautions are guidelines to help protect you from infectious diseases and help prevent the spread of infection from, to, or between patients. See below for more details.

Exposure to infectious diseases

Because blood-borne diseases can be transmitted from saliva-to-blood or from blood-to-blood contact, patrollers and first aid providers who come in contact with infected persons are at risk in the following circumstances:

- The patroller has a laceration, abrasion or other fresh injury to his skin permitting contact with the blood or bloody body fluids of an infected person;
- The patroller has an oral lesion or other injury to the mucous membrane lining of his mouth, such as a tongue bite, and gives artificial respiration to an infected patient.

Generally speaking, non-bloody body fluids of an infected person pose a small risk to those with a skin break. Yet, it is impossible to guarantee that this risk does not exist. Therefore, patrollers with open sores or wounds should avoid direct contact with the body fluids of those they treat. Casual contact between infected and non infected individuals is not dangerous.

Signs, symptoms and transmission of infectious diseases

Hepatitis

Infectious hepatitis is caused by a number of different viruses, some of which have not yet been fully identified.

Hepatitis A and hepatitis E viruses cause fever, diarrhea, flu-like symptoms and jaundice (yellowing of the skin and eyes). These infections are not generally fatal, resolve on their own without treatment and are contracted by ingesting the virus orally.

Hepatitis B, C, and D viruses, on the other hand, are much more serious. These viruses are spread through direct contact between your bloodstream and the blood or body fluids of someone who is infected. Hepatitis B is found in saliva and other body fluids such as urine, vomitus, sputum and feces. These viruses cause an acute liver infection, marked by fever and jaundice. The infection may:

- resolve completely (go away),
- progress rapidly to total liver failure causing death, or
- become a chronic infection that leaves the individual without symptoms but still able to infect others.

Chronic hepatitis results in cirrhosis. Cirrhosis refers to the severe scarring of the liver and can progress to liver cancer. Both cirrhosis and cancer are life threatening diseases.

Chronic hepatitis is much more common than HIV and is responsible for a greater number of deaths.

A vaccine that is more than 90 per cent effective now exists to protect individuals against hepatitis B. This vaccine is now widely used for routine childhood immunization. The hepatitis B vaccine does not prevent infections against other Hepatitis viruses. It should be noted that up to 10 per cent of those who receive the vaccine do not respond to it. Nonetheless, it is strongly recommended that all health care workers receive the hepatitis B vaccine.

The CSP recommends hepatitis A and B (and C when available) vaccination for all ski patrollers. In many jurisdictions, this is available through public health agencies at no cost for first responders.

HIV/AIDS

Simple exposure of normal, uninjured skin to HIV infected blood has not been shown to be a risk for infection. The likelihood of a patroller contracting HIV infection through random exposure to the blood of an injured person is minuscule and even more unlikely when exposed to non bloody bodily fluids.

The chance of becoming infected with HIV after being exposed to the blood of an HIV infected individual appears to be very low. It has been reported that, in more than 3,600 health care workers exposed to the blood of known HIV-infected patients through needle sticks and other accidents, the rate of infection attributable to the injury was approximately 3 in 1,000 or 0.3 per cent. The chance of acquiring HIV through a mucous membrane exposure appears even lower and is estimated at 9 in 10,000 or 0.09 per cent.

Personal concerns

What should you do if you suspect exposure to a transmissible infection?

Suppose you are first on the scene of an unresponsive person. The person has just collided with a tree and is bleeding heavily from an open fracture. After donning protective gloves, ensuring the scene is safe, and confirming the patient's airway and breathing are all right, you compress the bleeding site with a dry sterile dressing only to discover that a fragment of bone has pierced the glove and punctured your skin. The patient is in his late sixties and doesn't look like someone who could have HIV or hepatitis infection.

How should you proceed?

Don't panic. Stay calm. Continue to attend to the patient as carefully as possible, but remove yourself from the rescue scene at the earliest possible opportunity when someone else can take over for you. Where the risk of exposure to blood and body fluids is present, the number of patrollers involved with the patient should be the absolute minimum.

Immediately wash off the patient's blood and then bleed out your own wound. This is accomplished by squeezing blood from the wound for five minutes. Disinfect your injury extensively with alcohol or another disinfectant.

Discretely ask the individual whether they have been diagnosed with any infections. This is highly sensitive and confidential information that must be shared only with those immediately caring for the individual. Other information relating to the patient's risk for HIV/hepatitis could be used by the physician to determine how to manage your situation but you should not seek this information directly.

Exchange contact information

Establish some way of contacting the patient should it be necessary.

The patient has also been directly exposed to your blood and may contract a disease from you that you may not even know you have. For this reason, you must also provide your contact information to the patient and calmly explain that you believe you have contacted each other's blood in an unavoidable way and that a doctor needs to determine if there is anything further to be done.

Treatment

Contact an emergency department physician immediately to explain the situation because some protocols recommend treatment within hours. (Don't forget that the injured person needs to be similarly considered.)

The emergency room physician may need to contact an infectious disease specialist for consultation and up to date information. He may also recommend to vaccinate you against hepatitis B and to give you temporary antibodies against this virus.

Currently, there is no treatment for hepatitis C. For HIV, some physicians may initiate urgent treatment within hours, if they believe you were exposed to a high risk situation.

If you have contacted the patient's blood or body fluids, but not through a skin break on your body, there is generally no reason for concern or further action. However, if you are concerned, contact a physician to obtain further information.

Summary

If you think you have had a high-risk exposure to an injured person's infected blood:

- Don't panic.
- Attend to the patient's priorities.
- Wash, bleed out and disinfect your wound immediately.
- Remove yourself from the scene as soon as further help arrives to the scene.
- Inform the patient that you have likely become exposed to each other's blood and exchange contact information.
- Ask the patient discretely and privately whether he or she is known to have an infectious disease. Do not share this information with anyone not immediately involved in caring for the patient.
- Contact an emergency physician immediately to explain the situation.

Universal precautions

Universal precautions refer to the routine use of barrier precautions, such as gloves, and other practices to avoid contact with body fluids. These barriers are aimed at preventing contact between the blood and body fluids of an injured person and the patroller's bloodstream.

Following the emergence of the first cases of AIDS, the Centre for Disease Control and Prevention (CDC) in the United States advocated the principle of “universal precautions” as a measure to reduce the risk of transmitting dangerous blood borne infections to health care workers.

Figure 1: Barrier devices

People with infectious diseases such as HIV often show no signs that they are infected because of the long incubation period. Therefore, patrollers and first aid providers should assume that **all blood and body fluids are potentially infectious**.

Use caution in all contacts with patients

Universal precautions were devised to protect the medical and paramedical professions. Practitioners of these professions are at a much greater risk of contacting infected blood than patrollers. Nevertheless, always practise universal precautions to reduce the risk of contracting any of the infectious diseases mentioned above.

Precautions

The following measures are strongly recommended in order to avoid direct skin contact with the injured person's blood or body fluids. This is especially important if you have skin or mucous membrane lesions.

- Wear disposable, single use, impermeable gloves when examining any patient or when in contact with body fluids. Examination gloves offer the best protection. If they are not available, leave your ski gloves on during treatment to avoid direct skin contact with body fluids.
- Use a separate set of gloves for each patient to avoid cross-contamination.
- Use a pocket face mask or other barrier type device wherever possible for assisted ventilations.
- Keep sharp objects such as broken glass, pen knives, pins, and scissors, away from the scene. If this is unavoidable, handle them as little as possible and with extreme caution around bleeding individuals. Be sure everyone present is aware of where they are.
- Dispose of bloody bandages in plastic bags and seal them. Soiled garments belonging to the injured person should likewise be placed in plastic bags, sealed and kept with the injured person.
- Clean up blood and body fluids spilled at the scene using detergents where feasible.

- Remove or cover bloody snow.
- Wear eye goggles when blood and body fluids cannot be controlled, e.g. spurting blood from an injured vessel or vomiting.
- If possible, wear a face mask that protects the nose and mouth.

Examination gloves

Examination gloves offer the most frequently used and all around best form of barrier protection.

Figure 2: Glove removal sequence

When wearing gloves:

- Do not wear jewellery that might tear examination gloves.
- Examine the gloves frequently for tears.
- When removing the first glove, grip the outside of the glove near the top and pull it off.
- Remove the second glove by sliding two fingers inside the glove and pushing down.
- Then grab the inside of the glove and pull it off.
- Place the gloves in double bags, sealing each bag; then dispose of both bags in the garbage.
- Wash your hands thoroughly with soap and water.

Conclusion

The risk of exposure to life-threatening infections in the performance of regular duties is minimal. Nonetheless, any unprotected contact with the blood of another person can be potentially dangerous. Measures should always be taken to minimize this risk.

- understand that the risk of contracting Hepatitis or HIV infection following contact with the blood of infected individuals is extremely small but not zero,
- routinely use barrier protection (gloves, pocket face masks and impermeable coverage of skin lesions) when dealing with blood and body fluids,
- avoid sharp objects in the presence of body fluids, and know how to respond when you have come into contact with body fluids.

Notes...

Patient Assessment

Upon completion of this chapter the student will be able to:

1. Perform a scene survey.
2. Perform a primary and secondary assessment on a simulated patient while verbalizing what is being felt and looked for at each component of the assessment.
3. Make a transportation decision based upon the clinical severity of the patient.
4. Perform the 'taking' of all vital signs.
5. Describe the application of the Simple triage and rapid treatment (START) system for multiple patient situations.
6. Describe the CSP pain management protocol.

Learning outcome

Know how to implement the CSP patient assessment of an injured person.

Overview

The assessment process is your tool to:

- ensure the safety of yourself and others,
- get help when you need it,
- rationally and accurately evaluate the severity of a person's injuries
- make prudent decisions about treatment and transportation

Every situation is different but it is the same process every time. This will allow you to avoid hazards to yourself, the patient, and others who may be around. It will also allow you to get an initial sense of what has happened and how to manage the situation.

Stages in assessment

Scene survey:	Is it safe and do you need help?
Primary assessment:	Are there life-threatening injuries?
Transportation decision:	Is it a load and go, or stay and treat?
Secondary assessment:	Establish baseline vital signs and thoroughly reassess patient for all injuries.

Scene survey

As you approach the scene of an accident, evaluate the safety of the situation, ensure your own safety and that of your patient, and assess whether you need help right away.

As you approach the scene of an accident, consider and look for the following:

- Are there any further dangers to myself, the patient or others?
- Communicable diseases that can be transmitted through blood or bodily fluids are a potential danger to you - put your barrier protection gloves on.
- Note the time.
- Note the mechanism of injury; is it serious?
- Angulated fractures?
- Bleeding?
- Colour of skin, is it white or blue?
- Distraught patient? Is the patient moving at all? What is the patient's response - physically and emotionally? Is it appropriate for the given situation?
- Number of people injured?
- Do you think you need assistance handling the scene? If yes, call for help right away.

Primary assessment

The primary assessment is a rapid, systematic check for life-threatening conditions that begins as you get closer to the patient. It includes a systematic check of the vital areas of the body, and starts your assessment for life-threatening injuries (priorities).

Priorities

The priorities are:

1. Protect from danger of further injury.
2. Clear airway with cervical spine control (if required).
3. Ensure there is an adequate volume of air and a minimum effort to breathe.
4. Check for functioning circulatory system.
5. Control major bleeding.
6. Check for level of consciousness (alert, verbal, pain or unresponsive - AVPU scale)(see "Unresponsiveness and lowered levels of consciousness" on page 16-16).
7. Protect the spinal column.

Take action to manage priority problems as they are found. If life-threatening conditions are found, quickly attempt to manage those threats: take care of ABCDs:

A Airway

B Breathing

C Circulation

D Disabilities

The Patient Assessment system was developed, piloted and first implemented in Calgary Zone 20 years ago. It was first presented at the 1995 NAC by Terry Abrams in Montreal.

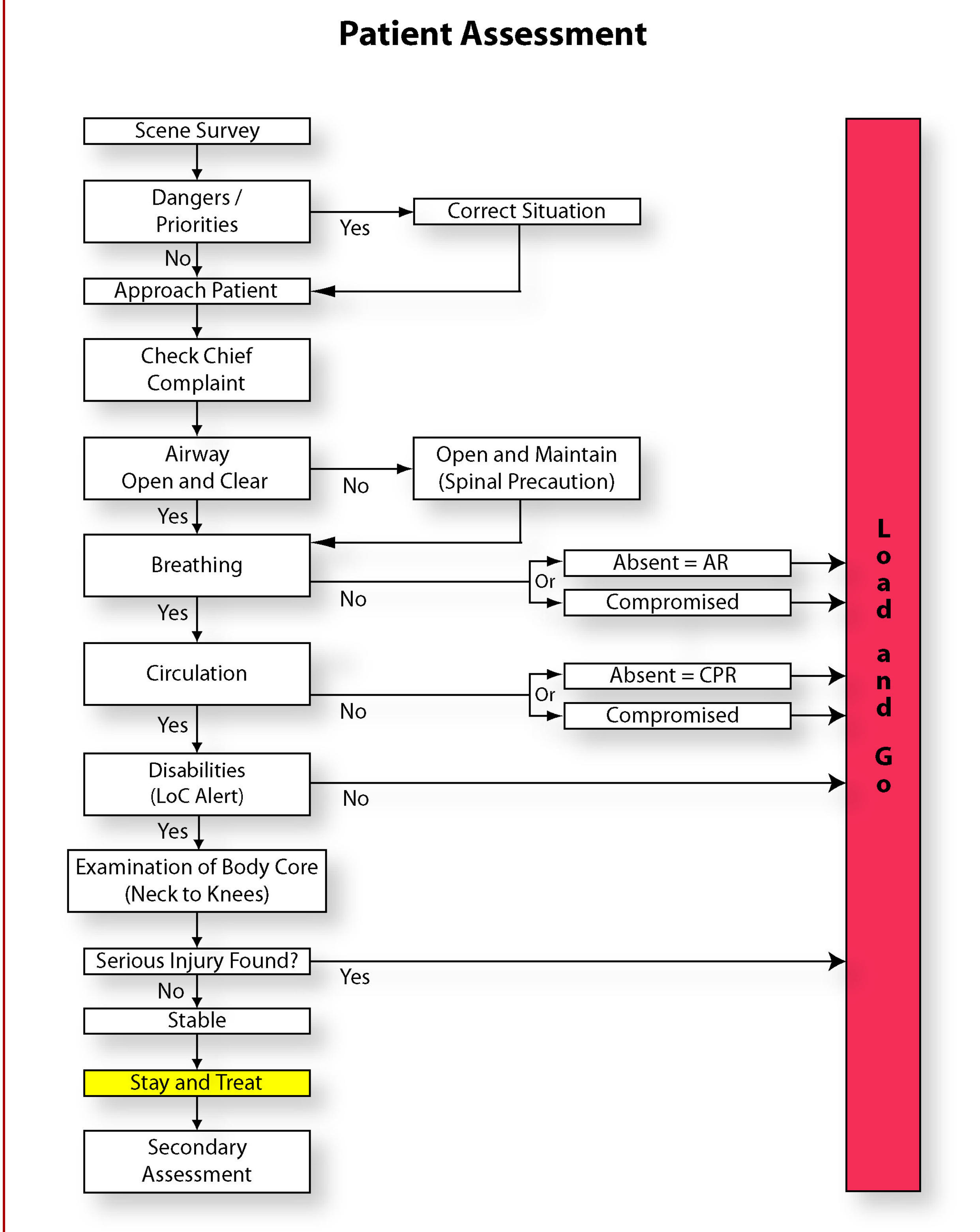


Figure 1: Patient assessment

The first part of the primary assessment begins with a series of questions.

- Approach the patient face to face.
- Obtain permission.
  Say, "*I am a Canadian Ski Patroller trained in first aid. May I help you?*"
- Where do you hurt?
  Say, "*Please do not move until I have checked you for injuries.*"
- Assess the patient in the position found.
  Say, "*I am going to hold your head to remind you not to move and prevent further injury.*"
- Apply manual cervical spine (C-spine) control, if indicated

  Ask,

  - "*What is your name?*"
  - "*Can you tell me what happened?*" "*When did it happen?*"
  - "*Can you take a deep breath? … How did that feel?*"
  - "*Do you hurt anywhere else? … Have you had this before?*"
  - "*Do you have any pain or tingling in your neck or back?*"
  - "*Can you wiggle your fingers and toes? Can you feel your fingers and toes?*"
- With your free hand, examine the neck with particular attention to the vertebrae and, if possible, the spine all the way down the back as well if necessary.

  - Are the muscles rigid?
  - Does the exam cause the patient further discomfort or anxiety?
  - Does touching cause numbness or a tingling sensation?

  If yes to **any** of these, treat for a C-spine injury.

A cervical spinal injury is unlikely if **all** of the following are met:

- During the scene survey, you saw the patient freely moving their head without apparent pain.
- Patient has had no loss of consciousness,
- Patient is completely alert,
- Patient has not had any alcohol or other drugs,
- Patient has no tenderness or deformity of the spine,
- Patient has no other painful injuries which may mask neck or back pain, and
- Patient has no loss of sensation or movement in the limbs.

  If you are unsure about any of these items, immobilize. If you have no concerns for C-spine injury, you may remove your hands from the patient's head.

This assessment does a preliminary check of airway, breathing, circulation, and disabilities. If the patient is responsive, ABCs are obviously present but their quality has yet to be assessed. If the patient responds appropriately to your introduction and questions, the patient is alert and conscious. [D = Disabilities]. If there are obvious problems with ABCDs including major bleeding, address those problems immediately.

The patient's answer to your questions helps determine your next course of action. When the patient is unsure about what happened, question bystanders.

Check the quality of the ABCDs

Airway

Check for and establish a clear airway. Listen to the patient's airway sounds. If the person is speaking to you, the patient's airway is not obstructed.

- A quiet airway is open.
- A noisy airway is partially obstructed - reposition the head if necessary.
- A silent airway is closed - open it!

Breathing

Look, listen, and feel for presence of breathing for at least 10 seconds. Observe depth and effort. The ability to take a deep breath is a very good sign that chest injury is unlikely, but is not a replacement for the assessment of the chest.

Check the rise and fall of the chest visually. If the person is speaking to you, there is some air movement into and out of the chest. If the patient speaks only one or two words between breaths, this may be a sign that he/she must make a significant effort to breathe and may indicate the presence of a breathing difficulty. Breathing difficulty is the earliest sign of serious chest injury.

- If no breathing, assist their ventilation using either a pocket face mask or a bag-valve mask. **Activate EMS**.
- If breathing is inadequate for the patient, call for oxygen and be prepared to administer artificial respirations.

Circulation

Are pulses present?
(What is their quality at the neck and wrist?)

Feel for the presence of a pulse at the neck and at the wrist. Feel both locations for at least 10 seconds to learn if the patient's heart is beating and if blood is circulating to the extremities.

- Note rhythm and strength of pulse.
- If absent, start CPR. **Activate EMS**.
- Look at the patient's skin colour.

Assess the need for oxygen if breathing or circulation seems abnormal, e.g. signs of shock.

Disabilities

What is the patient’s level of consciousness (LOC) and are the spinal functions intact?

If the person is speaking to you, they are not unconscious. If the patient responds appropriately to your introduction and questions, the patient is alert and conscious. If not, first apply a verbal stimulus, and then if necessary a pain stimulus. Note the level of response.

Rate the LOC you just observed during the assessment on the AVPU scale.

Anything below alert - **call for assistance**.

The cervical nerves control the head, breathing, and the upper extremities. Pain, numbness, weakness, and tingling are symptoms that may develop when one or more spinal nerves are injured, irritated, or stretched. If there is no pain or tingling and they can wiggle their fingers and toes then preliminary indications are the spinal functions are intact.

An assessment of spinal function is done by asking the following questions:

- Do you have any pain or tingling in your neck or back?
- Can you wiggle your toes and fingers?

The second part of the primary assessment is a palpation of the body core (neck to knees).

This is a rapid assessment of the core areas of the body for life-threatening injuries.

Signs and symptoms

Throughout each step of the assessment, check for signs and symptoms of injury.

A sign is something you observe.
A symptom is something the patient tells you.

LOOK for DCAP-BLS:

D deformities - malformation, distortion, or disfigurement

C contusions - bruise or tissue injury usually without a break in the skin

A abrasions - scraping or rubbing of the skin and possibly tissues immediately below the surface

P penetrations - piercing or penetration of the skin

B burns - heat or chemical injury

L lacerations - cut, split or break in the skin

S swelling - abnormal enlargement

FEEL for TIC:

T tenderness - pain or sensitivity

I instability - lack of stability or firmness

C crepitus - a grating sensation felt over fracture sites

After examining each part of the body, check your gloves for signs of bleeding and wetness.

LISTEN

Listen to what the patient has to say such as:

- That hurts.
- I have a pain in my chest.
- I'm dizzy.
- I feel nauseous.
- I can't move that.

Areas of evaluation in the primary assessment

Start a systematic check of the patient from the neck to the knees. Examine the patient in the position found; remember, you asked them not to move. If the patient is in such a position that they cannot be effectively evaluated for life-threatening conditions, check as much of the patient as possible before you move them according to C-spine concerns.

Weather conditions should always be considered before you perform a "to skin" evaluation.

Evaluate the neck

The neck consists of more than just the cervical spine.

This page proudly sponsored by Red River Zone in memory of Keith Storey #050202290 - patroller and friend.

Look for evidence of deformity, contusions, abrasions, penetrations, burns, lacerations and swelling.

Feel the neck for evidence of, tenderness, instability and crepitus. Notice if touching the back of the neck causes the patient discomfort or anxiety. Ask the patient if touching their neck causes any numbness or tingling sensations. If you cannot feel the vertebrae, is it because the muscles are rigid?

If any of these signs or symptoms are positive, suspect a neck injury and employ C-spine control and protocols.

Evaluate the back

Look for evidence of deformity, contusions, abrasions, penetrations, burns, lacerations and swelling.

Feel the back for evidence of tenderness, instability and crepitus.

If the patient is lying face up (supine), evaluate the back when the patient is rolled to get them onto a backboard or similar lifting/ immobilization device.

Evaluate the chest

Look for evidence of deformity, contusions, abrasions, penetrations, burns, lacerations and swelling. At the chest also look for paradoxical movement - ribs or segment of ribs moving differently. Where the chest normally expands during inspiration, a loosened segment will be drawn in. Where the chest normally deflates during expiration, the loosened segment will bulge.

Feel the chest for evidence of, tenderness, instability and crepitus. At the chest, also feel for subcutaneous emphysema, air bubbles under the skin -- which feel like puffed rice (Rice Krispies).

Evaluate the abdomen

Look for evidence of deformity, contusions, abrasions, penetrations, burns, lacerations and swelling.

Feel the abdomen for tenderness, rigidity and guarding. Also check for distension and evisceration. Instability and crepitus relate to bones and are not relevant for the abdomen.

T	Tenderness - pain or sensitivity
R	Rigidity is a late sign of internal bleeding.
G	Guarding is localized involuntary muscle contraction when the injured area is touched.
D	Distension - The most common cause of abdominal distension is the accumulation of intestinal gases, due to the slowed intestinal passage as a result of injury to the abdomen, blocked or twisted bowel or lack of blood supply (ischemia) due to trauma or shock. Distension can also occur when blood begins to pool in the abdominal cavity, as a result of rupture of an abdominal organ or due to a very full bladder.
E	Evisceration is a laceration into the abdominal cavity.

Evaluate the pelvis

Look for evidence of deformity, contusions, abrasions, penetrations, burns, lacerations and swelling.

Feel the pelvis for instability by first pushing the sides of the pelvis together above the widest part of the hips and then pushing back on the outer wings of the pelvis.

The pelvis is an extremely strong, rigid structure. It takes a great deal of energy to do damage. Therefore, if the pelvis is fractured, it's a major injury. The vessels in and around the pelvis are large. Blood loss can be tremendous if they too are injured. Pelvic injury can also result in the rupturing of the bladder if it is full. Check for blood and wetness.

Evaluate the femurs

Look for evidence of deformity, contusions, abrasions, penetrations, burns, lacerations and swelling. Even scarcely-detectable swelling, associated with a fracture of the femur, may easily contain two litres (two quarts) of blood. If the femur is fractured, the foot will turn out when the patient is supine.

Feel for evidence of tenderness, instability and crepitus.

Feel the femur firmly with both hands, if possible.

Femur fractures are high-energy injuries. If the femur is fractured, it is a potentially life-threatening injury due to the high likelihood that the patient will develop shock and may have other internal injuries.

Transportation decision

At this point you will make the decision whether you should transport immediately because you have a patient with a life-threatening condition (load and go), or whether the patient can be fully checked and treated prior to departure (stay and treat).

Load and go

Load and go is an attitude as well as a treatment. It involves recognizing the importance of getting the patient to advanced medical care. The reality is that in spite of making this decision, you may still be on scene for an indeterminate amount of time due to problems with evacuation, transport, weather or a host of many other things. The critical point is that you have recognized the patient needs to go as soon as possible. If the patient has a life- or limb-threatening condition, you must:

- Continue life support.
- Stabilize any major injuries as quickly as possible.
- Apply oxygen, if available.
- Load the patient into a toboggan (preferably on a back board) or other means of transport, and
- Transport to EMS.

What is a life-threatening condition?

Here are some examples of load and go situations:

- Compromised ABCs
    - Airway control problems
    - Any inadequate breathing problem that cannot be corrected quickly
    - Chest injuries that affect breathing
    - Circulatory problems including uncontrollable bleeding, shock, suspected cardiac chest pain
    - Impaired distal circulation in extremity injuries
- Neurological disabilities
- Reduced level of consciousness
    - An unresponsive or pain responsive only patient
    - Head injury with unconsciousness
- An altered LOC
- Internal injury or bleeding
    - Acute abdominal pain
    - Tender, guarded, rigid or distended abdomen
    - Unstable pelvis
    - Fractured femur

While waiting for transport, go ahead with whatever means you have to get the patient ready for fast transport. When transport arrives **load** the patient and **go** to advanced care. Once you have begun this evacuation, you do not have time to complete the secondary assessment, apply extensive splinting or treat minor injuries. A backboard, scoop stretcher or immobilization mattress allows you to immobilize all long bone fractures against the patient's body and move the patient more easily to transport with less risk.

If the means of transportation still has not arrived, you may have the opportunity to do a secondary assessment. If the secondary assessment is completed prior to the arrival of transportation, then additional treatments are instituted.

Stay and treat

The point of the transport decision is about when, not if, to move the patient. Without life-threatening issues where time is of the essence, the patroller can **stay** and **treat** the patient when transportation arrives, then leave for more hospitable surroundings or further medical attention.

Communicate injury severity

Communicate the condition of the patient and request appropriate assistance and equipment. Whatever you describe, be concise and accurate. Provide a summary of the abnormal findings of your primary assessment.

Techniques vary. Many ski areas provide radios. Often there are special radio codes for serious injuries. Know the codes for your area. If your area allows you to describe the severity of injury over the radio, be concise and accurate. Follow the same format for information delivery as you used for your primary assessment.

For example:

Base Hut, this is Wilson at the bottom of Run 5. I am on the scene of a collision between a skier and a tree.
The patient is:

- a 24-year-old male:
- unresponsive
- rapid, shallow laboured breathing
- pulse present at the neck, absent at the wrist
- chest is tender on the left with instability
- I need a backboard, oxygen, toboggan and additional manpower right away. **Activate EMS.**

Secondary assessment

Purpose of the secondary assessment

The purpose of the secondary assessment is twofold:

- First, you will not be taken by surprise by something you have overlooked, and
- Second, you may discover hidden - but more serious - injuries of which the patient is not aware.

If you discover life-threatening injuries or other problems, upgrade the situation to load and go. A key example of the benefits of both assessments is the ability to uncover a progressive deterioration of the patient's condition, such as the development of shock due to internal bleeding or a sudden loss of consciousness.

Record information about the patient and the incident, during the secondary assessment. The primary assessment does not spend time documenting observations because the objective was to look for and attend to life-threatening injuries. Now is the time to note your observations from the primary assessment especially with respect to the quality of ABCDs. Just because the primary assessment did not include actual counts, your first findings still have value. You should also note the time of the incident and of your findings.

The secondary assessment consists of four major parts:

1. Vital signs
2. A head-to-toe exam
3. Patient history
4. Documentation

With practice you will be able to ask questions (and remember the answers) at the same time you are performing a physical assessment of the patient.

Vital signs

Vitals signs, often just called "vitals," are always recorded to enable the evaluation of the patient's overall condition immediately and over time. EMS can use your record of vital signs in their continued monitoring of the patient.

Measure and record:

- Breathing rate (depth and regularity)
- Pulse rate (strength and rhythm)
- Blood pressure (cuff optional)
- Level of consciousness (on AVPU scale)
- Pupil reaction to light (size and equality)
- Skin condition (temperature, colour and moisture)
- Patient's classification of pain (zero to 10).

Vitals are most meaningful when compared over time. The first set is the base line to which a patient's improvement or deterioration is measured. Always record the time and findings with each set of vitals you take.

With the first set of vitals, also record:

- Time the accident occurred and/or the time you first arrived on scene
- Your findings in the primary assessment
- The patient's full name
- A contact name and phone

This is important if the patient later becomes unresponsive.
Record the history details later.

Pulse

Observe the heart rate, strength, and rhythm. Try to use the radial or carotid artery, in that order. Although the carotid gives better results, patients usually find it intimidating and it does not give an indication of perfusion in the extremities.

Count the number of beats in 15 seconds, then multiply by four.
For example: 19 beats in 15 seconds are recorded as 76 beats per minute.

Note the strength of the pulse as bounding (very strong), strong (full) or weak. Note the rhythm as regular or irregular.

The average adult resting pulse is strong, regular and has a rate of 60 to 100 beats per minute.

Pulse		**Possible Causes**
Rate	None	Cardiac arrest
	Slow (<60/min.)	Cold injury Heart attack Overdose
	Fast (>100/min.)	Shock Heart attack Heat injury
Strength	Weak	Shock Heart attack Cold injury Overdose
	Strong	Normal
	Bounding	Heat injury Overdose Heart attack
Rhythm	Irregular	Heart attack Overdose
	Regular	Normal

Blood Pressure

Blood pressure is the pressure that circulating blood exerts against the walls of the arteries. Blood pressure readings are recorded by placing the systolic pressure over the diastolic pressure, (e.g. 120/80). Systolic pressure is the level of pressure during the contraction of the heart, when blood is being pumped through the arteries. Diastolic pressure is the pressure in the vessels during relaxation of the heart, when blood is returning to the heart.

Blood pressure levels vary with age and sex. The usual rule of thumb for an average systolic pressure in a male patient is 100, plus the age of the patient; while the average diastolic pressure is 65 to 90. For the female patient, the pressure is usually eight to 10 lower than the male.

Blood pressure can be assessed using the following averages:

- If a radial pulse is present, the systolic pressure is above 80.
- If there is no radial pulse but a femoral pulse is present, the systolic pressure is 70.
- If only the carotid is present, then the systolic pressure is 60.

If available, blood pressure is measured by a device called the sphygmomanometer, also called a blood pressure cuff, which is used in conjunction with a stethoscope.

To measure blood pressure, secure the cuff around either arm of the patient just above the elbow. Follow the directions on the cuff for proper placement of the pressure diaphragm over the brachial artery. Find the brachial artery by palpating the arm in front of the elbow.

Inflate the cuff with the rubber bulb until the pressure is about 20 points above the point where the needle of the dial stops moving with the pulse. Avoid overinflating the cuff, since this can be painful for the patient.

Place the stethoscope diaphragm over the brachial artery in front of the elbow. Using the release valve located at the bulb, slowly release the air from the cuff. The point on the dial at which the first sound of a pulse is heard through the stethoscope, is the systolic pressure.

While listening through the stethoscope, slowly continue releasing the air from the cuff. The point on the dial at which the pulse sound disappears, is the diastolic pressure.

Breathing rate/ espirations

Observe rate, depth and effort needed to breath. Note airway sounds while you check the breathing as per the primary assessment. The secondary assessment also checks the rate.

Count the number of breaths/chest expansions in 15 seconds, then multiply by four.
For example: four breaths in 15 seconds are recorded as 16 breaths per minute. The normal adult rate range is 12 to 20.

Breathing rates	Possible causes
None	Respiratory arrest
Slow (< 10 / min.)	Stroke Head injury Overdose Chest injury
Fast (> 20 / min.)	Asthma Shortness of breath Chest injury Shock
Patterned	Head injury Diabetic coma

Level of consciousness

Record the patient's LOC on the AVPU scale as described in the primary assessment.

Pupil reaction

Examine to find whether the **p**upils are **e**qual and **r**eactive to **l**ight - **PERL**. Normally, pupils dilate (enlarge) in dimmer light and constrict (become smaller) in brighter light. Note that up to 10 per cent of normal individuals have unequal pupils. The pupils of the eyes are good indicators of the condition of the circulatory system and the brain. Normal eyes react to light equally and quickly.

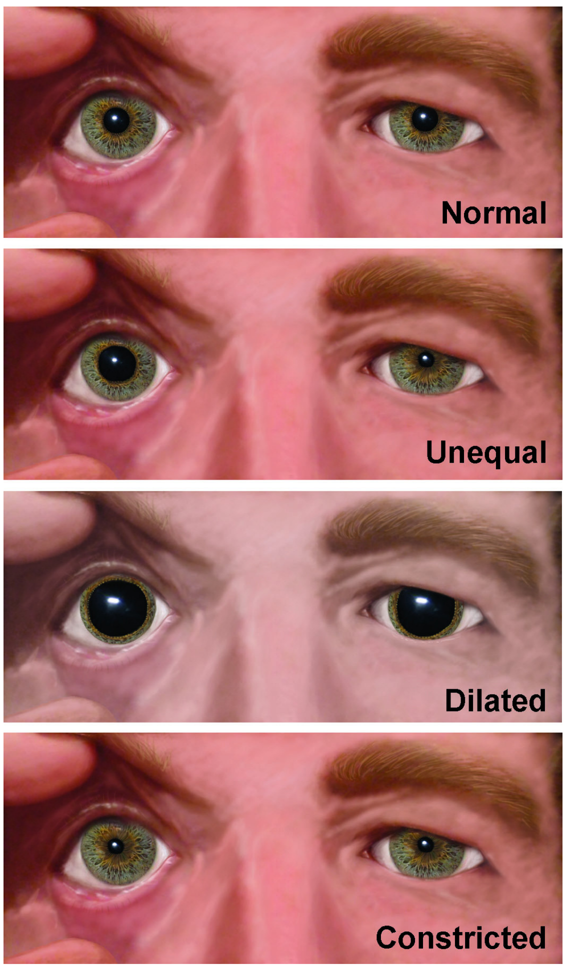


Figure 2: Pupil response

Perform the evaluation with a flashlight, if possible, or by putting a hand over an eye for a few seconds and removing it quickly. Do not shine a flashlight directly into the pupil. This is uncomfortable; shine the light from the side of the eye.

Pupil response	Possible causes
Equal and reactive	Normal
Non-reactive	Glass eye or contact lens
Fixed and dilated	Brain hypoxia
Unequal	Head injury or stroke, congenital
Fixed and constricted	Drug abuse or severe brain damage
Small, pinpoint	Drug usage or disease
Change from constricted to fixed and dilated	Worsening condition

Skin condition

Check the condition of the patient's skin:

- Colour - by looking at the patient's face
- Temperature - by placing the back of your hand on the patient's forehead
- Moisture - both visually and by touch

The condition of the skin is a good indicator of the circulation and oxygenation status of the patient.

Compare what you would expect the skin to be like given the patient's activity immediately prior to the accident, to what the skin is actually like. For instance, some activities may have caused the skin to differ from the usual pink, warm and dry. In the absence of strenuous activity, on a cold day the skin may be cool or even cold. After strenuous activity, such as during a race, it could be flushed, hot and sweaty.

Skin condition	Possible causes
Blue	Cyanosis Lack of oxygen
Pale, cool and clammy	Circulatory problems (shock, internal bleeding) Heat exhaustion Hypoglycemia (insulin shock)
Dry, warm, flushed	Hyperglycemia (diabetic coma)
Cold waxy	Hypothermia Severe frostbite
Red	Frostbite Burn
Yellow	Hepatitis/liver dysfunction
Flushed	Heat stroke Crushing chest injury

Pain measurement

The perception of pain is a symptom. A patroller can see the patient is experiencing discomfort, but is unable to measure it directly. To measure pain level, ask the patient to quantify the pain. "*On a scale of zero to 10, where 10 is the worst pain you've ever experienced, and zero is no pain, how would you rate the pain you are now experiencing?*" (This question should be asked for each individual injury.) Young children may find it easier to describe their pain by relative size instead of numeric magnitude, e.g. floor is no pain, ceiling is the most pain, how tall is your pain?

Head-to-toe exam

Recheck the core areas using the same techniques as the primary assessment (neck to knees).

Examine the head

Look for evidence of deformity, contusions, abrasions, penetrations, burns, lacerations and swelling.

Check for:

- Blood and/or fluid in the ears or nose.
- Bruising behind the ears (Battle's Sign).
- Bruising around the eyes (sometimes called "raccoon eyes").

  Any of which may indicate a skull fracture.

Check the mouth for broken teeth, blood and/or a fractured lower jaw.

Feel the head for evidence of tenderness, instability and crepitus. Feel the face for fractures, particularly just under the eyes, the nose and the upper jaw.

Listen to what the patient tells you. Have the patient clench their teeth to check for pain in the jaw possibly indicating a fracture.

Check the neck

Check the clavicles

Look for evidence of deformity, contusions, abrasions, penetrations, burns, lacerations and swelling.

Feel the clavicles for evidence of tenderness, instability and crepitus.

Gently push against the clavicles as you trace their path from the centre of the chest to the shoulder one at a time.

Listen to what the patient tells you. A fractured clavicle is a painful injury.

Check the scapulas

Look for evidence of deformity, contusions, abrasions, penetrations, burns, lacerations and swelling.

Feel the scapulas for evidence of tenderness, instability and crepitus.

Using the flat of your hand push on the scapulas (shoulder blades) one at a time. Broken scapulas are caused by heavy forces that might also have injured the chest, lungs, or internal organs.

Check the chest and the abdomen

Evaluate the upper extremities

Check the upper extremities (arm, shoulder elbow, wrist, hands and fingers).

Look for evidence of deformity, contusions, abrasions, penetrations, burns, lacerations and swelling.

Feel for evidence of, tenderness, instability and crepitus. Use a two handed technique to firmly squeeze all the way down the arm.

Evaluate the pulse, motor response and sensation (PMS):

Pulse

Pulse indicates circulation at the extremities.

Apply a small amount of pressure to the fingernail bed or a spot of skin until the pressured area turns white. Capillary refill is the time it takes for the area to recover its normal colour. Normal refill time is less than two seconds in a healthy person. If capillary refill takes more than two or three seconds, it may be an early sign of shock or dehydration. Note that refill is delayed in cold environments.

Motor response

Motor response shows whether a patient can move a finger if asked to do so.

Ask the patient to move all their fingers or squeeze your fingers.

Sensation

Sensation indicates whether a patient can feel a touch or pain stimulus.

Test for sensation by gently pinching the skin on the back of the hand or touching one finger and asking the patient, "*What did I do?*" Try not to let the patient see what you are doing.

Check the pelvis and the femurs

Evaluate the lower extremities

Lower legs

Check the lower extremities (knee, calf, ankle feet and toes).

Look for evidence of deformity, contusions, abrasions, penetrations, burns, lacerations and swelling.

Feel for evidence of tenderness, instability and crepitus. Use a two-handed technique to firmly squeeze all the way down the lower leg. If only one hand can be used, use the side of your thumb to press on the angular edge of the tibia all the way down its length. Use a similar technique to trace the fibula (outer side of the leg) down its length.

Evaluate PMS:

Pulse

Pulse indicates circulation at the extremities.

Apply a small amount of pressure to the toe or a spot of skin (above the ski boot) until the pressured area turns white. Capillary refill is the time it takes for the area to recover its normal colour. Normal refill time is less than two seconds in a healthy person. If capillary refill takes more than two or three seconds, it may be an early sign of shock or dehydration. Note that refill is delayed in cold environments.

Motor

Motor response shows whether a patient can move a foot if asked to do so.

Ask the patient to move their foot or press against your hand.

Sensation

Sensation shows whether a patient can feel a touch or pain stimulus.

Test for sensation by tapping on the bottom of their boot and asking if they can feel it.

Check the back

Patient history

As your assessment technique and experience increases, you will be able to ask questions of the patient at the same time you are conducting a physical assessment. **Depending on the situation, some of these questions may be pertinent during the primary assessment. You do not have to wait until the end of the secondary assessment to ask.** Now is the time to make sure previous information is recorded.

Repeating these questions during the secondary assessment can be useful if you suspect a concussion or previous unconsciousness. See if the patient gives you the same answer late in the secondary assessment as early in the primary assessment .

- What is your name? Address?
- Who can be contacted for you?
- What happened?
- Do you have any medical conditions that I should know about?
- Are you on any medications and what are they for?
- Do you wear a MedicAlert?
- Do you have any allergies?
- Have you taken any alcohol or drugs today?
- Are you a bleeder?
- Do you wear contact lenses or dentures?
- Have you had any serious illness, injury, or operations in the last year?
- When did you last eat?
- When did you last pass urine (in suspected pelvic/hip injuries)?

Figure 3: MedicAlert/sample of engraving on back of bracelet/necklet emblem

To help you remember the basic history information that needs to be gathered, use the acronym SAMPLE.

		Questions to ask
S	Signs and symptoms	What's wrong? (Observe, ask and record)
A	Allergies	Do you have any allergies?
M	Medication	Are you taking any medication?
P	Past medical history	Do you have any medical conditions?
L	Last meal	When did you last eat or drink?
E	Events leading to the injury or illness	What happened to cause the problem?

- Ask the patient to describe the pain (for each individual injury), using the acronym OPQRST.

How much does it hurt? Have you had this injury before?

- Re-assess the patient's pain level on a scale of zero to 10.
- How much does it hurt? Have you had this injury before?
- Has it ever hurt like this before?

Questions to Ask

O	Onset	How did the pain start? Was it sudden, gradual, or an ongoing chronic problem?
P	Provoke	What provokes the pain or causes it to get worse? E.g. movement or pressure. Is it better with rest?
Q	Quality	How would you describe the pain? (Burning, shooting pain, numbness, throbbing, etc.)
R	Radiation	Where, exactly, is the pain located? Does it radiate to other areas?
S	Severity	How bad is the pain? Use scale of zero to 10.
T	Time	When did the pain begin? How long has it been present? Is it intermittent or constant?

Pain management

Injuries are painful. To reduce pain, there are two pain management techniques that are approved for use by patrollers. These include pharmacological and non-pharmacological measures.

Non-pharmacological interventions

Injury stabilization by immobilization (splinting) and elevation, along with the application of cold packs, form the basis of non-pharmacological intervention.

By reducing local skin temperature, nerve conduction through pain receptors is slowed, reducing the perception of pain. In addition, swelling and inflammation is reduced which also reduces pain.

Make a cold pack by putting snow into a plastic bag.

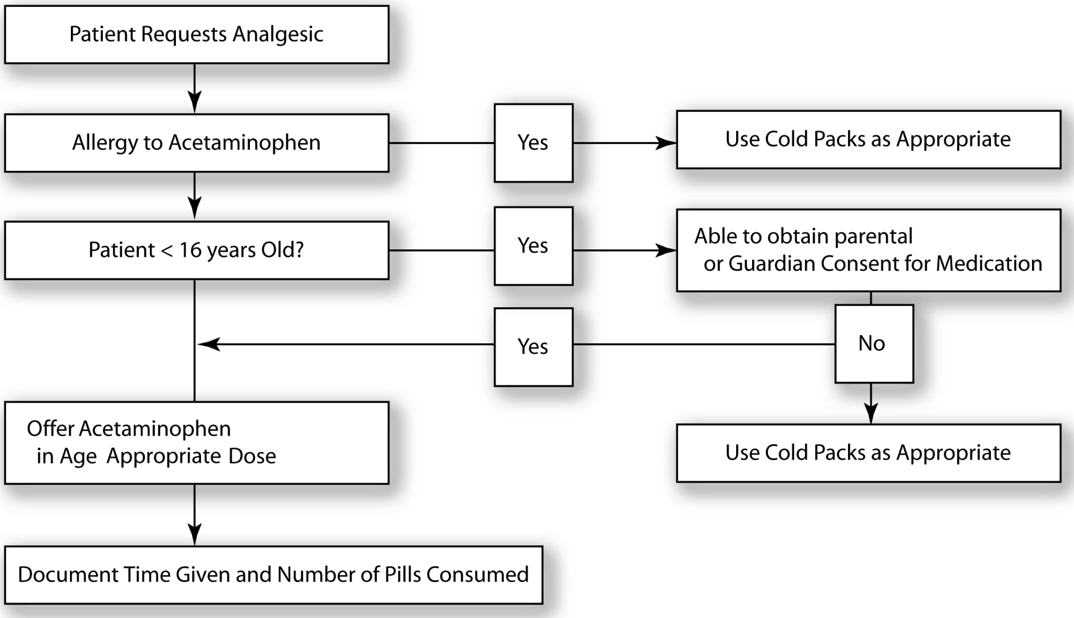
Apply the cold pack for 10 to 15 minutes then take it off for 10 to 15 minutes and repeat indefinitely.

Manage the size of the cold pack so that only the injured area is cooled, rather than the entire limb. Place a cloth or thin layer of some material between the cold pack and the skin. It is important to monitor the skin to prevent frostbite, and remove the cold pack if the patient complains of cold-induced pain.

Pharmacological interventions

Acetaminophen

Acetaminophen is an over-the-counter analgesic that is effective for sprains, strains and taking the edge off more painful injuries such as dislocations and fractures. Of the over-the-counter medications available, acetaminophen has the fewest side effects and can be taken by the greatest number of people.



Acetamininophen administration protocol

The only precautions are people with a known allergy or sensitivity to acetaminophen, and children under the age of six. Even for people with acetaminophen sensitivity, the most common adverse reaction is the formation of a rash.

Patrollers are authorized to respond to a request for pain relief by offering acetaminophen according to the following protocol.

- Ask the patient about sensitivity or allergy to acetaminophen.
- Obtain parental or guardian permission for children younger than 16 years old prior to offering acetaminophen.
- Have the patient swallow the pill(s) with the minimum amount of water required to do so.
- Continue to make transportation arrangements for the evacuation of the patient.
- Document time, dosage of medication when given, response to treatment.
- Acetaminophen is to be administered with the least amount of fluid required (sips of clear fluid), and patient is to refrain from having any other oral fluids if there is the possibility that further medical procedures or surgery will be required.

Dosage

Age	Maximum dose
6 to 12	325 mg
12 to16	650 mg
16+ years	1000 mg

FOR INFORMATION ONLY

[A CSP Regular Member (Advanced First Aid (AFA) certified) is not trained in these procedures]

Entonox

Entonox is a 50:50 mixture of nitrous oxide and oxygen gases that can be used to reduce pain in specific traumatic injuries. Nitrous oxide is an odourless and colourless gas. It is a strong analgesic, the effect of which, under the right circumstances, can be equivalent to about 10 mg of morphine. Entonox produces a central nervous system depression (sedation), but has little effect on circulation and respiratory systems. It is administered by the patient and it normally starts relieving pain within seconds. The patient who receives Entonox may have an altered LOC and may experience drowsiness, dizziness or giddiness. Discontinuation of Entonox will normally dissipate its effects within seconds. The use of Entonox is warranted by a patient's reported pain level or intolerance to pain. There can be difficulties associated with its use outdoors in cold environments.

Indications :

- To reduce pain in specific traumatic injuries.
- Primarily used with stable patients (vital signs adequate and not deteriorating) with extremity injuries.
- Can be used for shoulder and clavicle injuries.
- Can be used in hip or pelvis injuries, if patient is stable.
- Can be used in stable burn patients
- Patients must be capable of self-administration.
- Helpful when manipulating and splinting breaks or dislocations.

Entonox continued...

The above is a partial explanation only of Entonox and its use to relieve pain and is included only for increased awareness, not a detailed instruction on its use.

Contraindications :

- Usage in an enclosed treatment area without ventilation.
- Inability to comply with instructions.
- Suspected inhalation injury or pneumothorax.
- Patient has taken Nitroglycerin within the last five minutes.
- Decompression sickness.

Cautions :

- Depressant drugs (ensure LOC is not affected).
- Maxillofacial injuries (might affect patient's ability to self-administer the gas or compromise airway).
- COPD (The major stimulus to breathing for COPD patients is lower oxygen levels and this stimulus may be compromised by Entonox, which is 50 per cent oxygen).
- Distended abdomen (do not administer Entonox if the abdomen is obstructed or injured).
- Shock (monitor for unstable vital signs).

Entonox Tank

Retake vital signs

For severely injured patients, when shock is suspected, or ABCs are compromised, take a set of vitals every five minutes for the first 15 minutes, then every 15 minutes for the next hour.

Documentation

Documentation is the best way to pass your information on to others in the health care system.

Include the mechanism of injury and the position of the patient, as well as what you found during your assessment.

Include the best description you can and any treatments you administered. Your handwriting must be legible for your information to be useful.

You are the only member of the health care team to actually have witnessed the setting of the incident. This information is often crucial later in the treatment of the patient.

Refer to the sample intervention report at the end of this chapter. (see "Sample intervention report" on page 4-25)

In addition to the intervention report or note to the doctor, it is important to understand that each area may have accident report forms to be completed. The patroller must be familiar with the various forms at their area and how to complete them.

FOR INFORMATION ONLY

[A CSP Regular Member (Advanced First Aid (AFA) certified) is not trained in these procedures]

The Canadian Triage and Acuity Scale (CTAS)

The Canadian Triage and Acuity Scale (CTAS) was designed to improve the process of triage in emergency departments.

CTAS is used to assign a level of acuity or severity to patients requiring aid and to define the patient's need for care. It is based on establishing a relationship between the patient's chief complaint, the potential causes and the patient's final diagnosis. These include how a patient looks, their vital signs and associated signs and symptoms. The patient is the focus of this triage system as it attempts to define the ideal time in which patients should be seen.

As most emergency medical services, or EMS, organizations are extensions of the emergency department this scale is routinely used by some EMS providers across the country. This ensures that paramedics, emergency staff, and, as front line providers of advanced first aid, the Canadian ski patroller, are speaking a common language for identifying a patient’s condition.

CTAS is a five-level scale with the highest severity being Level 1-resuscitation and the lowest severity being Level 5-non-urgent.

Level 1 – resuscitation

Conditions that are threats to life or limb (or imminent risk of deterioration) requiring immediate aggressive interventions.

Level 2 – emergent

Conditions that are a potential threat to life limb or function, requiring rapid medical intervention or delegated acts.

Level 3 – urgent

Conditions that could potentially progress to a serious problem requiring emergency intervention. May be associated with significant discomfort or may affect ability to function at work or activities of daily living.

Level 4 – less urgent

Conditions that relate to patient age, distress, or potential for deterioration, would benefit from intervention or reassurance.

Level 5 – non urgent

Conditions that may be acute but non-urgent as well as conditions which may be part of a chronic problem with or without evidence of deterioration.

Only members of the Canadian Ski Patrol, trained in CTAS by local or regional emergency medical services or paramedics may use this system. When EMS utilizes CTAS for pre-hospital patient care then usage by the CSP may be warranted.

Multiple patients - triage

Triage (French for "sort") is the process of sorting patients based on the seriousness of their injuries. Use triage if there are numerous patients involved to determine who may need help and who needs to be transported in what order. Patients are quickly assigned one of four colour codes as summarized in the following table.

START

This system of prioritising patients is called **S**imple **t**riage **a**nd **r**apid **t**reatment (START).

The process is based on the process of rapidly assessing ABCD.

Assessing the patients is a continuous process. A patient's status can be upgraded or downgraded at any time as their condition improves or worsens. It is based on changes in the patient's condition, the availability of transportation, the arrival of additional manpower and the number of patients remaining. When additional patrollers arrive on the scene, you can quickly communicate the status of patients simply by reporting their triage colour.

General triage procedures

(Adapted from Community emergency response team (CERT) Conducting triage)

Step 1. Scene survey

- Note the time
- Are there any further dangers to myself, the patients or any others?
- What is the mechanism of injury (what happened)?
- Is there more that one person injured? Yes

Definition	Designation	Priority
Critical Life-threatening injuries. These patients have compromised breathing or circulation or LOC. They require immediate treatment and transportation.	**Red**	High
Serious Not immediately life-threatening. These patients have patent ABCs, no obvious signs of shock, and seem alert but are not likely walking. Any bleeds can be controlled. They require treatment but transport may be delayed.	**Yellow**	Medium
Minor May need treatment. These patients are walking and alert. Transport can be delayed with no detriment to the patient's outcome.	**Green**	Low
Dead or non-salvageable These patients have no spontaneous breathing even with a repositioned airway.	**Black**	None

- Do I require assistance with handling the scene? Yes, call for help.

> Note: This scene survey focuses only on the physical scene and not the conditions of the patients.

Step 2. Conduct voice triage.

Begin sorting patients by calling out, "Canadian Ski Patrol, if you can walk, come to the sound of my voice."

If there are injured or non-injured people who can walk, they are "green." They should be directed to a designated safe location while you continue with triage.

If you need assistance, you can ask the "green" to help. They may also provide useful information about the locations of other patients.

Step 3. Follow a systematic route.

Now you're ready to start working with non-ambulatory patients. To make sure that you don't miss anyone:

- Start where you stand.
- Start with the closest patients.
- Work outward in a systematic fashion.

Step 4. Triage and tag each patient green, red, yellow or black

Assess each patient for ABCDs. Check if they are breathing. If not, reposition their airway and check again. Any unconscious, breathing person should be put in the recovery position so they can keep breathing. Major bleeding should be controlled.

Assign each patient a tag/colour.

Step 5. Document triage results.

After you triage patients in an area, record the number of patients by triage colour and their locations. This documentation will help responders and back up when they arrive to:

- Identify the locations of patients.
- Deploy resources effectively.
- Estimate the number of patients by degree of severity.

Triage pitfalls

- No team plan, organization, or goal.
- Indecisive leadership about where to start and what to do.
- Too much focus on one injury or person.
- Treatment rather than triage.

Keep gloves sterile each time that you handle a new patient, your latex gloves must be sterile, to avoid cross-contamination. There are two ways to ensure that your gloves are sterile:

- Change protective gloves every time you handle a new patient. Gloves must be changed to avoid any possible cross-contamination.
- When supplies are limited, it may not be possible to use a new pair of gloves for every patient. In this case, you can sterilize gloves between patients using one part bleach to 10 parts water.

Date ______ Location ______ Time ______

Name ______ Phone Number ______

D.O.B. ______ Age ______ Male/Female ______

Address ______

______

Contact Name ______

Relationship ______ Phone Number ______

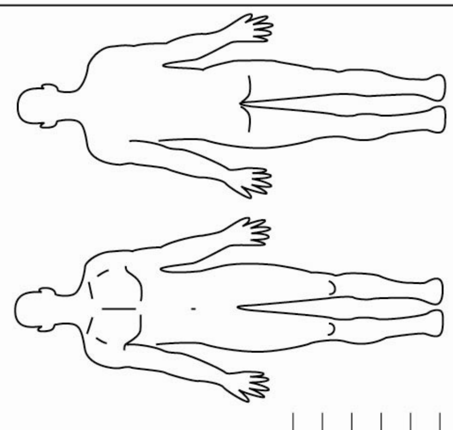
Address ______

Priorities:
- Airway Concerns Y N
- Cardio Concerns Y N
- Severe Bleeding Y N
- Level of Consciousness Y N
- Spinal Concerns Y N

Pain:
- **O**nset
- **P**rovoke
- **Q**uality
- **R**adiation
- **S**everity
- **T**ime

Chief Complaint ______

Vital Signs	1	2	3	4
Time				
Pulse	Strong/Weak Regular/Irreg	Strong/Weak Regular/Irreg	Strong/Weak Regular/Irreg	Strong/Weak Regular/Irreg
Respiration	Deep/Shallow Regular/Irreg	Deep/Shallow Regular/Irreg	Deep/Shallow Regular/Irreg	Deep/Shallow Regular/Irreg
Skin	Pale Moist Normal Dry Flush	Pale Moist Normal Dry Flush	Pale Moist Normal Dry Flush	Pale Moist Normal Dry Flush
Pupils	Equal&Reactive Unequal Non-Reactive	Equal&Reactive Unequal Non-Reactive	Equal&Reactive Unequal Non-Reactive	Equal&Reactive Unequal Non-Reactive
Pain Level				
L.O.C.	A V P U	A V P U	A V P U	A V P U
B/P				



- Fracture
- Laceration
- Amputation
- Pain Location
- Radiating Pain

Contact Lenses ______
Dentures ______
Alcohol/Drugs ______
Last Meal (Time) ______
Washroom (Time) ______
Recent Operations ______
Medic Alert ______
Allergies ______
Medication ______
Pre-existing Condition ______

Accident Details ______

Injurie(s)/Treatment(s) ______

Figure 4: Sample intervention report

Notes...

Oxygen

Upon completion of this chapter the student will be able to:

1. Describe the oxygen delivery devices.
2. Describe the purpose, benefits, indications and complications for supplemental oxygen.
3. Describe the safe storage of oxygen equipment.
4. Perform the procedure for administering oxygen to a breathing patient.
5. Perform the procedure for administering oxygen to a non-breathing patient.

Learning outcome

Describe, understand and demonstrate the use of oxygen in the treatment of a patient.

Introduction

This section provides the basic theory for use of oxygen in treating a patient who has suffered a serious injury. Equipment will vary from centre to centre and training on the use of the oxygen equipment is the responsibility of each local ski centre.

Always ensure a clear airway before administering oxygen. Do not administer oxygen to a patient unless you have been trained by qualified personnel on how to use the proper equipment. Also, do not administer oxygen using units equipped with a positive pressure resuscitator. These devices can cause lung damage to the patient if used improperly.

Oxygen is a drug. Be cautious about when it is appropriate to administer it, how much to administer and be aware of what to expect.

Benefits of administering oxygen

Atmospheric air, the air around us, contains about 21 per cent oxygen. Oxygen is transported across the alveoli - air sacs - of the lungs to the red blood cells which in turn, carry oxygen to other cells of the body. Therefore, for cellular oxygenation to occur, both the respiratory and circulatory systems must be intact.

In cases of impairment to either system, administering oxygen may be beneficial as described below:

Impairment of circulatory system

When there is a deficiency in the circulatory system, there may be fewer red blood cells (hemorrhage) or they may be circulating inefficiently (shock). Administering oxygen increases the concentration of oxygen in the lungs resulting in more oxygen being absorbed by each red blood cell, delivering more oxygen to the cells. This in turn compensates for the lower number of red blood cells in the circulatory system that occurs during trauma and may help reduce or prevent the progression of shock.

Impairment of respiratory system

During artificial respiration, oxygen concentration in the lungs is reduced from 21 per cent to 16 per cent. CPR maintains circulation at about 30 per cent of normal levels, which reduces oxygen concentration even further. While this is enough oxygen to keep a patient alive, administering oxygen in these cases increases oxygen concentration in the lungs resulting in an increase in the amount of oxygen available for the blood to carry to the cells.

This improves the patient's survival chances.

> Obtaining a clear airway takes precedence over giving oxygen.

Hypoxia

Hypoxia is a condition resulting from a decrease in the level of oxygen available to the cells. It is crucial that a first aid provider be able to recognize the signs and symptoms that indicate the onset of hypoxia.

The ultimate goal in treating hypoxia is to increase blood oxygen concentration and thus prevent the patient's condition from deteriorating and developing shock, respiratory arrest or ultimately resulting in brain damage and death.

To avoid any such complications, first stabilize the condition causing the problem, and then administer oxygen to increase the oxygen concentration in the lungs. Hypoxia may be caused by CRASH.

C	Cardiac
R	Respiratory
A	Altered level of consciousness
S	Shock
H	Head injury

Inadequate respiration

Inadequate respiration refers to insufficient amounts of oxygen exchange in the lungs. This could be caused by impure or insufficient air, an obstructed airway, chest injury, disease of the lungs, drug or alcohol abuse, or high altitude; all of which can lead to hypoxia.

Inadequate circulation

Inadequate circulation refers to a reduction in blood flow to the tissues. This could be caused by a heart attack, shock, severe bleeding or disease.

Cellular transport problems

Cellular transport problems refer to reduction in the oxygen-carrying capacity of the red blood cells. This could be caused by a heart attack, shock, severe bleeding or disease.

Chronic bronchitis

Bronchitis occurs when long-term exposures to irritants, usually from smoking, causes the large and small airways to become inflamed. This irritation leads to increased mucus production and cellular changes in the mucosal wall. The condition is considered chronic if the person has a productive cough for more than three months per year for two years in a row. The patient must work much harder to breathe than a normal person. This increased effort can lead to respiratory distress and eventual respiratory failure.

Complications of oxygen administration

Complications may arise from administering oxygen either for extended periods of times or if the patient is exposed to higher-than-normal levels of concentration of oxygen.

Oxygen toxicity (poisoning) occurs when the patient is exposed to high concentrations of oxygen. This can result in lung tissue destruction. This condition is rare in the pre-hospital environment. Taking a history first will reveal if the patient has had any prior extended exposure to oxygen.

Respiratory arrest occurs in cases where the patient suffers from chronic obstructive pulmonary disease (COPD) such as emphysema and chronic bronchitis, and is exposed to high concentrations of oxygen (close to 100 per cent) for extended periods of time.

Note: These conditions are more common in elderly populations especially those with a long history of smoking.

Chronic obstructive pulmonary disease (COPD) and oxygen use

In normal lungs, the major stimulus to breathing is the concentration of CO_2 (carbon dioxide) in the blood. The airway of a patient with COPD becomes partially obstructed; their body adapts to a higher concentration of CO_2 in the blood. Therefore, the body's major stimulus to breathing becomes lower oxygen levels.

Take great care while administering oxygen to a COPD patient as the stimulus to breathe may be compromised and the patient could stop breathing.

Patients suffering from COPD will alert you to their condition. Take a detailed history and monitor their condition while administering oxygen and get medical assistance as soon as you can.

Oxygen equipment

Most oxygen equipment systems will consist of a tank, regulator, hose and face mask.

- The **oxygen tank** will either be green or white, and should have a yellow diamond marker saying oxidiser.
- A **pressure regulator** lowers the pressure from 2,000 psi (138 Bar) inside the tank to less than 50 psi (3.45 Bar).
- A **hose** and a **face mask**.

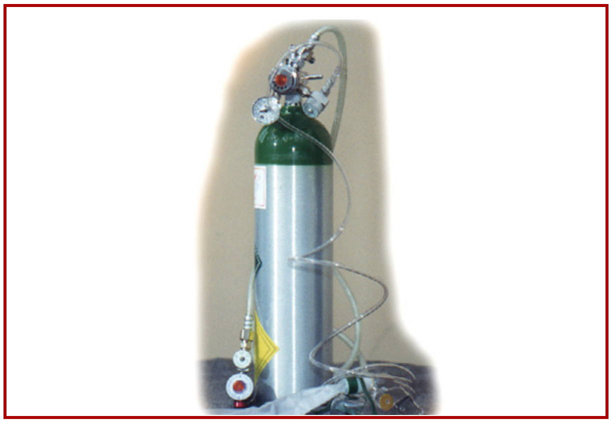


Figure 1: O_2 tank and regulator

Tank and pressure regulator

The pressure regulator has a pressure gauge that reads tank pressure. It has a three-prong key system that will not allow it to be connected to the wrong type of tank.

Figure 2: Pressure regulator and flowmeter

There is a plastic O-ring between the regulator and the tank to maintain an effective seal. The output of the regulator feeds a flowmeter.

Regulator and flowmeter

The flowmeter normally controls the output of oxygen to be delivered from one to 15 litres per minute (lpm).

Face mask

Figure 3: Pocket face mask with oxygen line

A face mask can deliver up to 50 per cent oxygen concentration.

Exhaled air exits through holes on each side of the mask. It is possible for the patient to draw air in through the holes. This lowers the concentration of the oxygen.

Figure 4: Face mask, non-rebreathing mask and cannula

Type	Use	Flowrate (lpm)	Oxygen concentration
Face mask	Moderate flow rates	6 to 15	30% to 50%
Partial rebreather mask	Higher concentration Moderate rates	6 to 10	30% to 60%
Non-rebreathing mask	High concentration	6 to 15	80% to 100%
Nasal cannula	Low concentration	1 to 6	24% to 52%
Bag valve mask	High concentration	10 to 15	80% to 100%

Non-rebreathing mask

Non-rebreathing masks are equipped with an oxygen reservoir. The patient draws oxygen from the reservoir through a one-way valve. The flow rate of the oxygen should be high enough that the reservoir does not totally collapse on inhalation.

Nasal cannula

Use a nasal cannula when the patient refuses a mask or is vomiting.

Insert the two soft tips into the nostrils, then place the tubing behind each ear. Slide the adjuster to keep the tubing in place. The cannula will only deliver low concentrations of oxygen, therefore, it is not normally used in a trauma case.

Handling of oxygen equipment and administration

There are two main concerns when using supplemental oxygen:

- Storage and handling of oxygen equipment; and
- Proper administration of oxygen.

Storage and handling of oxygen equipment

Due to the various sizes of oxygen cylinders, the duration of the tank's use is directly related to its litre capacity and the flow rate (litres per minute, lmp) that is being used. The maximum pressure most commonly used is 2,000 psi when full and anytime the tank gets down to below 400 psi it should be refilled.

There are a variety of oxygen delivery products in use, you only need to familiarize yourself with the specific equipment available where you patrol. Generally speaking, there are two common sizes you are likely to encounter; they are "D" and "M" tanks. D tanks are the most common size for portable units, while M cylinders are used in facilities. The duration of the D cylinder is approximately 20 minutes while the duration of an M tank is approximately three hours, at a flow rate of 15 litres per minute.

All tanks regardless of design have a medical post for turning the tank on and off. Clockwise closes the tank and to open it you only have to give it a quarter to half turn counterclockwise and it will be completely open. After shutting the tank valve, reopen the flow regulator to bleed (release) the pressure out of the rest of the system.

When the oxygen delivery system has been used at your area, the non-disposable parts need to be cleaned and decontaminated. This can be accomplished by using a solution of four litres of water to 80 millilitres (one gallon to one-quarter cup) of five per cent bleach solution. The parts should be scrubbed and then soaked for a minimum of 20 minutes. Any disposable parts should be double bagged and left in a biohazard waste receptacle at your local hospital or facility.

Safe handling of equipment

Handle tanks with care. Do not drop or puncture the tank as it could turn it into a projectile.

Do not use oxygen around an open flame, spark, or in an area where people are smoking. Oxygen supports combustion.

Never allow petroleum products, such as grease or oil, to come in contact with oxygen under pressure. The mixture can promote ignition.

Proper oxygen administration

Before administering oxygen, you must first prepare the equipment by following the steps below:

1. Make sure the tank contains oxygen.
2. Remove the shipping seal from the tank and save the gasket.
3. Open the tank valve for one second to clean debris from the valve. Make sure the regulatory pins match the tank.
4. Insert the gasket into the large cylinder opening.
5. Install the regulator and tighten.
6. Open the cylinder one full turn if the pressure in the main tank is maximum.
7. Attach the delivery device to the flowmeter.
8. Set the required flow rate.

Oxygen can be administered to breathing patients or non-breathing patients.

Figure 5: Tank valve and regulator

Administering oxygen to a breathing patient

Follow the steps below if administering oxygen to a breathing patient:
Do the following:

1. Explain the procedure to the patient.
2. Place mask over their face.
3. Recheck and adjust the flowmeter.
4. Secure the equipment for transport.
5. Monitor vitals and maintain airway continually.
6. Be prepared to do artificial respiration in case of respiratory arrest.

If the patient cannot tolerate wearing the face mask, have them hold the mask close to their face until they can put the mask on. This does not deliver the same concentration of oxygen as wearing the mask but they will get some benefit from the oxygen.

Nasal cannulas do not deliver as much oxygen as a mask. However, some patients cannot tolerate a mask at all (e.g. claustrophobia), which make nasal cannulas the only option.

When the patient no longer needs oxygen administration, do the following:

1. Remove the mask from the patient's face.
2. Close the main regulator valve.
3. Refer to the manufacturer's documentation and follow the proper shutdown procedure for the equipment being used.

Administering oxygen to a non-breathing patient

Oxygen can be administered to a non-breathing patient using a pocket face mask or a bag-valve mask resuscitator. These units connect directly to the oxygen equipment by a delivery tube.

For patients suffering from cardiac arrest, use two-rescuer CPR procedures so that one rescuer can focus on keeping the mask in place and maintain the seal.

Pulse Oximetry

Pulse oximetry is a non-invasive method of monitoring a person’s oxygen saturation. A pulse oximeter is a fingertip-mounted device that uses light to measure the percentage of saturated hemoglobin in blood, ideally with oxygen. The advantage of pulse oximetry is that low saturations of oxygen can be detected earlier than by clinical indicators such as skin color changes and cyanosis.

The device will display the patient’s heart rate (beats per minute), the degree of hemaglobin saturation as a percentage and a waveform of the pulse waves. The evolution of pulse oximeters has resulted in units that are quite accurate, convenient to use, lightweight, noninvasive and inexpensive to purchase.

Pulse oximeters are best used indoors, with patients who have good peripheral blood flow. It is important to remember that the oximeter is measuring hemaglobin saturation, not the quality of patient ventilations. Saturations in the range of 94 to 99% are considered normal. The use of supplemental oxygen should be considered for consistent saturations below 89%, with more aggressive airway management and breathing assistance indicated for saturations consistently below 80%.

Cold hands, nail polished finger nails and low peripheral blood flow will result in false low readings. Exposure to carbon monoxide or cyanide will result in false high readings on the oximeter.

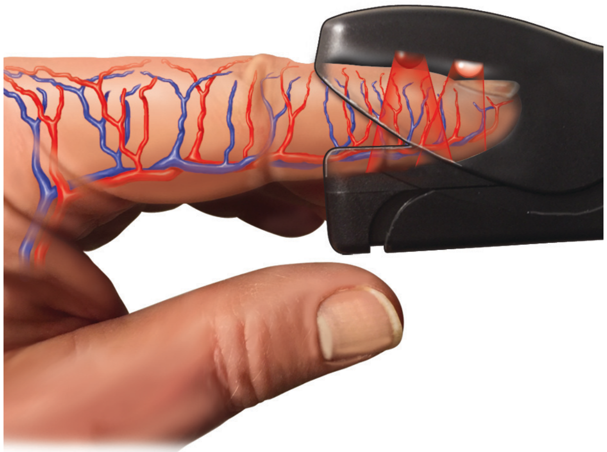


Figure 6: Pulse oximeter illustration.

Figure 7: Pulse oximeter.

Conclusion

Administering oxygen to patients in distress can help reduce the progression of shock and generally improves their recovery chances.

Handle oxygen with care.

Monitor the patient continually until further medical assistance arrives or the patient is transported to another medical service.

Basic Life Support

Upon completion of this chapter the student will be able to:

1. Recognize the signs and symptoms of airway, breathing and circulatory problems.
2. Demonstrate airway management, including relief of airway obstructions, for adults, children, and infants.
3. Understand when and how an automated external defibrillator (AED) should be used.
4. Demonstrate both one- and two-person cardiopulmonary resuscitation (CPR) for an adult, child and infant.

Learning outcome

Describe, understand, and demonstrate basic life support techniques.

All CSP cardiopulmonary resuscitation (CPR) courses are developed from basic life support (BLS) guidelines based on the International Liaison Committee on Resuscitation (ILCOR) Consensus on Science with Treatment Recommendations (COSTR).

CPR levels

The CSP has two levels of CPR for patrollers: **Level C CPR** and **HCP CPR**.

Level C is the minimum requirement for the CSP and includes: adult, child, infant CPR and choking, artificial respiration, two-rescuer CPR and AED.

Level HCP CPR includes: adult, child, infant CPR and choking, artificial respiration, two-rescuer CPR, bag valve mask (BVM) and AED.

ABCs of basic life support

Simply put, basic life support consists of several life-saving techniques related to airway, breathing and circulation.

- **Airway**: the protection and maintenance of patient's airway;
- **Breathing**: the actual flow of air through respiration either natural or artificial respiration;
- **Circulation**: the movement of blood through heart beating or the emergency measure of CPR.

Each of these topics is discussed individually below:

a. see "Clearing the airway" on page 6-5
b. see "Artificial respiration (breathing)" on page 6-12, and
c. see "Cardiopulmonary resuscitation (CPR)" on page 6-21.

Basic life necessities

Airway obstruction, cessation of breathing, or cardiac arrest endangers life. These conditions require immediate resuscitation. Without sufficient oxygen, the brain will begin deteriorating within minutes.

To prevent irreversible damage, begin basic life support procedures immediately.

Clinical and biological death

Arrested respiration and the lack of oxygen in the blood for four to six minutes, will result in damage to brain cells. In rare cases, people have been resuscitated after their vital signs have been undetectable for periods of 20 minutes or more with no ill effects. However, these survivors usually went into cardiac and respiratory arrest under conditions where a cold environment was involved, such as immersion in cold water which caused hypothermia.

Hypothermia can cause the body function to slow because of the cold and thus reduces the need for oxygen to such a low level that deterioration of the cells takes longer than it would in a normal environment. (see "Hypothermia" on page 17-5)

<table>
<tr><th colspan="4">Brain damage
due to hypoxia</th></tr>
<tr><th colspan="4">Time (minutes)</th></tr>
<tr><td>0 to 4</td><td>4 to 6</td><td>6 to 10</td><td>10</td></tr>
<tr><td>Not likely</td><td>Likely</td><td>Probable</td><td>Almost certain</td></tr>
<tr><td colspan="2">Clinical death
Respiratory and cardiac arrest</td><td colspan="2">Biological death
Irreversible brain damage probable</td></tr>
</table>

Airway: causes of airway problems

There are two forms of airway blockages

- anatomical obstruction,
- mechanical obstruction.

Anatomical obstruction

Anatomical obstructions can cause respiratory failure or inadequate ventilation. The most common cause of anatomical obstruction for an unresponsive patient is obstruction by the tongue. It is also the least complex problem and easy to fix.

Mechanical obstruction

Mechanical obstructions result when a foreign object blocks the airway passage. Typical examples of mechanical obstructions are vomitus blockage or a solid foreign body such as a toy, tooth, broken denture, or piece of food.

It is impossible to rectify breathing problems if the patient's airway is not clear. Therefore, identify and rectify airway problems first before going on to the next stage.

Breathing: causes of breathing problems

Typical breathing problems, include the following:

- **Medical problems:** Respiratory failure can be caused by spasms of the larynx, asthma, pneumonia, emphysema or anaphylactic reactions. Asthma is the most common amongst these conditions. (see "Asthma" on page 16-6)
- **Trauma:** Injuries such as blows to the head, throat or chest may cause respiration problems.
- **Lack of oxygen:** Insufficient oxygen supply (hypoxia) causes respiratory arrest. Asphyxiation occurs when a patient is forced to breathe with an inadequate oxygen level or when there is an obstruction of the airway.
- **Poisoning:** Respiration-depressing drugs, such as codeine, morphine, barbiturates and alcohol, can result in the patient not breathing. Inhaled poison, gases and smoke can cause inflammation and swelling of the airway.
- **Agonal breathing:** When someone first goes into cardiac arrest or VSA (vital signs absent), the brain tries to get the lungs to keep breathing. This makes the diaphragm move up/down to draw air into the lungs. This effort is not effective breathing and is called agonal breathing. Agonal breathing may sound like gasping, grunting or noisy breathing with accessory muscle or abdominal movement. It **is not** normal regular breathing. You will not see the chest go up and down as in regular breathing, and you will not hear regular breathing when you look and listen. This can last for a few seconds or even as long as 20 seconds, and can happen when someone first loses their breathing and pulse. Responders can usually recognize when this happens to the patient, and that the person's breathing is different, weird or bizarre, but fail to know that they are actually seeing agonal breathing. Agonal breathing **is not** regular or effective breathing; AR or CPR needs to be started right away. It is important to remember that when assessing the patient for breathing, you need to see the chest move up and down for effective breathing. Breathing that is found to be too fast, too slow or ineffective (agonal) requires immediate intervention. Treatment could be with assisted breaths, AR or CPR.

Other major causes of respiratory distress include the following:

- swelling as a result of burns to the face and the inhalation of heated air can block air exchange,
- drowning,
- shock (see "Shock" on page 9-1),
- altitude sickness (see "Altitude sickness" on page 17-1), and
- electrocution.

Signs and symptoms of airway and breathing problems

Respiratory distress can manifest itself as follows:

- an absence of, or irregular movement of the chest wall and abdomen,
- abnormal breathing sounds (whistling or high-pitched wheezing),
- irregular respiration rate or rhythm, and

- cyanosis (blueness of the skin). For people with a dark complexion look inside the mouth, check finger nail beds, palms of hands and eyes.

Circulation problems

Impaired circulation is generally caused by one of the following:

- **Regulatory mechanisms:** Impaired breathing can result in changes in the oxygen level (i.e. lack of oxygen) and balance between acid and base in the blood which can result in the brain quickly losing its ability to regulate circulatory mechanisms.
- **Circulatory causes:** The following are the major causes of impaired circulation:
    - **Heart attack:** An inadequate blood supply to the cardiac muscle due to an obstruction of a coronary artery causes damage to the heart muscle resulting in impaired cardiac function.
    - **Stroke:** A cerebral vascular accident (CVA) is the result of a reduction of the supply of blood to a section of the brain usually caused either by a blood clot or bleeding within the brain.
    - **Shock:** Hemorrhage causes a decrease in the effective blood volume resulting in shock (see "Shock" on page 9-1).
    - **Electric shock:** An electric current or lightning may disrupt the normal rhythms of the heart or stop it, thus disrupting the normal circulatory system.

Signs and symptoms of circulatory problems

The following are signs and symptoms of circulatory problems:

- cyanosis (blueness of the skin),
- increased respiratory rate,
- abnormal pulse rate and character,
- shallow breathing,
- pale, cool and clammy skin,
- absent radial or carotid pulse, and
- drop in blood pressure.

Methods and principles used in cardiopulmonary resuscitation (CPR)

The following methods will be used throughout the procedures for managing obstructed airways, artificial respiration (AR) and cardiopulmonary resuscitation (CPR) described later in this chapter. Understanding these methods will help in the assimilation and mastering of the various sequences to come.

When applying the skills you are about to learn, you must always consider the height and size of the patient. Generally speaking, infant sequences are intended for patients that are up to one year of age, the child sequences are for patients from one year to eight years old (or puberty onset) and finally adult sequences are intended for patients that are eight years old (or puberty onset) and above.

Category	Age
Infant	Up to one year old
Child	One year old up to eight years old or puberty onset
Adult	More than eight years old or puberty onset

Activating emergency medical services

Contact the designated emergency medical services (EMS) in the following situations:

- If the patient requires a level of medical attention that you cannot possibly provide because of the scope of training you received.
- If you assess that facilities at hand are not adequate to provide the proper medical attention to the patient.

In either case, the well being of the patient may be compromised if EMS is not contacted.

Another secondary role to contacting EMS is to provide on-lookers with a useful function while you concentrate on treating the patient.

Follow these steps when activating EMS:

1. Ask some one to call an ambulance, provided you are not alone. Bystanders should use mobile phones to immediately call 9-1-1, placing phones on speaker mode, so the dispatcher can help bystanders check for breathing, get the precise location and provide instructions for performing CPR. Mobile technology and social media applications that notify rescuers of a nearby cardiac arrest may increase the rate of bystander-initiated CPR.
2. Have them describe the patient when reporting the emergency. For example, unresponsive female adult, not breathing; an unresponsive child not breathing; an unresponsive elderly male with an apparent heart attack; adult male, CPR in progress, etc.
3. Ask them to come back so you may verify the call has been made and they can assist you.
4. If an AED is available, ask them to bring the AED to you.

If you are alone with an unresponsive patient, the patient should be placed in the recovery position if you have to leave them to activate EMS. Get an AED if available after you activate EMS.

If alone with a child or an infant, initiate the necessary resuscitation techniques for two minutes or five cycles, then activate EMS, continue until help arrives or until you are too tired to continue.

Clearing the airway

Many unresponsive patients do not require artificial respiration, but rather proper positioning of the head to allow adequate natural breathing through an open air passage.

Your most important task is to re-establish breathing and obtain medical assistance as soon as possible. There are many methods to establish an airway. However, if there is a possible neck injury, use the jaw thrust method without repositioning the head.

Head tilt - chin lift

Place the palm of your hand, closest to the head, on the patient's forehead and apply firm, backward pressure to tilt the head back. At the same time, lift the chin by placing the fingers of your other hand under the bony part of the lower jaw near the chin.

The fingers must not press deeply into the soft tissue under the chin, which might obstruct the airway. This is the recommended way to open the airway if no spinal/head injury is suspected.

Figure 1: Head tilt - chin lift

Tongue jaw lift

Place your thumb in the mouth and grab the jaw, lifting the mandible up and out. Use your other hand to stabilize the head. Do not hyper-extend the neck. Used when doing the finger sweep.

Jaw thrust

Place the fingers of both hands behind the angle of the patient's lower jaw and lift, forcing the mandible forward and tilting the head back. In the case of a neck injury this method must be used without tilting the head back or moving the patient's head.

Figure 2: Tongue jaw lift

Figure 3: Jaw thrust

Airway obstructions

There are two classes of airway obstructions:

- mild airway obstructions, and
- severe airway obstructions.

Mild airway obstruction

Airway obstruction caused by a foreign object usually occurs when a patient is eating or chewing.

The patient may use the universal distress signal to indicate an airway obstruction: clutching their hands to their throat.

They may begin to turn blue and will obviously be very frightened. Ask the patient, "*Are you choking?*"

Signs and symptoms

Determine if the patient is suffering from a mild airway obstruction by looking for the following signs and symptoms:

- the ability to forcibly cough, and
- wheezing between coughs.

Treatment

To treat a mild airway obstruction, do the following:

1. Prevent further injury;
2. Identify yourself as a trained first aider;
3. Offer assistance and ask permission;
4. Do not attempt abdominal thrusts;
5. Never interfere with the patient's efforts to clear the airway;
6. Stay with the patient until breathing is normal;
7. Monitor vital signs;
8. Encourage the patient to try and dislodge the object by coughing;
9. If the condition persists, activate EMS;
10. If the patient becomes unresponsive, treat the situation as a severe airway obstruction. see "Severe airway obstruction" on page 6-7.

Severe airway obstruction

The inability to produce any sound indicates a severe airway obstruction and the need for immediate action. Without oxygen the patient may soon become unresponsive. Within four to six minutes brain damage may occur.

Signs and symptoms

Signs and symptoms of a severe airway obstruction include:

- inability to speak, breathe or cough;
- absence of chest movement or air exchange; and
- increased cyanosis.

Abdominal thrusts/back blows-conscious adult or child

If an obstruction cannot be removed willingly by a responsive patient (e.g. coughing), it must be expelled by making use of the trapped air that remains in the patient's lungs.

This process is known as abdominal thrusts and back blows. More than one technique is usually required, all techniques are equally effective.

With the exception of positioning and applied force, abdominal thrusts and back blows are basically administered in the same fashion for both the adult and the child.

For a person sitting or standing, abdominal thrusts are administered in the following manner:

1. Position yourself behind the choking patient; and

2. Wrap your arms around their waist.

Figure 4: Position behind choking adult patient

Figure 5: Position behind responsive choking child

3. Make a fist with one hand.

Figure 6: Grab fist with other hand

4. Place the thumb side against the abdomen above the navel but well below the sternum. Grasp this fist with the other hand.
5. Administer five quick upward thrusts to the abdomen. Each thrust should be distinct and delivered in such a way to expel the foreign body out of the airway.
6. Back blows: administer five back blows between the shoulder blades with the heel of your hand.
7. Continue this sequence until successful or patient becomes unresponsive.

Use the heel of the hand to deliver the back blows between the shoulder blades. If possible the patient should be slightly bent forward, and use the other hand to support the patient on the chest.

Special considerations

Responsive pregnant or grossly obese patient

Use the chest thrust for pregnant women or grossly obese people. This is done by placing the fist mid-sternum (CPR position) and administering backward pulls

Figure 7: Back blows

to clear the airway. Be careful to place your fist in the correct position to avoid any possible internal damage. Administer five chest thrusts followed by five back blows.

Figure 8: Position with a pregnant or obese patient

Back blows and chest thrusts on a conscious infant

1. Pick up the infant while supporting the head and the body.
2. Place the infant face down, supporting their body on your thigh (hook the infant's leg between your arm and body). Ensure the infant's head is well supported and lower than their body.
3. Administer five back blows between the shoulder blades with the heel of your hand.

Figure 9: Back blows

4. Turn the infant face up, supporting their body on the opposite thigh (hook the infant's leg between your arm and body). Ensure the infant's head is well supported and lower than their body.

Landmarking

1. Place two fingers in the middle of the infant's chest between the nipples,
2. Slide your fingers to just below the nipple line, and
3. Administer five chest thrusts with the two fingers. Press down quickly with the two fingers on the centre of the chest.

Figure 10: Chest thrusts

Finger sweep

Finger sweep must be avoided unless you can see the object when opening the patient's mouth. This rule is applicable for the adult, child and the infant. Always be mindful that too hasty or forceful action may insert the obstruction more solidly. This is especially true of children and small-framed adults. Look first. Try to identify the obstruction visually (e.g. dislodged dentures or false teeth).

Do the following:

1. Check the mouth with a tongue jaw lift and finger sweep:
   a. Open the mouth.
   b. Grasp both the tongue and the lower jaw between the thumb and the fingers.
   c. Lift the mandible.
   d. Insert the index finger of the other hand down along the inside of the cheek and sweep the throat at the base of the tongue.

Figure 11: Finger sweep

2. Carefully scoop out the obstruction.

Only perform the Finger Sweep procedure when you can see the obstruction. In the case of an infant use your small finger to carefully remove the obstruction.

Suction

Suction devices are used to remove fluids and vomit from the airway. Although there are many devices on the market, they share common instructions and precautions for use. Suction is applied only to the oral cavity and upper airway. Insert the tip of the device into the mouth over the tongue. Never place the suction tip beyond where you can see; in other words, no blind suctioning. Apply suction for five to 10 seconds, while the tip is being withdrawn. Ensure that the patient is ventilated and oxygenated between suction attempts.

All suction equipment should be kept clean, and preferably sterile. This can be managed by keeping whatever method of suctioning you elect to use in sealed containers or bags. Once the suction has been used, the non-disposable parts need to be cleaned and decontaminated. This can be accomplished by using a solution of four litres of water to 80 millilitres (one gallon to one-quarter cup) of five per cent bleach solution. The parts should be scrubbed and then soaked for a minimum of 10 minutes. Rinse thoroughly with clean water. Any disposable parts should be double bagged and left in a biohazard waste receptacle at your local hospital or medical facility.

The following are signs and symptoms that would require the use of suction:

- Decreased level of consciousness (LOC),
- Facial injuries involving the mouth or nose,
- Any person whose ventilations are being assisted, or
- Any time an oral airway (OPA) is used.

Prior to using any suction equipment make sure that it functions properly and is complete.

Suctioning the mouth

When suctioning, you must not suction for any longer than five to 10 seconds at a time.

Positioning is important

Set yourself at the head of the patient looking down the body.

When C-spine precautions are not a concern, turn the head to the side to aid in drainage while you suction.

If C-spine is a problem, then you will have to suction the patient in the supine position.

Take into account that the patient may not protect his or her airway at all.

Do not allow fluids to build to the point where the airway is totally compromised.

You must continually monitor airway and suction fluid as necessary.

When suctioning, always start at the rear, or farthest point from the lips and work your way forward to the outside.

Never place the suction tip beyond where you can see. In other words, no blind suctioning.

Bulb-type suction device

If using a bulb type of suction, squeeze the bulb prior to inserting into the mouth. Then slowly release the bulb while withdrawing it.

It may be necessary to repeat this procedure several times until all the fluid is removed. If using suction units like the V-Vac, Res-Q-Vac or similar devices, remember to place the tip in the mouth within sight and to continuously pump the handle until all secretions are removed. Again bear in mind the time frame. If you are assisting ventilations, it will be necessary to suction for only five seconds and then give the patient a breath. If you are doing CPR the same rule applies. You must intersperse the suctioning with the ventilations.

Remember the following when suctioning:

- make sure the patient is adequately oxygenated,
- use suctions only five to 10 seconds at a time,
- don't suction where you cannot see.

It is your responsibility to familiarize yourself with the available devices at your respective facilities and to ensure that you have received proper training on the specific device.

Artificial respiration (breathing)

Artificial respiration (AR) refers to respiration simulation where air is provided to a patient who is not breathing or is incapable of breathing on their own.

Lay rescuers and public are not taught AR as part of CPR.

AR must be started immediately in the case of respiratory arrest and at the first signs of lack of oxygen. This occurs when respirations drop below eight to 10 times per minute and continue for a period of time.

There are several methods of AR.

Direct methods involve ventilating the patient's lungs by making a seal between your mouth and the patient's mouth and blowing or by using a mechanical device.

Protect yourself from body fluids by using a pocket face mask or other barrier device, if available. You must be trained and have practiced using them.

Using artificial respiration

Once started, continue to use artificial respiration until one of the following occurs:

- spontaneous breathing returns (see "Spontaneous breathing" on page 6-17);
- another trained rescuer can take over;
- you are unable to continue; or
- the patient is declared dead by appropriate medical personnel.

Ventilation

Ventilating is the action of exhaling breath from the first aider into the patient.

When ventilating, and in order to minimize excess air going into the stomach (gastric distention), consider the size of the patient and limit the volume of air you exhale to what is required to make the chest clearly rise.

In order to enable you to continue ventilating the patient for a period of time without hyperventilating, you must also consider the normal respiratory rates for the age group of the patient and your own.

Respiration rates vary depending on the patient's age. Established duration and rates at which each breath is given are described in the table below:

Groups (yr.)	Rates	Duration per breath	Volumes
Infant	one every three seconds (20/min.)	one second	until the chest clearly rises
Child	one every three seconds (20/min.)	one second	until the chest clearly rises
Adult	one every five seconds (12/min.)	one second	until the chest clearly rises

Caution: An infant's lungs can be easily damaged. Use gentle puffs and do not over inflate.

Gastric distention is an accumulation of air into the stomach. This is usually caused by giving too great a volume of air during ventilation, forceful ventilation or an improper positioning of the airway.
The usual sign is the distention of the abdomen (bloating) hence the term gastric distention.

If you notice this condition:

- reposition the airway,
- reduce the volume of air of each breath only to the extent that you start seeing the chest rise.

Do not attempt to expel the air from the stomach. This could cause the patient to vomit and aspirate the stomach contents into the lungs.

Equipment and treatments

There are several devices used for resuscitation, some are:

- Pocket face mask;
- Bag valve mask (BVM);
- Oropharyngeal airway (OPA); and
- Intra-oral mask (IOM).

Proper training is required on how to use these devices and should be provided by a certified instructor.

Ventilating with a pocket face mask

Using a pocket face mask to perform ventilation is the recommended method.

1. Position yourself at the top of the patient's head looking towards their feet.
2. Place the bottom of the mask between the patient's lower lip and chin. This retracts the lip downward and holds the mouth open.
3. Clamp the mask onto the patient's face using your thumbs along both sides of the mask.
4. Grasp the chin just beneath the angle of the mandible with your fingers and pull upward using a combination of head tilt and jaw thrust. If you suspect a neck injury use the jaw thrust without tilting the head.
5. Breathe into the mask. The chest will rise.
6. Let the patient exhale through normal relaxation of the rib cage.
7. Look at the chest fall and listen for the patient's exhalation.
8. Allow the air to escape before repeating.

For an infant, rotate the mask 180 degrees so that the nose portion of the mask points towards the infant's chin.

Ventilating with the bag valve mask (BVM)

A single rescuer providing ventilations should use the mouth-to-mask ventilations. In situations where at least two rescuers are available to support ventilations, and are properly trained, the two-person BVM technique is preferred.

Figure 12: Mouth-to-mask

The device consists of:

- a self inflating bag;
- a one way valve; and
- the mask

An oxygen reservoir can be attached to the BVM if supplemental oxygen is available.

Place the mask on the patient's face, maintaining a tight seal and an open airway with one hand. Use the other hand to gently squeeze the bag.

The BVM should ideally be used by two experienced and trained rescuers; the first rescuer maintains an open airway and a tight seal; the second rescuer squeezes the bag.

A person breathing at a rate of less than eight or greater than 30 breaths per minute, who is in obvious respiratory distress due to a medical condition, or as a result of trauma, should have their breathing assisted with either a pocket mask or a bag valve mask assembly. In either case, supplemental oxygen should be attached to the device.

For someone breathing fewer than 10 times per minute, you should assist their ventilations at a rate of one breath every five seconds, or 12 per minute. To assist a person breathing more than 30 times per minute, you should ventilate them every second breath.

It can be very difficult to assist someone that is already having difficulty breathing. You must time each ventilation as the person takes a breath in. When assisting a conscious person, you must focus on nothing but monitoring their respiratory rate and provide constant reassurance to them. Most people in respiratory distress will fight the thought of placing something over their face and this can become more difficult to manage the longer they are in respiratory distress.

Figure 13: Bag valve mask

Cleaning the masks

After use, clean the mask by scrubbing and soaking in a solution of four litres (one gallon) of water to 80 millilitres (one-quarter cup) five per cent bleach solution for a minimum of 10 minutes. Rinse thoroughly with clean water.

You may leave the mask in the first aid kit but check it on a monthly basis. "Single use only" masks or valves should never be re-used.

Oropharyngeal airways

The most common obstruction in an unresponsive patient is their tongue. An oropharyngeal airway (OPA) is a curved device inserted into the mouth of an unresponsive patient to keep the tongue from blocking the airway.

OPAs come in different sizes. Before inserting an OPA, you should already be maintaining an open airway. If doing a head tilt - chin lift, make sure the patient is unresponsive by seeing if they have a reaction to touching their eyelashes.

If there is no reaction:

1. Select the proper sized OPA by measuring the distance between the earlobe to the mouth.
2. Perform a jaw thrust and maintain it with one hand or place two fingers on the front of the patients jaw and open the mouth.
3. Insert the airway with the tip and inside of the u-shaped portion upwards along the roof of the mouth.
4. As the device approaches the rear of the mouth rotate the device one half turn. The device should drop into the back of the mouth with no resistance, and the flange should sit on the patient's lip.
5. Suction must be available in case of vomiting.
6. Monitor the patient carefully.

Figure 14: Sizing the OPA

Ventilating without pocket face mask

As infectious diseases are ever present, the rescuer must be aware of the consequences. In the absence of a pocket face mask or any other type of barrier device, rescuers must decide if they wish to use one of the following techniques.

Mouth-to-mouth

1. Use the jaw thrust or head tilt - chin lift method (see "Head tilt - chin lift" on page 6-6) to establish an airway.
2. Look, listen and feel for 10 seconds to determine if the patient is breathing.
3. At a comfortable distance, kneel beside the head and shoulders of your patient.
4. If using:
    - the head tilt - chin lift method: seal the nose by pinching the nostrils with the hand on the forehead.
    - the jaw-thrust method: seal the nose by placing your cheek against the patient's nose.
5. Take a breath and seal the open lips of the patient with your lips.
6. Give the patient a breath by exhaling into the mouth.

7. Release the seal; let the patient exhale through normal relaxation of the rib cage.
8. Look at the chest fall and listen for the patient's exhalation.
9. Allow the air to escape before repeating.

Mouth-to-mouth-and-nose

This technique is identical to mouth-to-mouth, discussed above.

Use mouth-to-mouth-and-nose on infants, small children, or in situations where this will give you superior ventilation.

1. Use the jaw thrust or head tilt - chin lift method to establish an airway.
2. Look, listen and feel for 10 seconds to determine if the patient is breathing.
3. At a comfortable distance, kneel beside the head and shoulders of your patient.
4. Take a breath and seal the open lips and the nose of the patient with your lips.
5. Give the patient a breath by exhaling into the patient's mouth and nose at the same time and look for the chest to rise.
6. Release the seal; let the patient exhale through normal relaxation of the rib cage.
7. Look at the chest fall and listen for the patient's exhalation.
8. Allow the air to escape before repeating.

Mouth-to-nose

Use mouth-to-nose in situations where, due to trauma to the mouth, it is impossible to use the mouth-to-mouth or mouth-to-mouth and nose techniques.

1. Using the jaw thrust or head tilt - chin lift method (see "Head tilt - chin lift" on page 6-6) establish an airway.
2. Look, listen and feel for 10 seconds to determine if the patient is breathing.
3. Seal the mouth by placing your cheek or hand over the patient's lips.
4. Take a breath and seal the nose of the patient with your lips.
5. Give the patient a breath by exhaling into the patient's nose.
6. Release the seal over the nose and mouth, let the patient exhale through normal relaxation of the rib cage.
7. Look at the chest fall, and listen for the patient's exhalation.

Laryngectomy (neck breather)

A neck breather is usually a survivor of cancer of the larynx (voice box). In a small percentage of cases, it may be the result of injury, burns or infection. Typically, the voice box has been removed either totally or partially, requiring the surgical opening of a hole in the neck (stoma) which must be kept open and clean to permit breathing. A metal or plastic tube may be worn in the opening.

For AR, purposes, all neck breathers should be treated as total neck breathers with AR applied mouth to stoma instead of mouth to mouth.

Total neck breather

A total neck breather is someone who breathes only through the neck opening and has no connection between the lungs and the nose or mouth; the larynx is usually absent. There may or may not be a plastic or metal tube in the neck opening.

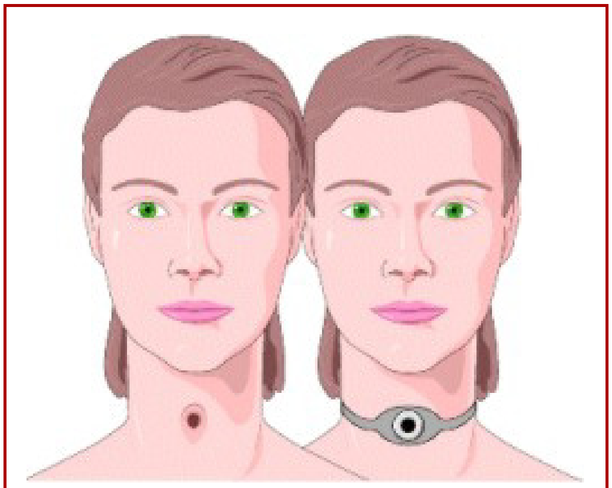


Figure 15: Total neck breather

Partial neck breather

A partial neck breather is someone who breathes mainly through the neck opening but still has a connection between the lungs and the nose and mouth. The larynx may or may not be present. There may or may not be a metal or plastic tube in the neck opening.

Regardless of whether the patient is a total or partial neck breather use the following technique:

Mouth-to-stoma

1. Look, listen and feel for 10 seconds to determine if the patient is breathing.
2. At a comfortable distance, kneel beside the head and shoulders of your patient.
3. Seal the patient's mouth and nose with your hand.

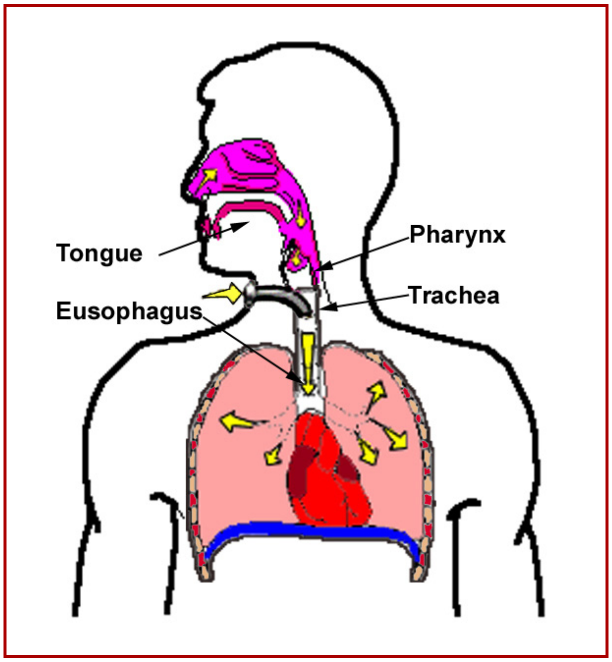


Figure 16: Partial neck breather

4. Take a breath and seal the open stoma of the patient with your lips. In some cases (partial neck breathers) you will have to remove the plastic plug located at the stoma.
5. Give the patient a breath by exhaling into the patient's stoma.
6. Release the seal over the mouth, nose and stoma, let the patient exhale through normal relaxation of the rib cage.
7. Look at the chest fall and listen for the patient exhalation (at the stoma).
8. Allow the air to escape before repeating.

Spontaneous breathing

If spontaneous breathing returns:

1. Establish and maintain a good airway.
2. Re-assess and stabilize all priorities and then perform a physical examination.
3. Monitor the patient's breathing after two minutes and every five minutes thereafter.

4. Place the patient in the recovery position if there are no spinal or other concerns.

Points to remember

The following summarizes important, related concepts:

- Assessment and recognition are very important. Good air exchange means that the patient can:
  - cough,
  - speak,
  - grunt,
  - cry, or
  - make a noise.
- Never interfere with the responsive patient's own attempts to expel the foreign object.
- When practicing on a partner, simulate the motions and take great care with all manoeuvres to prevent damage to vital organs.
- If you suspect a neck injury, do not tilt the head. Use the jaw-thrust method to open the airway.
- A patient with an obstructed airway, who is alone, may perform the procedure on themselves by leaning across the back of a chair or counter and rapidly pressing their abdomen heavily, increasing pressure.
- A seated patient with an obstructed airway, is treated the same as a standing patient. If the chair is too large to get your arms around the patient, place the patient on the floor.
- The obstructed airway treatment you use depends on the size of the patient.
- After having abdominal or chest thrusts performed on them, all patients should be seen by medical doctors.

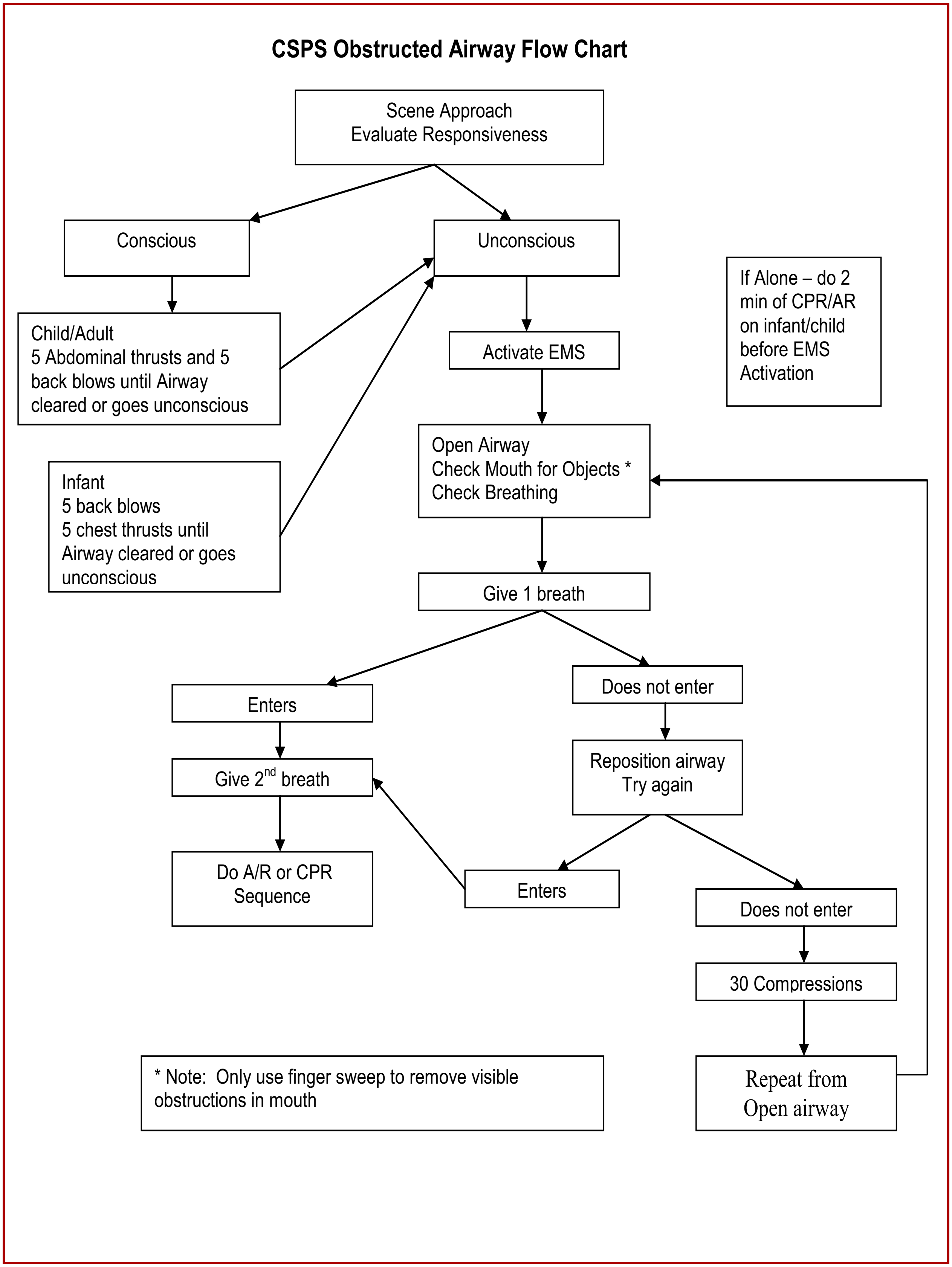


Figure 17: Obstructed airway flow chart

Obstructed airway	Infant	Child	Adult
Mild	Stand by	Stand by	Stand by
Severe	5 back blows 5 chest thrusts Until relieved	5 Abdominal thrusts 5 Back blows Until relieved	5 Abdominal thrusts 5 Back blows Until relieved
Goes unconscious	Position on ground Face up	Position on ground Face up	Position on ground Face up
Activate EMS Get AED - if available	Activate EMS If alone, do 2 min. CPR first	Activate EMS If alone, do 2 min. CPR first	Activate EMS
Open airway	Look in mouth Head tilt – chin lift	Look in mouth Head tilt – chin lift Spinal ? Use Jaw thrust	Look in mouth Head tilt – chin lift Spinal ? Use Jaw thrust
Check breathing (max 10 seconds)	Look – listen - feel	Look – listen - feel	Look – listen - feel
No breathing Chest should clearly rise with breaths	Give 2 breaths If first breath will not go in – reposition head and try again	Give 2 breaths If first breath will not go in – reposition head and try again	Give 2 breaths If first breath will not go in – reposition head and try again
No air entry Landmark	Centre of chest -2 finger width below nipple line Use 2 fingers	Centre of chest-hand on sternum Use 1 or 2 hands	Centre of chest-hand on sternum Use two hands
Compressions	Give 30 compressions	Give 30 compressions	Give 30 compressions
Open airway	Look in mouth Give 2 breaths If first breath will not go in – give 30 compressions	Look in mouth Give 2 breaths If first breath will not go in – give 30 compressions	Look in mouth Give 2 breaths If first breath will not go in – give 30 compressions
When air enters	Give 2 breaths	Give 2 breaths	Give 2 breaths
Check Pulse (max. 10 seconds)	Brachial pulse No pulse – give compressions	Carotid pulse check No pulse – give compressions	Carotid pulse check No pulse – give compressions

Figure 18: Obstructed airway table

Cardiopulmonary resuscitation (CPR)

Cardiopulmonary resuscitation (CPR) is a proven technique to administer basic life support to a patient whose heart has stopped beating. CPR consists of artificial respiration which supplies oxygen to the blood and heart compressions which supply blood to the body.

The heart is located in the centre of the chest between the sternum and the spine. Compressions are done by squeezing the heart between these two structures.

Keep in mind that perfectly performed CPR, will give, at most, 25 per cent of the normal body's arterial blood flow. This is the minimum required for sustaining life.

> Never practice CPR on a patient who is conscious. Use the proper practice equipment and mannequins when reviewing the procedure.

In the absence of an adequate barrier device rescuers may hesitate (due to fear) to perform artificial respiration on a patient. If such is the case, the International Liaison Committee on Resuscitation (ILCOR) urges rescuers to at least perform the cardiac compression sequences (compression-only CPR).

Automated external defibrillator (AED)

A defibrillator is a device that generates an electric shock. The shock is sent through the heart to stop an abnormal electrical heart rhythm that does not produce a pulse. While the heart is in an abnormal rhythm, it is not effectively pumping blood throughout the body.

An AED will analyze the patient's heart rhythm, and indicate if an electric shock would be beneficial to the patient. CPR skills must be used in combination with early defibrillation to give the patient the best chance of survival.

The Canadian Ski Patrol recognizes the importance of early defibrillation and promotes public access to defibrillation so that all cardiac arrest patients can have access to defibrillation within the first five minutes of cardiac arrest. The rescuer must recognize that proper specialized training and access to an AED is of the utmost importance to a patient that has no pulse. Ask for an AED - if available - when activating EMS. (see "Automated External Defibrillator (AED)" on page 7-1)

In the absence of an AED the rescuer should make every effort to activate the EMS as early as possible and perform CPR until trained personnel and AED equipment is available. Continue CPR until the AED pads are ready to be put on the patient.

Pulse check

For an adult or child the most dependable site to take a pulse is the carotid artery (i.e. the outside base of the throat). It is usually quite accessible, very large and close to the heart. For an infant the most dependable site is at the brachial artery. The pulse check is only taught to trained responders.

A pulse check on the **carotid artery** is performed as follows:

- Place two or three of your fingers on the top centre of the patient's neck.
- Slide your fingers to the side of the neck (approximately one inch) until your fingers rest on the neck muscle close to the trachea.

A pulse check on the **brachial artery** is performed as follows:

- Place two or three of your fingers along the humerus, between the biceps and triceps muscles.

The pulse check should never take more than 10 seconds.

Initially when assessing the patient's condition, if the patient is unresponsive and not breathing and you don't find a pulse after 10 seconds you must conclude that the patient is in cardiac arrest. You should immediately begin CPR and AED (if available) treatment without further delay.

Landmark for cardiac

Compressions for an adult patient

Using the hand closest to the head, place the heel of that hand on the sternum, in the centre of the chest. Make sure that the heel of your hand doesn't land on the xiphoid process (the lower end of the sternum).

Place the heel of the other hand on top of the first hand. You can interlace the fingers, to keep them off the chest. Only the heel of the bottom hand should be in contact with the chest.

Remember it is very important to landmark every time you remove your hands from an adult patient's chest and are about to give compressions. Correct landmarking will help minimize the danger of injury and improve blood flow to the body. Incorrect positioning could result in separated or fractured ribs.

CPR must be performed on a hard, flat surface like a floor or backboard.

Simplified landmarking: Lay rescuers are taught to place the heel of one hand in the middle of the chest on the sternum then place the second hand on top of the first.

Compression depth for adult CPR is to be at least 5 cm (2 inches) and allowing complete chest recoil after each compression.

Figure 19: Landmarking on an adult

Compressions for a child patient

Using one hand, place the heel of that hand on the sternum, in the centre of the chest. Make sure that the heel of your hand doesn't land on the xiphoid process located at the bottom of the sternum.

Only the heel of the hand should be in contact with the chest.

For the child, you administer cardiac compressions with one or two hands. For two hands, place the heel of the other hand on top of the first hand. You can interlace the fingers, to keep them off the chest. Compress the chest at least one third the anteroposterior diameter of the chest in infants (younger than 1 year) to children up to the onset of puberty.. Observe and remember your hand position. On the child, subsequent landmarking is done visually.

Figure 20: Landmarking on a child

Compressions for an infant patient

Landmark by:

- Placing two fingers in the middle of the infant's chest between the nipples;
- Sliding your fingers to just below the nipple line; and
- Administering chest compressions with the two fingers.
- Compress the chest at least one third the anteroposterior diameter of the chest in infants (younger than 1 year).

Figure 21: Landmarking on a baby

Cardiac compression and ventilation ratios

The cycle is 30 compressions followed by 2 breaths, at a speed of 100 to 120 compressions per minute with the intent to administer 30 compressions in 15 to 18 seconds.

Adult one-rescuer CPR

The proper cycle consists of 30 compressions followed by two breaths repeated five times before the first pulse check is taken (approximately two minutes elapsed time).

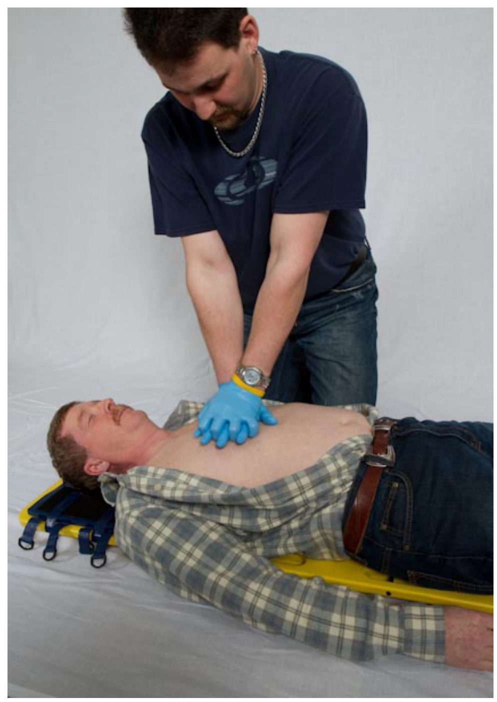


Figure 22: Cardiac compressions on an adult

Adult two-rescuer CPR

If a second rescuer arrives while one rescuer CPR is in progress do the following.

Second rescuer arrives and identifies themselves as a person trained in two-rescuer CPR and offers his help (e.g. I know CPR. May I help you?).

After the first rescuer has acknowledged the second, the second rescuer asks if EMS has been activated:

- if EMS has not been activated, then the second rescuer activates EMS and returns to the scene, bringing the AED if available;
- if EMS has been activated, then the rescuer waits for directions from the first rescuer.

The first rescuer acknowledges the second rescuer and directs them to check the compressions for efficiency.

The second rescuer may check the compressions for efficiency. On finding the pulse (as a result of compressions), the rescuer at the chest is informed that the compressions are good.

If the first rescuer is too exhausted, the newly arrived rescuer can take over by doing one-rescuer CPR after checking ABCs. In fact, it is recommended that both rescuers switch positions every few minutes as this will provide effective CPR without getting too tired.

When re-assessing the pulse, never take more than 10 seconds. The rule is: if there is no pulse then the patient is not breathing. If you can feel a pulse, check for breathing for no longer than 10 seconds.

While doing compressions, keep the arms straight with the elbows locked and shoulders directly over the sternum.

Figure 23: Cardiac compressions on an adult (two-rescuer CPR)

Changeover sequence

The following changeover sequence serves as an example:

1. Rescuer at chest does two minutes of compressions while the rescuer at the head provides the breaths.

2. Rescuers switch positions. The rescuer at the head goes to the chest and the rescuer at the chest goes to the head.
3. Rescuer at head checks ABCs.
   If no breathing or pulse, tells rescuer at chest to begin compressions.
   30 to two ratio is continued.
4. Rescuers then switch positions again after two minutes. The rescuer at the head should frequently assess effectiveness of chest compressions by taking the pulse regularly while the other rescuer is performing chest compressions.

Child CPR (one year up to eight years old or puberty)

The proper cycle consists of 30 compressions followed by two breaths, then repeat commencing again with 30 compressions, then two breaths, etc. The cycle of 30 compressions and two breaths is repeated approximately five times before the first pulse check is done (approximately two minutes elapsed time).

> While doing compressions, keep your arm straight with the elbow locked and shoulder directly over the patient's sternum. One or two hands can be used for compressions.

Infant CPR (up to 1 year)

Like adults, infants may experience a cardiac arrest for a variety of reasons. One of the main causes of death in infants is sudden infant death syndrome (SIDS). The cause of this condition is unknown, but it often results in the cessation of breathing and heartbeat.

The proper cardiac compression cycle consists of 30 compressions followed by two breaths, then repeat commencing again with 30 compressions, then two breaths, etc. The cycle of 30 compressions and two breaths is repeated approximately five times before the first pulse check is done (approximately two minutes elapsed time).

Counting out loud “one, two, three, four, five, one, two, three, four, ten, one, two, three, four, fifteen” up to 30. The mnemonic is identical for both one- and two-rescuer sequences.

In all cases, if the heart does not resume beating after two minutes, through detection of a pulse, (no longer than 10 seconds), at the carotid artery (adult and child) and brachial artery (infant), then CPR is resumed and continued for approximately five minutes before the next pulse check.

Do not resuscitate (DNR)

Do not resuscitate cases where the patient is:

- decapitated,
- in rigor mortis,
- incinerated,
- eviscerated,
- decayed,
- prolonged submersion, i.e. days of decomposition, and
- ordered not to by a physician or police officer.

Major trauma with vital signs absent and fixed pupils may include the following:

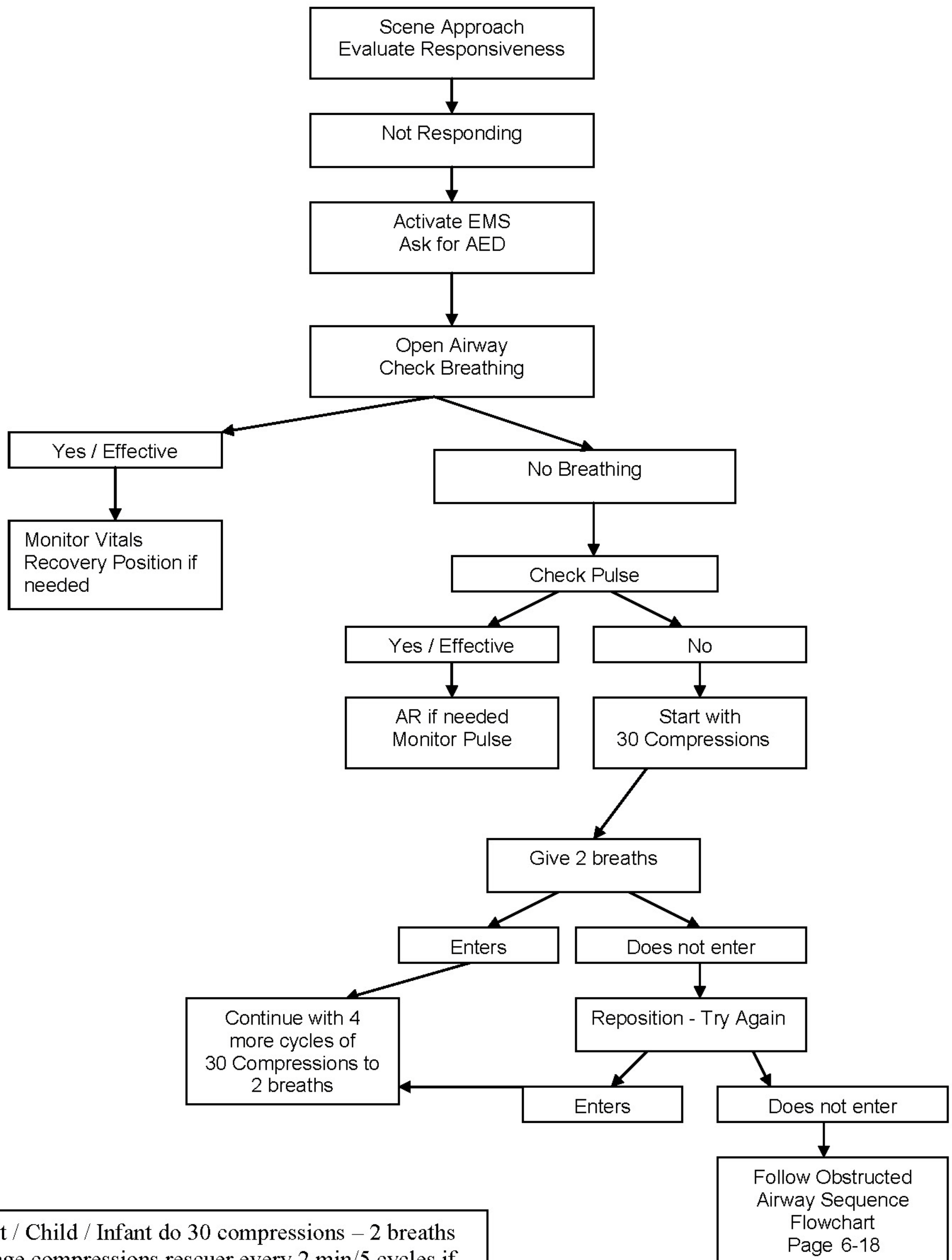
- open or crushed head injury,
- crushed or penetrating chest injury.

In a situation with multiple trauma patients, patients with life-threatening injuries and vital signs present are given priority treatment over patients who do not have any vital signs present. (see "Multiple patients - triage" on page 4-22)

Points to Remember

- Maintain the correct body and hand position for most effective CPR and to prevent further injury to the patient.
- Use an even squeezing motion when doing the compressions. Never punch or jab.
- CPR should only be interrupted for more than 10 seconds to:
    - Transport a patient down/up stairs;
    - Move a patient from further danger;
- Always release pressure from the chest between compressions to allow the heart to fully refill. Maintain contact with the skin at all times.
- Deliver each breath over one second, each causing the chest to rise.
- For an adult or child, interlace fingers of both hands or extend them straight out to give a straight, downward pressure on the sternum and not on the ribs.
- Expect some damage to the patient's chest while doing CPR. Ribs may fracture, or separate from the sternum during the procedure. Correct hand position should help to prevent further internal damage.
- Injuries to the chest area can be life-threatening if they result in damage to either the heart or lungs, or cause severe internal bleeding. Fractures of the rib cage may result in serious injury to the vital organs. However, it is possible to apply CPR even if chest injuries are present.
- After the first five cycles or two minutes of CPR, circulation checks are done every five minutes.
- Responders may require critical incident stress (CIS) support after performing CPR.

CSP A/R CPR Flow Chart



Adult / Child / Infant do 30 compressions – 2 breaths
Change compressions rescuer every 2 min/5 cycles if possible

CPR	Infant	Child	Adult
Approach	Call out for help	Call out for help	Call out for help
Establish unresponsiveness	Identify yourself Offer help	Identify yourself Offer help	Identify yourself Offer help
Activate EMS Get AED - if available	Activate EMS If alone, do 2 min. CPR first	Activate EMS If alone, do 2 min CPR first	Activate EMS
Open airway	Head tilt – chin lift	Head tilt – chin lift Spinal ? Use Jaw thrust	Head tilt – chin lift Spinal ? Use Jaw thrust
Check breathing (max. 10 seconds)	Look – listen - feel	Look – listen - feel	Look – listen - feel
Check pulse (max. 10 seconds)	Brachial Pulse No pulse – give compressions	Carotid Pulse check No pulse – give compressions	Carotid Pulse check No pulse – give compressions
Compressions 100-120 per min	30 compressions	30 compressions	30 compressions
No breathing Chest should clearly rise with breaths	Give 2 breaths If first breath will not go in – reposition head and try again	Give 2 breaths If first breath will not go in – reposition head and try again	Give 2 breaths If first breath will not go in – reposition head and try again
No air entry	If second breath will not go in, treat as obstructed airway Give 30 compressions	If second breath will not go in, treat as obstructed airway Give 30 compressions	If second breath will not go in, treat as obstructed airway Give 30 compressions
Air enters Continue CPR	30 compressions 2 breaths	30 compressions 2 breaths	30 compressions 2 breaths
Landmark	Centre of chest -2 finger width below nipple line Use 2 fingers	Centre of chest-hand on sternum Use 1 or 2 hands	Centre of chest-hand on sternum Use two hands
Two-rescuer CPR Change every 2 min/5 cycles	30-2 Level C 15 – 2 HCP Change every 2 min/5 cycles	30-2 Level C 15 – 2 HCP Change every 2 min/5 cycles	30-2 Level C 30-2 Level HCP Change every 2 min/5 cycles

Chain of Survival

The Canadian Ski Patrol recommends emphasis on the early recognition, early EMS, early CPR, early defibrillation and early advanced care links.

Recognition of warning signs

- Not all heart diseases and strokes can be prevented. The symptoms of heart attack and stroke must be recognized early enough, so that proper help can be obtained.
- Common delays to treatment include: denial, lack of recognition of symptoms, and not knowing what action to take.

Early access to the emergency medical services (EMS) system

- Once bystanders recognize the emergency, the EMS system must be activated by calling 911 or the local emergency number.
- Individuals experiencing the signs or symptoms of a heart attack or stroke must be assisted as quickly as possible to prevent death and disability.

Early CPR

- To increase survival chances, basic CPR must be started immediately after cardiac arrest is recognized.
- CPR keeps oxygenated blood flowing to the heart and the brain until normal circulation can be restored.

Early defibrillation

- Defibrillation, which re-establishes a normal spontaneous rhythm in the heart, is the link most likely to improve survival rates in heart attack patients.
- The speed with which defibrillation is performed is a major determinant of the success of the resuscitation attempt.

Early advanced care

- By trained health care professionals, advanced care may be provided at the scene and/or at the hospital.

CPR for the health care provider

There are different skills that may be performed by the health care provider (HCP) during CPR.

- EMS activation. **If the patient is suffering from respiratory arrest (or drowning)**, when alone the HCP should perform five cycles of CPR before calling/activating EMS. The HCP begins with two breaths before compressions when first starting CPR.
- Child/Infant CPR:
  - Witnessed: Follow adult/ adolescence steps
  - Unwitnessed: Give 2 minutes of CPR, leave person to activate EMS and obtain AED, return and resume CPR, use AED as soon as it is available
- In order to reduce the time to first compressions, when assessing an unresponsive person simultaneous assessment of breathing and pulse is recommended.
- Two-rescuer CPR on children and infants will be done at the rate of 15 to 2. When using advanced airways, delivering breaths should be interposed between compressions with no pauses at a rate of eight to 10 per minute.
- The age guidelines for HCP is: infant up to one year of age, child one year to puberty onset and adult after puberty. (Puberty is defined as the onset of facial hair in males, and the development of breast tissue in females.)
- Infant compressions may be delivered using the two thumbs with hands encircling the chest.

Figure 24: Infant Compressions

Notes...

Automated External Defibrillator (AED)

Upon completion of this chapter the student will be able to:

1. Explain how an automated external defibrillator (AED) works.
2. Demonstrate the operation of an AED.
3. Describe the use of an AED for various types of injured persons in different environments.
4. Explain the information to be given to EMS personnel.

Learning outcome

Describe, understand, and demonstrate the use of AEDs.

The CSP automated external defibrillator (AED) program is generic in scope and is designed to be taught as a separate program or in conjunction with CPR. Certification in CPR is mandatory before taking the AED program.

The use of an AED with CPR offers a patient the best chances of survival from cardiac arrest. Time is a crucial factor when using an AED. For every minute the patient is not breathing or has no pulse, their chance of survival decreases by ten percent.

AED training is recommended for all first aid providers. Additionally, patrollers at areas where an AED is available must follow training protocols as directed by their area.

What is an AED and how does it work

When someone suffers a myocardial Infarction (MI) or heart attack, this can send the heart into an abnormal electrical rhythm. An AED is a computerized electronic device that applies an electrical shock to the heart to stop all electrical activity or rhythm. This shock overrides the abnormal rhythm, allowing the heart to restart in a normal rhythm. This process can be likened to rebooting a computer.

The AED is used when a patient is not breathing and has no pulse. Once attached to the patient, the AED will evaluate the electrical rhythm and indicate to the patroller if a shock is needed. If no shock is indicated, the patroller will continue with CPR.

This page is dedicated to Shannon Howlett and sponsored by Humber Dorset Zone.

Conduction system of the heart

The heart is a muscle that relies on oxygenated blood to keep pumping blood throughout the body. The cells in the heart are specialized and generate electrical impulses. In normal circumstances, these electrical impulses are coordinated; they cause the heart muscle to contract and relax, allowing the heart to pump blood. The electrical impulses originate from the sino-atrial (SA) node located in the right atrium which is considered the natural pacemaker of the heart.

From the SA node, the impulses travel to the atrio-ventricular (AV) node located near the middle of the heart and then travel around the ventricles, causing them to contract.

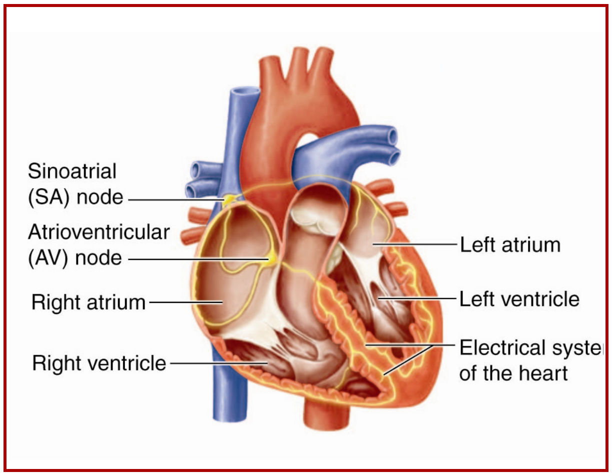


Figure 1: Sino-atrial and atrio-ventricular nodes

During a heart attack, the tissue in the area where the attack happens dies, preventing the electrical impulses from traveling across the dead tissue area. When this happens the electrical impulses are disrupted and are no longer coordinated resulting in abnormal heart rhythms.

There are many types of irregular heart rhythms that can be caused by a heart attack. Most cardiac arrest patients (85 per cent) go into ventricular fibrillation (VF) or pulseless ventricular tachycardia (VT). The AED will deliver an electrical shock to try to correct these abnormal rhythms.

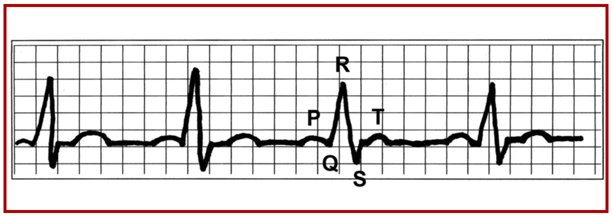


Figure 2: Normal sinus rhythm

Ventricular fibrillation (VF)

When the heart goes into VF, the electrical impulses within the heart become uncoordinated. The impulses originate from many areas of the ventricles and are out of synch with each other. This causes the heart to quiver and prevents the ventricle from effectively pumping blood. The use of an AED will diagnose VF and indicate a shock is required.

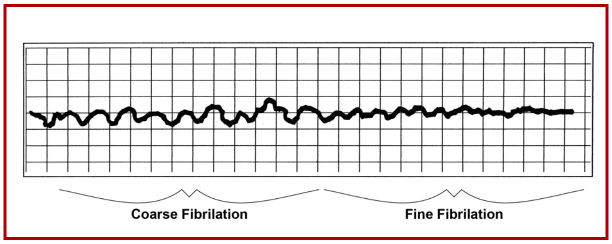


Figure 3: Ventricular fibrillation

Ventricular tachycardia

When the heart goes into VT, the electrical impulses become very fast. The impulses are so fast (more than 180 per minute) that the ventricles do not have time to fill and pump blood. The use of an AED will diagnose VT and indicate a shock is required.

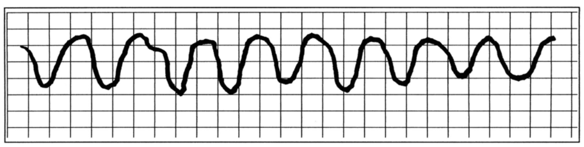


Figure 4: Ventricular tachicardia

Asystole

When the heart muscle has no electrical activity, it appears on an electrocardiogram (ECG) monitor as a flat line or asystole. In this case defibrillation is ineffective, and the AED will advise that there is no shock indicated.

Pulseless electrical activity (PEA)

Pulseless electrical activity (PEA) refers to electrical activity present in the heart that should produce pulse but does not. This results from the heart failing to work or pump blood either because of damage to the heart or as a result of major blood loss. The AED will indicate that there is no shock required.

Figure 5: Example of an AED (Lifepack CR-T)

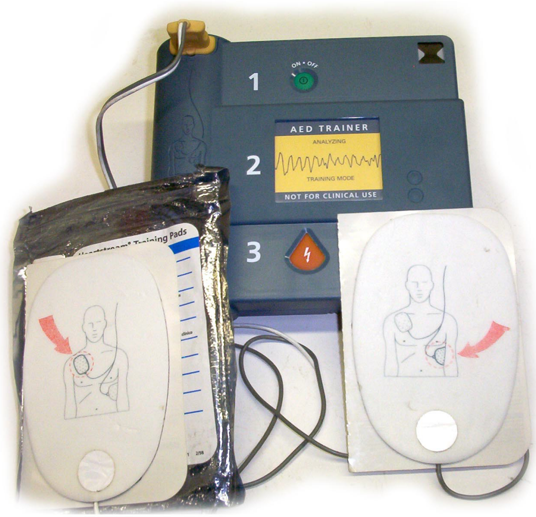


Figure 6: Example of an AED (Philips)

How to use the AED

Once the patient is assessed, and breathing and pulse are absent, the AED should be turned on and connected to the patient's bare chest. All AEDs once turned on, will give audio prompts to guide the patroller through the AED sequence. Most AEDs also display instructions that match the voice prompts. Always follow the manufacturers' instructions. If possible, continue CPR until the AED pads are ready to be put on the patient.

1. Turn power on.
2. Attach or connect the cables to the AED (if needed - some AEDs have pre-connected cables).
3. Open electrode package.
4. Expose the patient's chest.
5. Shave the patient's chest (if needed) - where the pads are applied. Too much hair will interfere with the AEDs ability to check the heart rhythm.
6. Dry the patient's chest where the pads are to be attached. If the chest is too wet, it will interfere with the pads adhering to it.
7. Attach the pads to patient's chest after peeling the backing off.
8. Stand clear and do not touch the patient. No one can be in contact with the patient.
9. Some AEDs automatically analyze the results, some require that an analyze button be pushed. If the AED has an Analyze button, push it.
10. If a shock is indicated, push the Shock button after making sure no one is in contact with the patient. (Some protocols require the AED provider to say, "I'm clear, you're clear, everyone clear" before pushing the shock button.)
11. Follow shock or no shock protocols (see "Shock / no shock protocols" on page 7-5).

Pad placement

When attaching the AED electrode pads to the patient, follow the directions on the pads. Most pads have pictures that show where the pads are to be attached. One pad will be attached to the patient's right upper chest, just below the clavicle.
The other pad is attached on the patient's left lower anterior chest wall.

Special considerations

Situations

Hypothermia patient

In cases of hypothermia, follow the AED prompts and continue with CPR and handle the patient gently.

Water and wet environments

The AED should never be used in wet environments. The patient must be removed from the water (shower or pool area, rain) and dried off before using the AED. Do not use if the patient is in large puddles of water. The AED can be used if the patient is lying on snow or ice. If a blanket or backboard is readily available, put it under the patient before delivering a shock.

Moving vehicles

The AED should not be used if the patient/ vehicle is moving. If in a vehicle, stretcher or toboggan it must be stopped in order to analyze and shock. The movement of the patient over a bumpy surface may

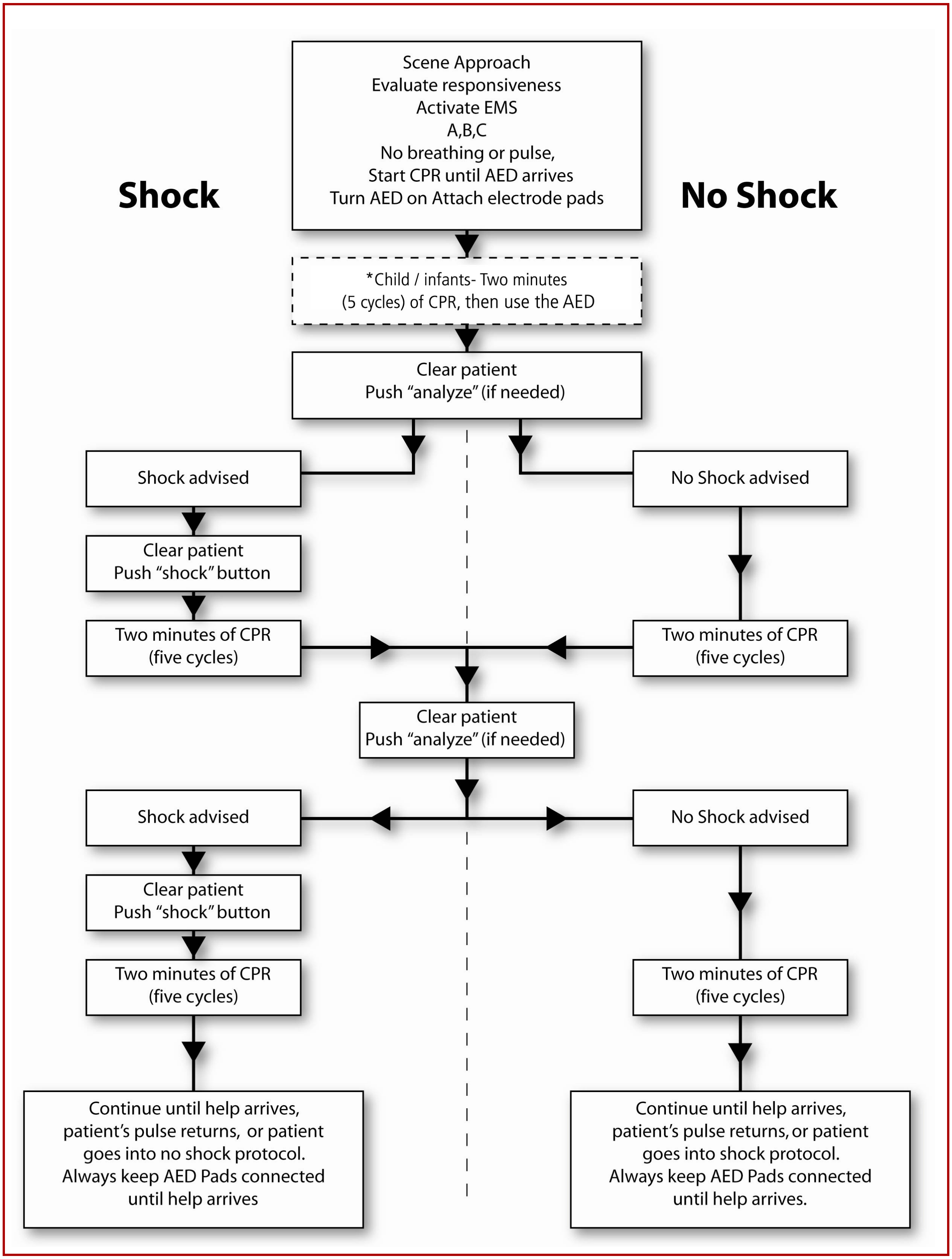


Figure 7: Shock / no shock protocols

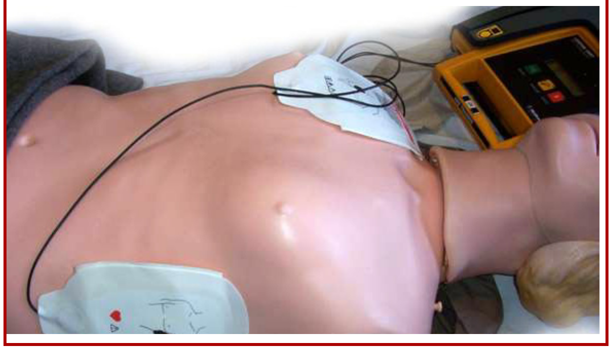


Figure 8: Example of pad placement (Lifepak 500)

Figure 9: Example of pad placement (ZOLL)

produce electrical artifact that may mimic VT or VF. This can confuse the interpretation of the heart rhythm by the AED.

Aircraft or helicopters

AEDs can safely be used on aircrafts.
It is recommended to let the aircrew know the AED is being used before delivering a shock.

Trauma patient

The AED should not be used on a severe or major trauma patient. Usually the heart has stopped from lack of blood and not a heart attack. However, if you suspect the patient suffered a heart attack prior to the trauma, the AED may be used while waiting for EMS.

Pregnant patient

The AED can be used normally without any special instructions.

Metal surfaces

The AED can be used on metal surfaces (industrial sites/catwalks etc). Ideally a blanket or backboard should be placed under the patient if available.

Patch medications

If the patient has a patch medication where a pad would be placed, remove the patch and clean the area. Remember to wear gloves as the medication is absorbed through the skin.

Pacemakers - implanted defibrillators

Some patients may have an implanted pacemaker or defibrillator. They are usually embedded under the skin in the upper chest area under the left clavicle, or in the upper abdomen. These devices are attached directly to the heart. The implanted defibrillator delivers a small shock to the heart if it detects a shockable rhythm. If breathing and pulse are absent, proceed as normal as the implanted device was ineffective.

When you expose the chest area you will see a bump approximately one to two inches in diameter, just under the skin surface where the device is embedded. Should the device be where the AED pad would be attached, move the pad at least one inch away from the device.

Children and infants

Some AEDs have child or pediatric pads to allow them to be used on children or infants. In the event of a child or infant patient and no child or pediatric pads are available, use the adult pads. When using adult pads, place one pad on the front middle of the chest and the other pad on the middle of the back. The pads must not touch each other. Follow local protocols. Pediatric pads should never be used on an adult.

Oxygen

Move oxygen one arm's length away from the patient during the shock phase.

Radio use

Do not transmit on two-way radios, during the analyze and shock phases as some radio transmissions may interfere with the AED.

Troubleshooting and maintenance

AEDs are quite reliable devices; there are very few things that can go wrong with them and some faults can be corrected when the AED is turned on. The reason being most AEDs perform a self-check as soon as they are turned on. AEDs can be programmed to perform a self-check at regular intervals; daily, weekly or monthly.

The following are issues that can arise when using an AED:

Symptom:

Prompt to connect or attach the electrode pads.

Problem:

Pads are not correctly connected to the AED.

Solution:

a. Ensure the pads are correctly attached to the patient as described in the pad placement section above.
b. If the prompt continues to display, replace the pads with a new set.

   Note: Always ensure that pads have not expired.

c. If the above fail, take the AED out of service.

Symptom:

Warning of low battery.

Problem:

Low battery charge

Solution:

An AED with a low battery warning may still have enough power for several shocks. Continue to use the AED until the unit fails. If a spare battery is available, change the battery. Follow manufacturer’s directions. Ask for another AED if the unit fails.

Storage

AEDs should not be stored where the electrode pads may freeze. If the pads freeze, they will need to be replaced and cannot be used. Follow the manufacturer's directions for cleaning and servicing.

AED check-off

The AED must be checked regularly. Follow local procedures and protocols (or manufacturer's directions if more stringent). Most AEDs come with accessory packs. At a minimum, they should have gloves, scissors, razor, towel and a barrier device. Ideally there should be a second set of electrode pads. This accessory pack should be checked regularly.

Legal aspects

In some provinces and territories, the use of an AED may be considered a medical act or require medical oversight. This means that you must be working with or under a physician's direction when using an AED. The supervising physician provides certification and medical control. Follow provincial or local regulations in the use of AEDs. Check with zone or division education officers on the use of AEDs in your area.

Handover to EMS

Under ideal conditions, a medical report should be sent with the patient to the hospital. Sometimes, patrollers are so busy with patient care that there is very little time to complete a medical report.

At a minimum, paramedics will need to know the following information:

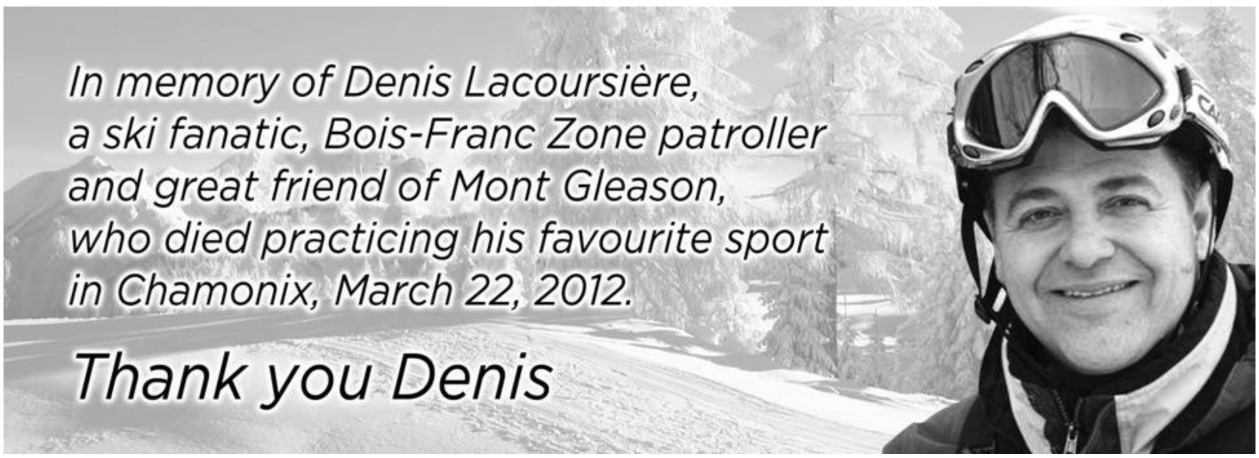
- When was the patient last seen;
- Did anyone see the patient collapse;
- How long has CPR been performed;
- Number of shocks delivered;
- Your name, contact information and whom you are certified under (program or medical director).

Most AEDs have internal event recorders that will record the following:

- the time as to when the unit was turned on, when shocks were delivered and when the unit was turned off;
- presenting cardiac rhythm and post-shock rhythm; and
- any trouble or fault prompts displayed during the use of the AED.

This information can be printed in a report form from the AED internal memory by connecting the unit to a computer or printer.

As soon as possible after the event, the patroller should complete a medical report with as much detail as possible. The AED coordinator in turn is responsible for passing this information together with the above mentioned report to the receiving hospital. Follow local procedures and protocols. Responders may require critical incident stress (CIS) support after performing CPR.


In memory of Denis Lacoursière,
a ski fanatic, Bois-Franc Zone patroller
and great friend of Mont Gleason,
who died practicing his favourite sport
in Chamonix, March 22, 2012.
Thank you Denis

Notes...

Chest Injuries

Upon completion of this chapter the student will be able to:

1. Describe the general signs of chest injury.
2. Outline the signs, symptoms and demonstrate specific treatments of:
   a. Rib fracture
   b. Flail chest
   c. Pneumothorax
      - Spontaneous
      - Tension
   d. Open chest injuries
   e. Impaled objects

Learning outcome

Recognize, understand, and treat chest injuries.

Overview of chest injuries

Injuries to the chest can be life-threatening. These injuries may result in damage to either the heart or the lung and can cause severe internal bleeding.

Rib cage fractures may result in serious injury to vital organs.

Deep, open wounds allow air to enter the chest cavity; closed wounds usually involve injury to the ribs and possibly underlying structures.

Chest injuries are divided into two groups:

- closed chest injuries (see "Closed chest injuries" on page 8-2), and
- open chest injuries (see "Open chest injuries" on page 8-5).

General signs of chest injuries

Look for the following signs beyond an obvious chest wound:

- impaired breathing,
- irregular, or lack of, chest expansion,
- coughing-up of blood,
- shock,
- subcutaneous emphysema.

Best indication of chest injury

Of all the signs, a change in the normal breathing pattern is most indicative of a chest injury.

> A patient who has breathing difficulty will usually move into a position where breathing is easiest. Typically, this position will be either sitting or reclining.

Subcutaneous emphysema

When a lung or part of the bronchi is lacerated, air can escape into the chest cavity. This air can then migrate to the subcutaneous tissues making it feel like puffed rice (Rice Krispies) under the skin. This causes a crackling sensation when the skin is pressed. This is why you looked for it during the secondary assessment.

Closed chest injuries

Typical closed chest injuries include:

- rib fractures,
- flail chest,
- pneumothorax.

Rib fractures

Rib fractures are almost always the result of trauma (a blow) to the rib cage.

Signs and symptoms

Signs and symptoms of fractured ribs include:

- Leaning toward the injured side with a hand over the fracture area in an effort to ease pain and immobilize the chest.
- A crackling sensation over the fracture site (subcutaneous emphysema) may be detected if the rib fracture has punctured a lung and air is escaping into the tissues of the chest wall.
- Unwillingness or inability to take a deep breath.
- Complaining of local pain and tenderness (patients may be able to direct you right to the location of the fracture).
- Pain when moving the rib cage when breathing or coughing.

Treatment

1. Administer oxygen, if available.
2. Make the patient as comfortable as possible.
3. Transport the patient quickly and safely to medical aid.

> Arrange for immediate transport, i.e. activate EMS and treat as a load and go, if you suspect rib fractures and there is difficulty breathing.

Transporting the patient

Transport the patient in the position of maximum comfort (sitting or reclining). If reclined, the injured side will usually be preferred down. This may have to be modified in the presence of other injuries.

The semi-prone position elevates the good lung, immobilizes the fracture, and prevents drainage of the blood into the good lung.

A conscious patient will usually adopt a comfortable position in order to relieve breathing difficulties. Respect this position if it does not interfere with transportation.

The position of comfort takes higher priority over any theoretical benefit that may be obtained from a specific positioning.

If you also suspect a spinal injury, immobilize the patient and transport on a backboard.

Flail chest

Several adjacent ribs fractured in more than one place can produce a loose section of the chest wall.

The loose section is called a flail section (or flail segment) and the condition is known as a flail chest.

The flail section moves inward when the patient breathes in, and outward when the patient breathes out. This phenomenon is known as paradoxical movement. That is:

- Where the chest normally expands during inspiration, a loosened segment will be drawn in.
- Where the chest normally deflates during expiration, the loosened segment will bulge out.

Initially, paradoxical breathing may not be seen because the chest muscles may be strong enough to splint the flail segment. As the injury progresses, the chest muscles tire and the paradoxical movement becomes more apparent. This is especially common in injuries to adults.

A flail chest is a serious injury and is frequently the result of injury to underlying vital organs, such as a crushing injury to the lung or heart.

Signs and symptoms

Signs and symptoms of a flail chest include:

- shortness of breath,
- swelling over the injury site,
- shock,
- muscle splinting of the injury site,
- possible paradoxical movement,
- severe pain when inhaling or exhaling.

Treatment

1. Administer oxygen as soon as possible.
2. If the patient is experiencing difficulty breathing and particularly if cyanosis (blueness) is present, assist breathing with oxygen and assisted ventilations. (see "Artificial respiration (breathing)" on page 6-12)
3. Help the patient get in a comfortable position and transport him/her to medical aid. Activate EMS and treat as a load and go. Continue to monitor vital signs.
4. Do not apply bulky padding or dressings to the flail segment so long as the patient is splinting the chest wall with the chest muscles or unless there is substantial bleeding.

Use of dressings on a flail chest

In the past, taped-on pads used to be the method for reducing pain from the paradoxical motion of a flail segment. However, the tape reduces the mobility of the chest wall and thus limits the already compromised expansion of the lung. Only consider a taped-on pad as a treatment in the following cases:

- a prolonged time before evacuation and access to medical care is expected, or
- the chest muscles become fatigued and no longer splint the flail segment.

To apply dressings:

1. Press the segment inward with your gloved hand to stabilize it.
2. Splint in the inward position with a pillow, large bulky dressing, or folded blanket or parka.
3. Secure this thoroughly in place with tape.

4. Be prepared to help breathing by providing assisted ventilation or artificial respiration.
5. Do not hold in place with bandages encircling the chest. This would further impair the patient's breathing effort.

Alternatively, have the patient lie with the segment against a hard surface, such as the base of the toboggan, depending on the position of maximum comfort, and other injuries that may be present.

Pneumothorax

A pneumothorax is a condition that results from air entering the interpleural space. The air in the interpleural space compresses the lung and prevents normal breathing.

There are two types of pneumothorax:

- tension pneumothorax.
- spontaneous pneumothorax.

Signs and symptoms

Signs and symptoms of a pneumothorax include:

- reduction of normal respiratory movements on the affected side,
- a fall in blood pressure,
- weak and rapid pulse,
- a sudden sharp chest pain.

Tension pneumothorax

Tension pneumothorax is particularly dangerous. It is a condition that occurs when air escapes into the interpleural space from damaged lung tissue but cannot regain entry into the lungs with each respiration. As a result, increasing air pressure in the interpleural space causes collapse of the lung tissue. As the pneumothorax injured lung collapses, the opposite lung and heart may also be affected.

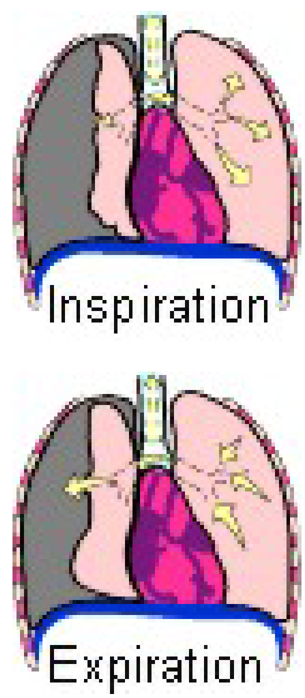


Figure 1: Pneumothorax

Treatment

1. Administer oxygen, if available,
2. Activate EMS and treat as a load and go. Monitor vital signs. As a first aid provider, you cannot provide surgical release of the air from the chest cavity (see Open chest injuries below).

Spontaneous pneumothorax

Spontaneous pneumothorax is not a life-threatening condition. It occurs when the lung surface - weakened as a result of congenital defect, disease or injury - ruptures.

Treatment

1. Administer oxygen, if available.
2. Transport patient to medical aid.

> **Note:** The patient may prefer to be in a seated position when being transported.

Open chest injuries

In penetration injuries of the chest wall, air can enter the interpleural space from the outside, causing the lung to collapse.

Air moving back and forth through the chest wall results in what is often called a sucking chest wound because of the sucking sound during inspiration.

Important notes
If the chest wall is punctured, air can enter the pleural cavity and the patient can develop a pneumothorax (see Pneumothorax, above).

If open chest injuries are not treated properly, they can result in tension pneumothorax.

Signs and symptoms

Signs and symptoms of a sucking chest wound may include:

- increasing difficulty in breathing,
- frothy blood at the mouth or site of wound,
- rapid, weak pulse,
- cyanosis,
- falling blood pressure,
- localized chest pain.

Treatment

Leave chest wounds open. If a dressing and direct pressure are required to control bleeding, care must be taken to ensure that the dressing does not become occlusive and seal the chest wound.

- If there is significant external bleeding, direct pressure to the chest wound with a hand and/or a non-occlusive dressing should be applied.
- If a dressing becomes saturated, it must be changed to prevent sealing the chest wound.

Transport the patient:

- in a position of comfort,
- in a position that will not impair breathing,
- administer oxygen, if available,
- monitor vital signs,
- activate EMS
  and treat as a load and go.

> Note: Transportation may be done with the head uphill if this is the position of comfort for a person with chest injuries or breathing difficulties for any reason.

Impaled objects

Impaled objects are things such as broken glass or large splinters that are both embedded into and protruding from the body.

Signs and symptoms

Impaled objects are easily identified by sight.

Treatment

1. Do not move or remove the object, since major vessels or organs may have been penetrated. Bleeding into the chest cavity can be massive and may be difficult to detect.
2. Build up a dressing around the object to hold it in place during transportation.
3. Tape the dressing in place.
4. Transport the patient in the most comfortable position possible, which may be either sitting or lying down.
5. Activate EMS and treat as a load and go. Continue to monitor vital signs.
6. If the object is obviously dangling from the skin or will cause extreme further damage, it should be removed.

Figure 2: Treatment for an impaled object

Conclusion

Chest injuries can become life-threatening. When there are also breathing difficulties, treat the situation as a load and fo.

If you suspect the presence of a spinal injury, use extreme care during treatment and transportation.

Always consider immobilising the patient on a backboard.

Shock and Severe Bleeding

Upon completion of this chapter the student will be able to:

1. Describe the different types of shock.
2. Describe the common signs, symptoms and treatment of shock.
3. Differentiate arterial bleeding, venous bleeding and capillary bleeding.
4. Demonstrate treatment for bleeding injuries.
5. Describe the signs, symptoms and treatment of internal bleeding from various sources.

Learning outcome

Recognize, understand, and treat shock and severe bleeding.

Shock

Shock is the medical condition that develops as a result of an imbalance between the delivery of oxygen and the consumption of oxygen at the cellular level. In our everyday lives, the cardiovascular system adjusts to changes in oxygen requirements in various parts of the body and maintains an oxygen equilibrium. These mechanisms of compensation allow blood to be directed to the key organs (heart, lungs, kidneys and brain).

Perfusion is the movement of sufficient oxygenated blood to the cells. Inadequate perfusion or hypoperfusion is the result of a problem in one of the three components of the system getting oxygen-rich blood to cells:

- **Heart:** the pump of the system.
- **Vessels:** the pipes of the system.
- **Blood:** the liquid circulating in the system.

A continuous interaction between these three components maintains blood pressure, circulation, perfusion and the delivery of oxygen to the body.

In the patrolling environment, generally:

- shock as a result of a traumatic event is most likely due to blood loss either internally or externally;
- shock as a result of a non-traumatic event is most likely due to pump failure or compromise;
- shock as a result of sepsis is rarely seen in the field.

Progressive nature of shock

Shock is a progressive condition, with some opportunities for stopping and reversing the progression. However there is a point at which the progression becomes irreversible and death or permanent organ dysfunction results.

The signs of shock will not show equally and will not progress equally in all patients. Some people, such as the elderly or those with pre-existing circulatory conditions, are more vulnerable and will progress more rapidly towards severe complications. Children generally will maintain the appearance of stability and then suddenly crash. At any rate, all patients present a progressive failure in the compensation mechanisms resulting in clinical signs. These signs may be subtle. The priority and secondary assessment system has been designed to detect these signs when combined with repeated measurements of the patient's vital signs. Changes in the vital signs over time and correlating with the history, the signs and symptoms will provide the patroller with a good indication of where the patient is currently in the progression, and whether treatment measures are making a difference.

> If the conditions causing the shock are not controlled, death may occur, even if the conditions are not fatal in their own right.

The presence of signs and/or symptoms of shock is the reason to initiate load and go. Monitor the patient continuously.

Signs and symptoms

Any or all of these signs and symptoms may be present. Note that many of these signs are changes in condition, and not just single observations.

Increased pulse rate:

- The pulse rate increases in an attempt to move more oxygenated blood to the cells.

Increased respiration rate:

- It is an attempt to increase the blood oxygen levels and increase elimination of carbon dioxide (CO_2) via the lungs.

Pale, cool, clammy skin; delayed capillary refill; cool extremities:

- The body attempts to maintain blood flow to the heart, brain, lungs and kidneys by sacrificing blood flow to the digestive organs and the extremities. This is achieved by constricting the arterioles and redistributing blood flow. The result is pale, moist skin, cool extremities and ultimately absent peripheral pulses.

High anxiety, restlessness and aggression:

- It is due to reduced oxygen supply to the brain. Do not mistake this behaviour for lack of consent.

General weakness, dizziness and nausea:

- It is due to reduced oxygen supply to the brain.

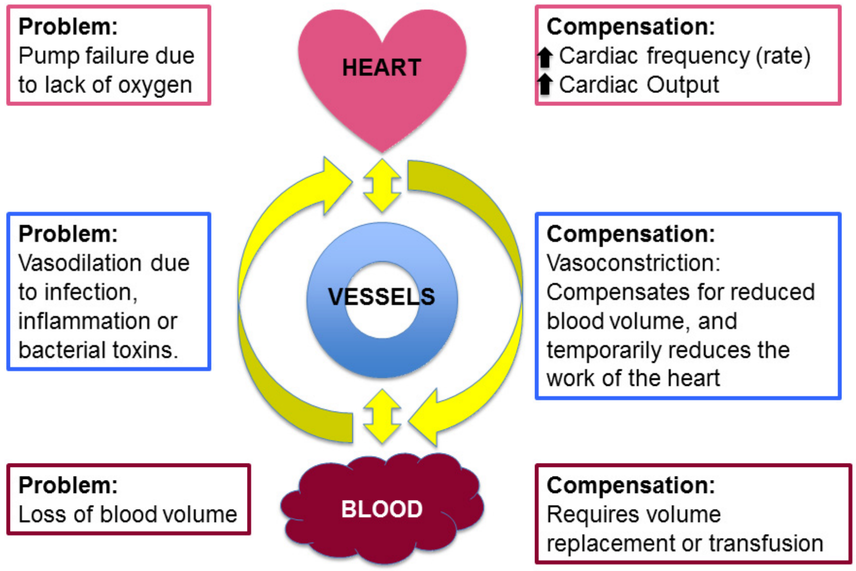


Figure 1: Shock

Thirst:

- It is due to an attempt at restoring blood volume. This volume could also be lost through dehydration. Drinking fluids will not restore blood volume. With the shutting down of the digestive organs, the fluids will not be absorbed.

Decreased pulse strength:

- The volume of blood ejected by the heart becomes less. This decrease results in decreased pulse strength. The heart may not be refilling adequately, or it may not be emptying effectively, or there may not be enough blood to maintain the filling pressure.

Drop in blood pressure:

- It may be caused by either a combination of blood loss, loss of peripheral vasoconstriction and/or failure of the cardiac pump.

Decreased level of consciousness:

- It is due to a decrease in blood flow and oxygen supply to the brain.

Treatment

Regardless of the cause or type of shock, the first responder treatment is the same.

- Stop external bleeding. Blood cannot be replaced in our environmental setting.
- Activate EMS and treat as a load and go.
- Administer oxygen at high flow rate.
- Keep the patient warm.
- Lay the patient down.
- Treat the patient gently.
- Give nothing by mouth.
- Closely monitor the patient. Record vital signs and history.
- Reassure the patient.

Do the following, as required:

- Assure adequate breathing, assist ventilations.
- Move patient to recovery position in case of vomiting.

- Assist patient in taking their medication.
- Control bleeding, apply traction on fractures or compression to the pelvix if a pelvic fracture is suspected, and administer other first aid to address the cause of shock.

Make every effort to prevent the situation from deteriorating. All movement and temperature regulation requires blood flow which is in short supply during shock. Keep the patient quiet and ensure they are not too hot or too cold.

Types of shock

There are different types of shock:

- Cardiogenic (affecting the pump - heart),
- Hypovolemic (affecting the circulating volume of blood),
- Distributive types (affecting the vessels (pipes))
    - Anaphylactic
    - Vagal (formerly called psychogenic)
    - Septic
    - Neurogenic / spinal (affecting the pump and the vessels)
- Obstructive (affecting the pump, the vessels and/or circulating volume)

Cardiogenic shock

Cardiogenic shock occurs when the heart can no longer perform its pumping functions. It results in a lesser quantity of blood pumped per heart beat and hence less blood sent to the organs. The normal heart dynamic is affected. Examples include myocardial infarction (heart attack), the rupture of a heart valve or damage to heart muscle.

Hypovolemic shock

Hypovolemic shock occurs when circulating blood volume is lost. Examples of loss are active bleeding, dehydration or leakage of blood plasma out of the vessels due to burns or anaphylaxis.

The active bleeding leading to shock can be organized into compartments:

Internal hemorrhage

- Thoracic compartment: such as hemothorax.
- Abdominal compartment: internal hemorrhage liver, spleen, large vessels.
- Extremities compartment: long bone fractures, hematomas, contusions.

External hemorrhage

- Laceration of any blood vessel following a fracture or a laceration.

Dehydration occurs with a lack of liquid intake or an increase in fluid loss usually over a longer time period, such as due to large burns or prolonged vomiting/ diarrhea.

Bleeding (hemorrhage) (hypovolemia)

The average adult body weighs 70 kg (154 lb.) and has about five litres of blood.

Any injury that disrupts the blood supply is potentially dangerous; the more blood loss the greater the danger. An estimate of blood loss is important in assessing the seriousness of a bleeding injury.

The condition deteriorates rapidly unless bleeding is arrested. Many small bleeds can be just as dangerous as one large one.

Failure to stop bleeding may lead to the progression of profound shock and eventually lead to death.

Blood loss	Result
More than 20 per cent (about one litre)	Moderate hypovolemic shock
More than 30 per cent (about 1.5 litres)	Severe hypovolemic shock - life threatening

Failure to stop bleeding may lead to the progression of profound shock and eventually lead to death.

External bleeding

When a vessel is cut across its length, bleeding will usually stop without treatment. The elastic walls of the severed vessels cause them to contract and retract from the surface of the injury. As a result, large wounds may bleed very little. If a laceration runs the length of a vessel rather than across then contraction will not be as easy and the wound will bleed more readily. Clotting helps seal the open vessels and prevent further bleeding. This process takes time. If the bleeding is brisk, clotting will not occur as quickly as needed, so the first aider must assist in stopping serious bleeding.

The general treatment for external bleeding is remembered easily with the acronym RED, which stands for:

- **R**est: lay the injured person down and rest the injured part (when possible),
- **E**levate: raise the bleeding part (when possible), and
- **D**irect: apply direct pressure to the wound.

Classes of external bleeding

External bleeding can be classified as follows:

Arterial bleeding

- The blood is bright red, flows in spurts, and may be profuse. The closer to the heart the injured vessel is, the more profusely it can bleed.

Venous bleeding

- The blood is dark red (even bluish) and flows steadily. This type of bleeding is easier to control than arterial bleeding.

Capillary bleeding

- The blood slowly oozes dark red, as would occur from a scrape. The danger from infection can be greater than that from blood loss.

Treatment

- The most effective method of controlling external bleeding is to apply direct pressure to the wound. This stops the blood flow long enough for blood to coagulate. (see "Dressings, Bandages and Slings" on page 13-1)

General treatment for external bleeding injuries

Do the following:

- Quickly check wound for foreign objects.
- Place your protected hand (or the patient's hand) on top of the wound and apply firm, direct pressure.
- With as little movement as possible, apply a sterile dressing and a cravat, or other form of bandage, to the wound.
- For severe bleeding, treat as for shock (don't wait for it to happen).

Treatment for bleeding injuries on the trunk

Do the following:

1. Fasten a sterile dressing and bandage over the wound by:
    - applying a bandage around the body, if it does not interfere with breathing, or
    - using a triangular bandage, or a chest/back bandage.

If the bandage cannot be applied without impairing breathing or circulation, tape the dressing in place.

2. Transport to medical aid. Evaluate the need for a load and go. Was bleeding significant? Does the patient show signs of shock? Is breathing compromised? Are there other chest injuries?
3. If bleeding is not controlled after 10 minutes, maintain direct pressure with fingers or hands during transportation to medical aid.

Treatment for injuries to the extremities

Do the following:

- Check the limb for possible fractures, foreign objects, and gross contamination. Immobilize, stabilize and clean as required.
- Apply a dressing and cravat, or other form of bandage, to the wound.
- Tie the knot directly over the wound to maintain constant pressure.
- Elevate the injury.
- Check distal circulation and sensation before and after bandaging.
- Transport to medical aid. If PMS is compromised, activate EMS and treat as a load and go.

Severe bleeding may require the use of a tourniquet.(see "Dressings, Bandages and Slings" on page 13-19).

> When treating a bleeding injury, always remember the acronym, **R E D**:
>
> **R**est - **E**levation - **D**irect pressure

Internal bleeding

Internal bleeding is loss of blood into compartments within the body. It can be organized in compartments depending on the affected organs. Signs and symptoms may or may not be evident in internal bleeding. Free blood in the abdominal cavity can irritate nerves resulting in pain, guarding and rigidity of the abdominal wall. It can also lead to the perception of pain in other locations such as the outer tips of the shoulders. Left shoulder tip pain is an indication of possible rupture of the spleen, Right shoulder tip pain may suggest injury to the liver or gall bladder. Shoulder tip pain in the presence of abdominal bleeding is known as Kehr's Sign.

Evident signs and symptoms

- If the patient coughs up bright red, frothy blood, then the source can be in the trachea or the lungs.
- If the patient vomits blood - this often has the appearance of coffee grounds - then the source can be the esophagus or the stomach.
- If the patient excretes blood mixed with feces (melena) - this often has a black, tarry appearance - then the source can be the stomach or the bowels.
- If the patient has red blood in the feces the source can be the intestine, the colon, rectum or anus.
- If the patient has urine that is smoky or red in appearance, then the source can be the kidneys, ureter or bladder. There may be pain over the kidney area as well.

It is important to note that any injury to the bowels (small or large), the stomach, or the bladder will more often result in free air in the abdomen and not internal bleeding.

Non-evident signs and symptoms

Internal bleeding resulting from a crushing type injury or from a blow to the abdominal region is very dangerous as the bleeding is not evident or easily identified. The presence of hematomas (swelling) or ecchymosis (bruising) on the skin may direct to an important internal hemorrhage.

For example:

- Bleeding into tissues associated with fractures may not be evident.
- Bleeding from the liver, spleen or pancreas takes place into the abdominal cavity and does not appear outside the body.
- The spleen may bleed into its capsule which may rupture at a later time, resulting in delayed symptoms.
- Bleeding from kidney injury does not present with any abdominal compartment signs and symptoms

Internal abdominal bleeding

Any of these signs and symptoms may be present:

- **Tenderness:** increasing sensitivity to touch or pressure.
- **Rigidity:** shows up as a wooden or boardlike feeling.
- **Guarding:** tightening of the muscles in the painful area.

When examining for internal bleeding:

- Be gentle.
- Avoid poking and touching the patient with cold hands.
- Palpate each quarter of the abdomen separately, in turn. If you have reason to suspect injury in a certain area, palpate that area last. Note the quadrant with the injury: upper or lower, left or right.

Treatment

There is not much to do as a first aid provider in the case of internal bleeding. As soon as signs and symptoms appear, do the following:

- Activate EMS and treat as a load and go.
- Treat for shock (don't wait for it to happen).

- Transport the patient flat on their back, unless there's fear of vomiting (place semi-prone in recovery position).
- Elevate the legs (no more than 30 cm).
- Do not give anything by mouth.

Internal bleeding at a fracture site

Fractured large bones may bleed from the bone and marrow or from surrounding damaged tissues. A fracture at the mid-femur could sever the femoral artery.

Carefully examine the fracture site to determine if there is swelling. Even scarcely detectable swelling, associated with a fracture of the femur, may easily contain two litres of blood. This is above the tolerable limit of blood loss, yet there is no sign of external bleeding. Look carefully at all fracture sites and compare them with the opposite normal limb.

If there is obvious swelling, assume there is loss of blood.

Signs and symptoms of shock may be present as well as:

- Pain, tenderness or discolouration where the injury is suspected.
- Bleeding from mouth, nose, rectum or other natural body openings.

Distributive shock

Distributive shock is a general term referring to problems with peripheral vascular resistance. Blood vessels are normally kept in a state of mild (tonic) vasoconstriction to maintain blood pressure and ensure perfusion to organs. In distributive shock the blood vessels dilate even though instruction from the body calls for vasoconstriction. Hence, the same blood volume is in a larger container. The result is a decrease in blood pressure and a decrease in perfusion to organs and peripheral tissues.

Anaphylactic shock

Anaphylactic shock is a medical emergency. It is a severe allergic reaction that may occur when a patient inhales, ingests or is injected with a substance to which they are highly allergic.

These substances react with antibodies in the patient's system causing the blood vessels to dilate. The cell walls of the vessels become “leaky” (increased capillary permeability) causing plasma loss to further reduce circulating blood volume and results in the hives and swelling associated with anaphylaxis.

Insect stings, shellfish and peanuts can cause a severe and rapid anaphylactic reaction. Allergic reactions may also cause severe swelling of the face and throat leading to blockage of the airway.

Septic shock

Septic shock results from severe infection and it is the most common form of distributive shock. The release of toxins from bacteria into the blood stream is at the centre of the problem. These toxins trigger dilation (opening) of the blood vessels. These dilated vessels are inefficient and unable to function and disrupts the usual exchange of oxygen with the cells.

Common causes of septic shock are pneumonia, urinary tract infections, skin infections (cellulitis), intra-abdominal infections (such as a ruptured appendix), and meningitis.

Neurogenic and vagal shock

These types of shock result from a severe stress to the nervous system which fails to control the size of smaller blood vessels. A drastic drop in blood pressure occurs when blood leaves the larger vessels to fill the distended capillaries and stops circulating through the body. This same interference with the nervous system often results in slowing of the heart and in turn results in further drop in blood pressure.

Neurogenic shock

Neurogenic shock results from injury to the spinal cord, which disrupts nerve control of the blood vessel walls. High spinal injuries may also result in loss of cardiac sympathetic tone and warm skin due to dilation of the peripheral blood vessels.

The term neurogenic shock should not be confused with spinal shock which is a recoverable loss of function of the spinal cord after injury and does not refer to perfusion instability.

Vagal shock syncope (fainting)

Vagal shock is a case of simple fainting from either physical or emotional causes. Such stress can cause sudden dilation of the peripheral blood vessels. In turn the blood pressure drops and the brain is temporarily deprived of oxygen, causing a loss of consciousness. This is a temporary, self-correcting state. When the patient is lying horizontally, normal blood flow to the brain resumes and consciousness returns.

Check for any injuries as a result of the patient’s collapse.

Obstructive shock

Obstructive shock is due to obstruction of blood flow outside of the heart. Many conditions can cause this form of shock.

Tension pneumothorax obstructs blood return to the heart as a result of the increased intrathoracic pressure and the distortion of the pulmonary blood vessels of the collapsed lung. There is reduced blood flow and eventually no flow of oxygenated blood back to the heart.

Cardiac tamponade is a condition where the sac surrounding the heart (pericardium) fills with blood restricting the filling of the heart with blood. Cardiac tamponade is most commonly associated with penetrating wounds to the centre of the chest.

Blockage of blood vessels can be caused by the movement of clots (pulmonary embolism), fatty tissue from a long bone fracture site (fat emboli) or compressed air bubbles (associated with scuba diving). In all cases the result is hindering the movement blood from or to the heart.

Aortic stenosis prevents circulation by obstructing the outflow of blood from the heart.

Notes...

Head Injuries

Upon completion of this chapter the student will be able to:

1. List examples of external and internal head injuries.
2. Recognize the signs and symptoms of head injuries.
3. Describe specialized considerations when treating patients with head injuries.
4. Describe the significance of changes in pupilary reactions to light.
5. Demonstrate the management of the unresponsive patient and of a patient who regains consciousness.

Learning outcome

Recognize, understand, and treat head injuries.

External head injuries can range from relatively mild lacerations to life-threatening blockages of the airway and heavy bleeding. These injuries are relatively easy to recognize and treat. Differences from the standard protocol for major bleeds and fractures are noted in this chapter.

Internal head injuries, such as concussions, can be less obvious yet are potentially more dangerous to the patient. If an internal head injury is suspected, the patient becomes a load and go, since the condition of the patient could deteriorate very quickly.

> Whenever external trauma to the head is present, always suspect an internal injury, as well as C-spine injury. A simple bump on the head becomes a load and go when the signs and symptoms of a fracture or concussion are present.

The following injuries are covered in this chapter:

External injuries:

- Facial and scalp contusions and lacerations,
- Jaw fractures,
- Skull fractures and associated injuries,
- For eye injuries, see "Eye injuries" on page 19-1.

Internal injuries:

- Concussion,
- Cerebral contusion,
- Intracranial pressure,
- Intracranial bleeding.

External head injuries

Facial, scalp contusions and lacerations

Any trauma to the head is likely to be accompanied by external wounds. The main things to watch for are:

- Airway problems due to bleeding in the mouth.
- Potential C-spine problems.
- Potential internal head injury.

The mechanism of injury can be informative here.

Treatment

The treatment of contusions or lacerations is routine (see "Types of wounds" on page 12-1). Special considerations with external head injuries include:

- The scalp is susceptible to heavy bleeding. Sufficient direct pressure may be difficult to apply with a bandage alone. Apply direct pressure by hand for a few minutes until clotting takes place.
- If there is a heavily bleeding laceration at the back of the head, place the patient supine with the head on a large dressing. The weight of the head will provide direct pressure.
- Swelling associated with closed wounds usually responds to ice packs.
- Never bandage around the jaw so that the patient's mouth will not open – in case there is bleeding from the mouth or vomiting. Use tape to secure a dressing.

Jaw fractures

Most often jaw fractures occur near the hinge. They can be one-sided or bilateral. These fractures are very painful and make it difficult for the patient to talk.

Signs and symptoms

- Facial deformity, asymmetry, or swelling.
- Difficulty in talking and swallowing.
- Bleeding.
- Inability to open the mouth or to clench the teeth.
- Bite irregularity.
- Pain.

Treatment

1. Maintain an open airway.
2. Administer oxygen if available.
3. Stabilize the cervical spine: apply a cervical collar if it does not interfere with breathing or cause undue pain. If a collar cannot be applied, stabilize the jaw and immobilize the head with padding or blankets.
4. Stop any external bleeding with direct pressure. Use tape to secure a dressing.
5. Recommend the patient seek further medical aid.

Skull fractures

A simple skull fracture is not easily detectable and is not considered a serious injury in and of itself. However, many severe head injuries are associated with spinal damage and there are a number of associated injuries which can be serious or life-threatening. These may include:

- Linear fracture (a break in the skull that follows a relatively straight line). These can occur at or beyond the point of impact.
- Depressed skull fractures: these injuries cause dents in the skull bone.
- Potential C-spine problems.
- Potential internal head injury.

Signs and symptoms

- Skull fractures may appear as an open or closed fracture, with or without detectable deformity. Examine the skull carefully during the secondary assessment.
- Depressed fractures may result in a portion of the skull pressing into the brain.
- Fractures of the base of the skull frequently result in bleeding from the ears, nose or mouth. Make sure this blood is not a result of laceration of the surrounding skin.
- The clear, straw-coloured fluid which surrounds the brain - cerebrospinal fluid - may leak from the ears or nose as a result of a skull fracture. This type of injury should be suspected if a patient has sustained a severe impact to the jaw.

Treatment

1. Maintain an open airway. Be prepared to administer assisted ventilations if the patient's condition deteriorates. Activate EMS.
2. Administer oxygen if available.
3. Be on the alert for the presence or development of internal head injuries. Together with an internal injury, they are a load and go.
4. Treat as for C-spine injury. Because head injuries are more likely to lead to an unresponsive patient, monitor carefully and be prepared to tilt the backboard to enable fluids to drain from the mouth and throat.
5. Bandage a dressing with enough pressure to stop external bleeding. However, if the skull is no longer rigid, do not apply pressure. Exercise caution and avoid depressing the fractured area.
6. If there is blood or clear fluid draining from the ears or nose, do not plug these orifices. Allow the fluid to drain. Apply a loose dressing and warn the patient not to blow their nose.
7. Your record keeping can be critically important in the case of head injuries. Inform medical authorities of the following:
   - Time and details of the incident.
   - Presence or absence of signs and symptoms of spinal disabilities or internal head injury.
   - Duration of unresponsiveness, if any.
   - Pay particular attention to any change in vital signs and the pupils. Check them every five minutes.
   - Blood or fluid appearing from ears, nose or mouth.

Internal head injuries

In increasing order of seriousness:

- Concussion,
- Cerebral contusion,
- Intracranial pressure,
- Intracranial bleeding.

Concussion

A blow to the head can cause a concussion (from the Latin concutere, "to shake violently," a very descriptive term). The trauma causes cerebral tissue to impact with the inside of the skull resulting in a temporary disruption of brain function; the effect is usually proportional to the magnitude of the blow. Although concussions are often associated with impacts with hard objects, they also occur when patients have been wearing helmets. Concussions are caused by the sudden deceleration of the skull followed shortly thereafter by the sudden deceleration of the brain that the cerebrospinal fluid cannot completely cushion.

A person who has experienced a blow to the head, consistent with concussion, should be encouraged to discontinue activity and seek medical aid.

If no other complicating factors are involved, there will be no damage or injury to brain tissue, only temporary neuronal dysfunction. However, since there is no way of knowing whether only a concussion is involved, and many of the signs and symptoms are similar to those of brain injury, all precautions applicable to brain injury should be taken.

Signs and symptoms

A loss of consciousness, however brief, after a head injury is an unequivocal sign of a concussion but not of its severity.

Signs and symptoms of concussion are a lowered level of consciousness, ranging from the patient being slightly dazed to being completely unresponsive. Obvious external head injury is not a necessary condition, neither is loss of consciousness. Since the degree of damage is never obvious, an apparent concussion can lead to intracranial pressure. Carefully continue monitoring the patient.

Questions that can help discover symptoms of a concussion:

"Tell me again… what happened? …where was that? … when was that? … how or why did it happen?" If there are different answers now than you received during the priority assessment, consider the mechanism of injury and compare the patient's answers with the observations of others at the scene.

Look for the following:

Memory or orientation problems:

- General confusion
- Memory loss
- Unaware of time, date, place
- Repeatedly asks the same questions

Typical Symptoms:

- Headache
- Feeling dazed or "slow"
- Dizziness
- Seeing stars or flashing lights
- Ringing in the ears (tinnitus)
- Sleepiness

- Loss of field of vision, double vision, blurred vision, light sensitivity
- Nausea

Signs:

- Poor coordination or balance.
- Vacant stare or glassy-eyed.
- Vomiting.
- Slurred speech.
- Slow to answer questions or follow directions.
- Easily distracted, poor concentration.
- Displaying unusual or inappropriate emotions (e.g. laughing, crying, swearing.)
- Personality changes.

Treatment

1. Maintain an open airway. Be prepared to administer assisted ventilations if the patient's condition deteriorates. Activate EMS.
2. Administer oxygen if available.
3. Be on the alert for the development of more serious internal head injuries, they are a load and go.
4. Treat as for C-spine injury. Because head injuries are more likely to lead to an unresponsive patient, monitor carefully and be prepared to tilt the backboard to enable fluids to drain from the mouth and throat.
5. Maintain normal body temperature.
6. Do not give any fluids.
7. Your record keeping can be critically important in the case of head injuries. Inform medical authorities of the following:
    - Time and details of the incident.
    - Presence or absence of signs and symptoms of spinal disabilities or external head injury.
    - Duration of unresponsiveness, if any.
    - Pay particular attention to any change in vital signs and the pupils. Check them every five minutes.

A patient who has lost consciousness should be kept under medical supervision for 24 hours following the injury.

Cerebral contusion

Cerebral contusion is the bruising of brain tissue. It's a concussion, only worse: the brain was not wearing its seatbelt and the airbag failed to deploy. The area of the brain directly beneath the blow may be injured or the area opposite the site of the blow may also be injured literally on the rebound. There is a possibility of intracranial pressure developing.

Signs and symptoms

The signs and symptoms are the same as for a concussion but may be more pronounced or longer lasting. A serious contusion may also have symptoms of intracranial pressure or bleeding. Obvious external head injury is not a necessary condition, neither is loss of consciousness.

A return to consciousness is usually followed by a period of confusion and amnesia. A patient with a head injury may recover consciousness and insist on leaving. This patient should be kept under medical supervision for 24 hours following the injury.

Treatment

Treat as a concussion.

Intracranial pressure

The skull can be thought of as a rigid box that contains a fixed volume. This constant cranial capacity contains a couple of components:

- fluid, both blood and cerebrospinal,
- the brain.

Any increase in either blood or cerebrospinal fluid leaves less room for the brain, assuming the skull is still intact.

A blow or injury to the head can cause bleeding or swelling inside the skull or the brain and often results in damage and/or impairment inconsistent with the size and severity of the original injury.

The rise in intracranial pressure has two major consequences. First, the pressure interferes with oxygenation of the brain cells, leading to hypoxia (inadequate oxygen supply). Hypoxia causes the deterioration of the patient's level of consciousness. In response to the resulting hypoxia, the brain blood vessels dilate as the body attempts to get more oxygen-rich blood to the brain cells. This tends to increase brain swelling even further, and results in raising the intracranial pressure even higher, continuing the deterioration.

Second, the pressure tends to push the brain stem down into the hole in the base of the skull, the foramen magnum, but it won't fit. The brain stem controls the basic life processes, most importantly, breathing regulation and heart function. The increased pressure compresses the brain stem which compromises those processes. Breathing gradually slows down and becomes irregular. Heart action gets stronger initially (bounding pulse) but also slows down more and more.

Intracranial bleeding

There is no way of knowing whether intracranial bleeding will occur following a head injury. Intracranial bleeding can take place outside or inside the lining of the brain, called the dura, which normally lies pressed against the inside of the skull. Bleeding outside the dura is called epidural, whereas bleeding inside the dura is called subdural. Signs and symptoms in either case may vary somewhat, but the treatment is the same.

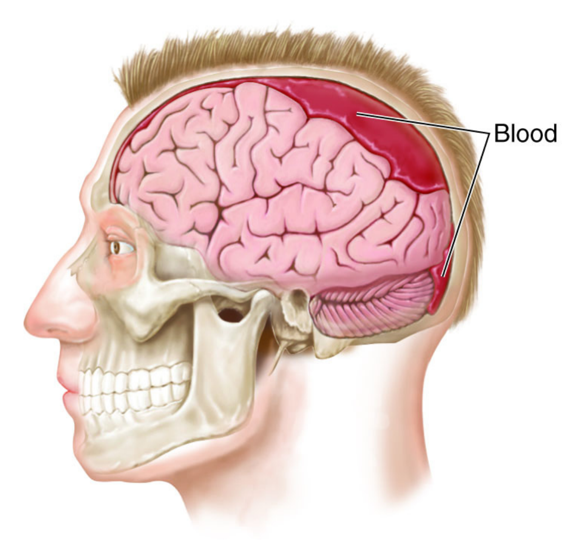


Figure 1: Intracranial bleeding

The speed with which bleeding develops depends on the number and size of the damaged blood vessels. The symptoms may become apparent within a few minutes, a few hours, or may not appear for two or three weeks or longer.

Epidural bleeding

Epidural bleeding usually results from trauma to the arteries outside the dura precipitated perhaps by a fracture on the side of the skull.

Because arteries are high-pressure blood vessels, there is a rapid accumulation of blood in the epidural space, with a rapid rise in intracranial pressure.

Subdural bleeding

Subdural bleeding usually results from trauma or tears in the veins below the dura. Injuries to these blood vessels can be as devastating as to epidural arteries. However, symptoms of subdural bleeding have a slower onset that those of epidural bleeding because the lower pressure veins bleed more slowly than arteries. Thus, signs and symptoms may not show for several days or even weeks after an injury.

When taking the history of a patient who has signs and symptoms of a head injury, ask about head injuries that may have taken place days or weeks before.

Signs and symptoms

Following a head injury, there is no way of knowing whether intracranial bleeding will occur. The speed with which bleeding develops depends on the number and size of the damaged blood vessels. A typical chain of events is an initial period of lowered responsiveness, then an apparent recovery for one to 24 hours, after which the patient's level of consciousness starts declining.

This injury is a true emergency that demands immediate attention.

Signs and symptoms may become apparent within a few minutes, a few hours, or they may not appear for two or three weeks or longer. They may include those of a concussion and any of the following:

- Lowered level of consciousness including progressive or recurring loss of consciousness.
- Bleeding or fluid from the nose, mouth or ears.
- Convulsions, general or local.
- Nausea.
- Vomiting, especially by children.
- Any unusual pupil reactions such as described in the secondary assessment or the table on page 10-8.
- A bounding (high pressure) pulse and/ or a very slow pulse.
- Cessation of breathing or patterned breathing.
- Partial or complete paralysis of the limbs, abnormal weakness of the limbs especially on one side, or loss of sensation in any part of the body.
- Discoloration behind the ears (Battle's sign).
- Discoloration below the eyes (often known as raccoon eyes).
- Abnormal or violent behavior.
- Confused, disturbed speech pattern.
- Headaches which may be severe.
- Restlessness.
- Fatigue.

The actual signs and symptoms may be minimal, so careful examination is very important. Any injury to the head where intracranial bleeding could be suspected, must be referred to medical aid.

Condition of pupils	Suspect
Impaired or unequal reaction to light	Intracranial pressure
Fixed and dilated	Severe damage to the central functions of the brain
One pupil dilated and one pupil normal	Damage is limited to one side of the brain
Fixed, constricted pupils	Drug abuse or severe irreparable brain damage
Constricted pupils that later become fixed and dilated	Worsening condition

Treatment

Treat as a concussion.

Determine the level of consciousness.

If the patient is in full control of his or her faculties:

- Maintain close and continuous monitoring.
- The patient may appear normal, but close observation reveals slurred speech, slight disorientation, uncoordinated movements and weakness.
- Carefully note these signs and look for signs of alcohol or drug abuse.
- Smell the breath but never assume that apparent drunkenness is the result of alcohol.

Often, someone not feeling well may take a little brandy to settle their stomach and later suffer a stroke or heart attack. Many people put to bed to sleep it off have never awakened, because they had actually suffered a concussion or other head injury.

If the patient becomes unresponsive, this is an indication of possible intracranial bleeding. This is a serious complication.

If the patient is unresponsive:

Check:

1. respiration,
2. pulse,
3. response of pupils to light, and
4. response to pain stimuli.

If these signs are normal and stable, there is no immediate danger to airway or breathing.

However, the situation may deteriorate.

- Monitor the patient continuously.
- Pay particular attention to the condition of the pupils.
- The patient may vomit; this is especially prevalent with children.
- Monitor and maintain the airway.
- A patient with a head injury may recover consciousness and insist on leaving. This patient should be kept under medical supervision for 24 hours following the injury.

Treat the development of any of the following as a load and go:

- confusion,
- deteriorating responsiveness,
- abnormal pupil response,

- vomiting,
- weakness,
- tiredness,
- convulsions.

Summary

For first aiders, the distinction between a concussion, a contusion, or worse is academic. Fortunately, diagnosis and treatment are the same. The severity of signs and symptoms - their number, strength, and duration - determine how fast the patient should be transported to medical aid. In the case of anything more than a simple laceration, the patient should always be advised to seek further medical aid to rule out complications.

The assessment and treatment of patients with a head injury should focus on:

- Maintaining the patient's airway and breathing.
- Controlling bleeding.
- C-spine control.
- Careful and continuous watch for developing intracranial pressure.
- Oxygen treatment.
- Assisted ventilations if breathing deteriorates or if intracranial pressure is suspected.

The severity of brain injuries can be evaluated by monitoring:

- Changes in the level of consciousness. Assess the patient every five minutes.
- Pupil size and response.
- Extremity weakness.

Notes...

Spinal Injuries

Upon completion of this chapter the student will be able to:

1. Describe the signs, symptoms and complications of neck and spinal injury.
2. Describe the primary objective of spinal immobilization.
3. Demonstrate the application of a cervical collar.
4. Demonstrate the loading and securing of a patient onto a backboard safely and with minimal movement.
5. Demonstrate safely straightening an injured person with a spinal injury.
6. Demonstrate safely moving an injured person from a prone position to a supine position.
7. Demonstrate the safe removal of a helmet from a spinal injury patient.

Learning outcome

Recognize, understand, and treat spinal injuries.

Spinal injuries are a relatively rare injury, reported as occurring approximately one per 100,000 skier days. However, the potential life impact of spinal and spinal cord injuries requires that patrollers maintain a high degree of suspicion and take steps to carefully evaluate whether an injury has occurred.

Several studies have noted that skiers tend to fall forward injuring the cervical spine, while snowboarders are more likely to fall backwards injuring the thoracic, lumbar or sacral spine. In addition the number of injuries as a result of hard landings and crashes associated with large terrain jumps and drops from a height has been increasing in recent years. Injuries such as fractured heels and associated compression fractures in the lumbar spine has been noted at several ski areas with large terrain park jumps.

The Canadian C-Spine Rules included here are a guideline for determining whether an injury to the spinal column or spinal cord is present. It is based on previous studies and clinical evidence to help identify when an injury is likely to be present and when an injury is likely not to be present. Careful and methodical application of the Canadian C-Spine Rules is required for them to be effective. In all cases where an injury cannot be ruled out, the patroller is directed to apply spinal immobilization until a more thorough investigation (generally in hospital) can be undertaken. Injuries of the spinal column are always accompanied by the possibility of injury to the enclosed spinal cord or spinal nerves. Bones knit back together, skin heals over, and many other parts of the body including peripheral nerves repair themselves. Severed spinal nerves do not regenerate.

The closer to the head the spinal injury occurs, the more serious the consequences. Cervical spine injuries can have life-threatening consequences.

Pressure on the spinal cord resulting from dislocated or broken fragments of vertebrae, often results in complete or partial loss of power (paralysis) and/or loss of sensation below the level of the injury.

Incorrect treatment of the injury may result in permanent paralysis.

Signs and symptoms

Signs and symptoms of spinal injury may include:

- impaired breathing,
- TIC (Tenderness, Instability, Crepitus) along the spine,
- loss of movement in the extremities,
- pain in the neck or back,
- numbness or tingling in any extremity,
- mechanism of injury suggests the possibility of a spinal injury.

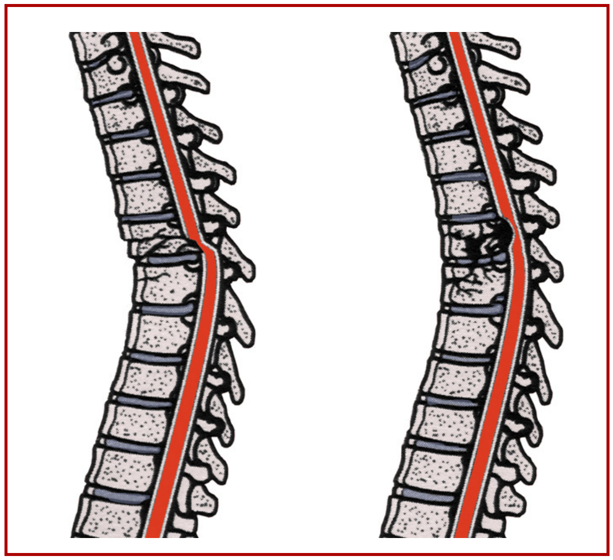


Figure 1: Damaged spine

Always consider the possibility of a spinal injury with a patient who is found unconscious or is suffering from a major head injury. A neck injury should be considered in the case of any injury involving the clavicles or above. If the patient is conscious, it is important to verify the medical history as the patient may have had a previous back injury or operation. When in doubt, treat as a spinal injury.

Complications due to neck injuries

With a cervical spine fracture, the muscles controlling breathing may be paralysed.

This could involve the rib muscles of the chest, the diaphragm muscles, or both. In the first case, this limits the patient to diaphragm breathing, which is not as effective. If the diaphragm muscle is paralysed and only chest muscles are used, the breathing effort is limited to one-third of the normal effort. If both are paralysed, there will be no breathing at all.

If any breathing problems are detected, you should administer oxygen if available, and be prepared to assist ventilations

The incident may have caused serious damage to the many structures contained in the neck area, in addition to possible damage to the spinal column. These complications may result in further breathing difficulties, as well as hemorrhage.

Treatment

Regardless of the exact location, all spinal injuries are treated as if they were the most serious cervical spine injuries. Given the mechanism of injury necessary to create a spinal injury, we cannot be sure it is confined to a single area. When there is a sign, a symptom or a suggestive mechanism of injury, the first aider cannot ever rule out spinal nerve involvement. Although the patient may complain only of a vague pain in the back, because the consequences of a damaged spinal nerve are severe, patients are treated as if they had a cervical spine injury. You will often hear patrollers sum this up as "C-spine!"

Three major steps in handling patients with (potential) spinal injuries are:

1. Prevent further injury by following C-spine procedures.
2. Immobilize the patient on a backboard or other suitable device.
3. Transport the patient by EMS.

Prevent further injury

Cervical spine (C-spine) procedures

As soon as the need for C-spine procedures is recognized, a rescuer must stabilize the head until the patient is immobilized on a backboard. If you are first-on, suspend the rest of your assessment until others arrive. The only thing that takes priority over maintaining C-spine control is ABCs.

Stabilize the head in a neutral position. A neutral position means:

- eyes are forward,
- nose, chin and sternum are in line, and
- ears are in line with the shoulders.

Gently conform your hands to each side of the head's contours. Your finger tips should not go beyond the jaw line. Try not to cover the patient's ears. (see "Applying a cervical collar" on page 11-6.)

Primary objective: minimal movement

Usually, a minimum of three rescuers is needed for the following procedures. This varies by:

- the location of the patient,
- the size, weight and shape of the patient, and
- the availability of other rescuers.

If life-threatening conditions are present, that is if airway, breathing or circulation (ABCs) are compromised, the patient may have to be moved by two or even one rescuer.

Try to move the patient only once directly onto a backboard or other immobilization device.

These procedures attempt to place the patient on a rigid surface with as little movement to the spine as possible. Keep the body, from head to hips, in the anatomically correct orientation during the procedure.

The goal of the head-to-hip stabilization is to properly align and maintain the patient's head, spine and hips centred to the midline without introducing or applying spinal compression, traction, flexion, or rotation; this is known as axial immobilization.

General C-spine points to remember include:

- All rescuers should practice and review the backboard loading sequence regularly.
- If using bystanders, practice the loading sequence before moving the patient.
- When moving a person with a suspected spinal injury, the rescuer at the head is always the one who co-ordinates the other rescuers stabilising the rest of the body.
- A rescuer other than the rescuer at the head may have overall command of the accident scene for the purposes of triage, communication and co-ordinating transportation.
- The procedures described in this chapter may be used for femur, hip, and pelvic injuries as well.

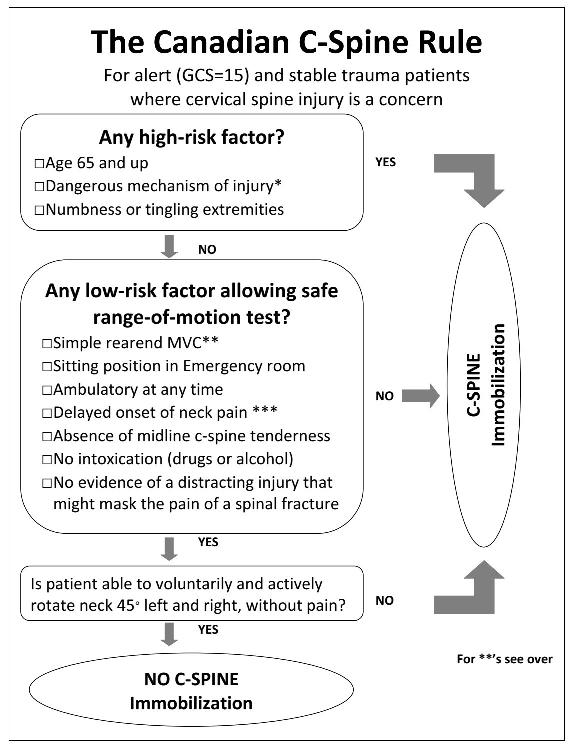
Use the following procedures for suspected spinal injuries after you determine that the patient:

- has a clear airway,
- is breathing,
- has a pulse, and
- has no severe bleeding.

If required administer oxygen.

If the patient is unresponsive:

- always maintain a clear airway, and
- be prepared that the patient may vomit.
- If the patient vomits, roll the body or tilt the backboard towards you and clear the airway using the tongue-jaw lift (see "Tongue jaw lift" on page 6-6) and finger sweep (see "Finger sweep" on page 6-10).



Dangerous Mechanism of Injury

- Fall from elevation of more than three feet or five stairs
- Axial load to head (e.g. diving)
- Motor vehicle collision (MVC) high speed (more than 100 km/hr),
- Rollover, ejection

- Motorized recreational vehicles
- Bicycle struck or collision

**** Simple rear-end MVC excludes:**

- Pushed into oncoming traffic
- Hit by bus or large truck
- Rollover
- Hit by high-speed vehicle

*****Delayed**

i.e. not immediate onset of neck pain

FOR INFORMATION ONLY

[A CSP Regular Member (Advanced First Aid (AFA) certified) is not trained in these procedures]

Glasgow Coma Scale

The Glasgow Coma Scale (GCS) is a neurological scale used to objectively describe the conscious state of a person. It also allows for easy trend identification when taken over time. The scale is based upon the evaluation of eye opening, verbal response and motor response.

Eye opening is scored on a scale from one to four, verbal response on a scale from one to five and motor response on a scale from one to six. The best response in each category is used to calculate the overall score. The minimum score is three, the maximum is 15.

	1	2	3	4	5	6
Eyes	Does not open eyes	Opens eyes in response to painful stimuli	Opens eyes in response to voice	Opens eyes spontaneously	N/A	N/A
Verbal	Makes no sounds	Incomprehensible sounds	Utters inappropriate words	Confused, disoriented	Oriented, converses normally	N/A
Motor	Makes no movements	Extension to painful stimuli	Abnormal flexion to painful stimuli	Flexion / withdrawal to painful stimuli	Localizes painful stimuli	Obeys commands

Cervical collar

For an injured person with suspected head and spinal injury, patrollers should initially use spinal manual restriction. In a suspected cervical spine injury, it is recommended to manually support the injured person's head and neck in a position limiting angular movement until more advanced care arrives (e.g. placing one hand on either side of the injured person's head to hold it still). The routine use of cervical collars is not recommended.

NOTE: in special circumstances, traditional immobilization devices may be used for extrication. (Immobilization devices are only to be used with proper training, and if used, the patroller must be under the supervision of a licensed medical doctor). i.e. CSP Medical Advisory Committee.

To apply a collar, the patient must be supine, sitting or standing position, with the head held in a neutral position by another rescuer. The supine/sitting requirement may not happen until the patient is rolled on to the backboard.

To apply the collar, do the following.

1. Tell the patient what you are about to do and ask them not to move. Cervical collars must be tightly fitted. It is normal for the patient to feel discomfort at the points of the jaw.
2. Remove any necklaces (they obscure an x-ray) and if possible any earrings (for patient comfort). Winter clothing and helmets may hinder the proper application of a cervical collar. Always consider the situation, the implications and the prevention of further injury. Should the situation warrant, remove or cut any excess clothing and also remove the helmet (see below) to

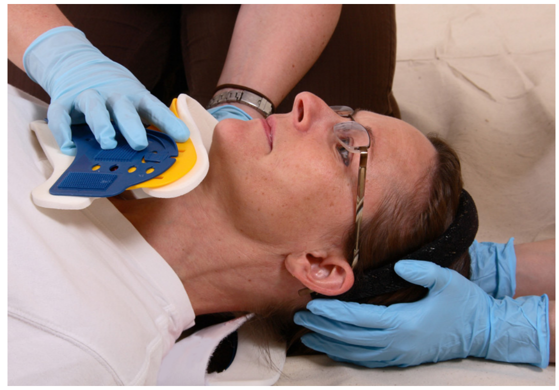


Figure 2: Applying a cervical collar

3. Size the collar to the patient. When in doubt, choose the smaller size to avoid hyper-extending the neck.

Follow the manufacturer's sizing and installation instructions. If you are using the Stifneck brand collar, use your fingers to measure the distance between the patient's chin and shoulder. The collar should have the same measurement between the chin cup and the edge of the collar.

4. After determining the correct size, assemble the collar according to the manufacturer's instructions.
5. Flex the collar a few times to make it more pliable.
6. Fold the Velcro tab to the inside of the collar to prevent it from becoming contaminated with dirt or snow.
7. Slide the back of the collar under the patient's neck so that the Velcro strap slides completely to the opposite side of the neck.

8. Position the front of the collar beneath the patient's chin.

> When applied, the chin cup should rest snugly against the patient's chin with the lower edge of the collar resting against the sternum.
>
> If the collar you first try does not fit, change it to the proper size before securing it to the patient.

9. Tighten the collar by gently pulling the strap and fastening it to the side of the collar. The collar should be tight enough to provide adequate support.
10. Do not remove the collar after it has been properly applied. Only qualified medical personnel should remove cervical collars.
11. After application of the collar ensure it is not too tight. Ask the patient:
    - Can you breathe?
    - Can you speak?
    - Can you swallow?

    If you have to re-adjust the collar, advise the patient that they will hear the Velcro strap tearing loose and that they should not be alarmed.
12. To the rescuer at the head:
    Don't let go!

    Be aware that even a tightly fitted cervical collar does not completely immobilize the head and neck; it only reduces the extent of motion.

    Treat a patient wearing a cervical collar with extreme caution and use the collar as a visual reminder of the criticality involved.

    You can let go after the head has been immobilized on the backboard.

What if a cervical collar cannot be applied to the patient's neck?

Due to resistance felt when aligning the head, severe blunt trauma with progressive swelling or a penetrating neck injury, you may be unable to position the patient's head in a neutral position. In this case you will not be able to apply a collar on the patient. Rather, ensure that the head and neck are adequately supported with padding and tape when securing the patient to a backboard. You may also need to use padding under the head to get the eyes-forward position. Stabilize the head at all times.

Immobilize the patient

It is your responsibility to establish a method of transporting the patient while maintaining an open airway and preventing movement that will cause further injury.

If you are unable to move the patient because of their location or injuries, call the appropriate EMS immediately; then assist the emergency personnel as requested.

The following procedures explain the procedure for loading a patient onto a backboard. The best loading method is the log roll .

Log roll

This technique allows rescuers to use the ground as a type of splint and have greater control of the patient.

The following procedure describes a patient in the supine position. If the patient is lying on their side, you will usually have to straighten the patient before continuing (see below for this procedure).

Figure 3: Leg immobilization

Do the following:

1. Explain to the patient what is going to happen and how they can help by lying still.
2. Apply a cervical collar as soon as possible. Continue to stabilize the head.
3. The rescuer at the head applies and maintains axial immobilization as well as being in charge of the log-roll procedure.
4. Place two rescuers on one side of the patient. One level to the chest, the other level with the thighs.
5. If available, place a blanket between the patient's legs.
6. Secure the blanket with a broad bandage at the knees and a figure-of-eight at the feet. This will prevent the legs from dangling and getting in the way. If available the rescuer at the patient's feet stabilizes the legs.

Figure 4: Position of rescuer at the feet

7. If the patient is unresponsive, loosely tie the patient's hands together with a cravat.
8. Position for rescuers at the head and feet:
    - Given that the rescuers at the head and feet may stay in that position for an extended period of time, they must assume a very stable and comfortable position. Their positioning will be dependent on the direction of the roll.
    - Rescuers who will roll the patient must also assume a stable and comfortable position.
9. Apply and maintain head to hip immobilization. This provides stability. **Do not introduce spinal compression or traction during movement.**
10. The rescuers assisting with the roll, position their hands as follows:

Figure 5: Position of rescuer at the side

- The rescuer at chest level reaches over the patient and places one hand at the shoulder level and the other just below the hips.
- The rescuer at the thighs reaches over the patient and places one hand just above the patient's hips (criss-crossing arms with the other rescuer) and the other hand at the knees.

This criss-cross position effectively locks both assisting rescuers, enabling them to move the patient as a unit.

If ABCs are compromised it is still possible to perform the log roll with only two rescuers.

One rescuer stabilizes the head and the other assumes the side position at chest level.

Assure that axial immobilization is maintained throughout the manoeuvre.

11. The rescuer at the head verifies if everyone is ready. Once everyone is ready, the rescuer at the head gives the command to roll the patient onto their side, as far as is necessary to insert the board under the patient.

Figure 6: Four rescuers performing a log roll

Figure 7: Three rescuers performing a log roll

12. Check the patient's back for TIC and DCAP-BLS. Place a blanket or closed-cell foam pad, on the backboard prior to loading the patient. This greatly eases the relocation of the patient prior to the tie down and reduces the potential for the development of pressure sores due to prolonged immobilization on the backboard.
13. Align the backboard to the patient so that the patient's ears align with the top tie down position.
14. Position the backboard and hold it as tightly as possible to the patient, preventing the board from slipping or twisting.

Figure 8: Positioning the backboard

15. On command from the rescuer at the head, the patient is rolled onto the board. The backboard is lowered to the ground with the patient.
16. If the patient needs to be moved on the backboard to centre and align the ears with the first slot on the board, then the rescuer at the head gives directions to move the patient while **axial immobilization and stabilization are still maintained.**

Figure 9: Repositioning the patient on the backboard

17. Secure the patient to the board using bandages. The number of bandages required will depend on the size of the patient. Tie the bandages in sequence from chest to feet (i.e. top-to-bottom). Always tie the head last.
18. Maintain axial immobilization until the patient is stable on the backboard.

Due to certain terrain conditions, you may have to tie a patient to the backboard before the patient is stable on the board.

Scoop stretcher

When a scoop stretcher is used, each side is separately inserted under the patient from the side. The sides are then re-fastened and the patient is securely immobilized to the stretcher with straps or cravats. Axial immobilization must be maintained throughout this procedure.

FOR INFORMATION ONLY

Use of an upper body motion restriction device

Patrollers may be asked to assist more advanced medical responders to immobilize a patient with an upper body motion restriction device. The Kendrick Extrication Device (KED) is one example. The strapping system on an upper body motion restraining device mirrors a typical backboard and is very familiar to patrollers and simple to learn.

The device however, is not part of the standard equipment found at all CSP areas, due to its cost. Devices such as a KED may be used by our members provided the manufacturer's instructions for use are followed.

Tie down procedures using triangulars

The objective here is to prevent the patient from sliding during transportation.

Some of the following steps may not be practical depending on the circumstances of the incident. If available and properly trained in their usage, rescuers may use a head-immobilising device such as Ferno head blocks (see Figure 13) and use Speed-Clips or Spider-Straps in replacement of the triangular bandages. Note that the head is secured to the backboard only after the thorax, the pelvic region and the legs are well secured to the backboard.

Figure 10: Tie down

Where possible, do the following:

1. Place a folded blanket around the patient's head. The blanket should extend beyond the patient's shoulders.
2. The rescuer positioned at the patient's head will continue to stabilize the head by placing their hands on each side of the patient's head. The finger tips should be placed along the cervical collar, approximately at the jaw line.
3. If padding is needed to prevent movement, roll two blankets and place them under the armpits and down each side of the body. If a blanket was used on the backboard, the excess may be used as padding along the sides.
4. Two rescuers simultaneously tie cravat bandages over the chest area in criss-cross fashion. Start by tying the bandage end to a slot at ear level, come over the blanket on the patient's shoulder and across the chest. Feed the end through a slot above the hip, tell the patient to take and hold a deep breath while the two rescuers tie the ends. The padding over the shoulders will prevent the bandages from sliding into the cervical collar.
5. After securing the bandages check that the patient is still able to breathe properly.
6. Apply another set of criss-crossed cravat bandages across the patient's hips.
7. Place padding under the knees, to fill the hollow.
8. Apply another set of criss-cross bandages over the knees. Be careful not to over-tighten this bandage.Use two triangular bandages to apply a figure-of-eight or stirrup around the ankles; then secure the ankles to

the board without introducing pull or traction. When securing young children, you may have to use a third triangular bandage to cover the extra distance from their feet to the end of the backboard. This bandage prevents the body from sliding towards the top of the board.

Figure 11: Foot tie down

9. Tie broad bandages across the patient's chest, hips, and legs (above or below the knees).

   Ensure that the bandage at the chest or abdomen does not impair the breathing in any way. Snug is good.

   Ask the patient if the bandages are too tight and check them yourself.

10. Tie a broad bandage so that it covers the eyebrows of the patient. Do not use a chin strap as it may prevent fluids from draining and prevent the patient from communicating.
11. Tie one end of a triangular to the side of the brow bandage around the criss-cross of the chest bandages and then to the other side of the brow bandage.

Figure 12: Head tie down on the backboard

Figure 13: Head immobilization device

General points of consideration

Where possible, apply the following guidelines:

- Use as many bandages or as much padding as required to prevent movement.
- Bandages applied with too much pressure may affect breathing or cause pressure on the spine.
- Try to prevent direct pressure on the knees.

Do not secure the patient's head to the backboard until all other tie down procedures are complete. This eliminates the possibility of spinal injury if the patient slides off the backboard or vomits while only the head is secured.

FOR INFORMATION ONLY

Vacuum mattress

A vacuum mattress is a whole-body immobilization device. It is a flat, sealed, flexible pouch filled with particulate about the size of sand or gravel. A valve allows air to enter and to be pumped out of the pouch. The pouch is formed to a patient's contours by folding it and moving the particulate to fill hollows. Pumping the air out of the pouch results in a rigid, contour-moulding immobilization. The operating temperature range is -40 C to 70 C. Follow the manufacturer's instruction when using a vacuum mattress.

Other spinal situations

Depending on the circumstances of each incident, you will have to employ different and specific techniques:

The two main specialized spinal situations are:

- straightening a patient with a spinal injury, and
- dealing with a patient in the prone (face down) position.

Straightening a patient with a spinal injury

You may find a patient with a spinal injury wrapped around a tree, post, mogul or other object which cannot be moved.

In such cases, where the patient is probably on their side, the log roll is the preferred method for placing the patient on the backboard. Apply axial immobilization between the head and hips before proceeding to move the patient.

Straightening procedure

Some of the following steps may not be practical due to the circumstances of the incident and the availability of rescuers.

Where possible, do the following:

1. Stabilize the head and body and apply a cervical collar if possible. Reminder: to apply a collar, the patient must be supine or sitting, with the neck in a neutral position.

   You may need to use non-compressible padding under the head to get the eyes-forward position.

2. Position of thighs and knees:
   - If the thighs and knees are together, secure them with a broad bandage.
   - If the thighs and knees are not, wait until axial immobilization is applied at the head and hips before placing them together.
3. Tie the wrists together with a cravat.
4. If rescuers are available, position them as follows:
   - One rescuer at the head to stabilize and apply axial immobilization,
   - One rescuer at the chest to stabilize the shoulders
   - One rescuer at the hips, and
   - One rescuer at the feet to straighten the legs.

   Be careful not to introduce traction or compression at the head to hip area during the manoeuvre.

Figure 14: Rescuer positions to straighten a patient

This procedure is also possible to perform with only three rescuers.

- One rescuer stabilizes the head,
- The second rescuer takes position at the hips,
- The third rescuer at the feet, places the feet together and stabilizes the lower legs until patient is straightened.

Should any resistance or increased pain be detected while applying axial immobilization and straightening, stop and immobilize the patient in the position found.

5. The rescuers positioned at the head and hips maintain head to hip immobilization.
6. The rescuer at the chest applies pressure towards the midline.
7. The rescuer at the feet brings the legs together and then straightens them **slowly and carefully**.
8. Once the patient has been straightened, maintain head-to-hip axial immobilization.
9. The rescuers then place their hands in the proper position to perform the roll onto the backboard.
10. **Quickly** examine the patient's back (TIC and DCAP-BLS) as they are rolled onto the backboard.
11. Secure the patient to the backboard.

Figure 15: Straightened patient

Patient found face down

You may find a patient lying face down either breathing, or not breathing.
First Aid techniques vary accordingly.

Patient breathing

This procedure is similar to the log roll described on page 11-8; you will require the same number of rescuers. The major difference between the two procedures is that you start with the patient in the face down position.

Always perform the roll in the direction of the back of the patient's head. The roll must be performed in a manner that causes the least amount of movement to the patient's head and neck.

Do the following:

1. Always explain to the patient what is going to be done and that they can help by lying still.
2. Immobilize the patient's head in the position found. The rescuer at the head must be sure of his/ her hand positions before actually rolling the patient. Think about where your hands will be after the patient has been rolled.

   If a blanket is available, place it between the patient's legs and secure the blanket at the knees and feet.

3. The other rescuers assume the positions as outlined in the face-up log roll procedure.
4. On command from the rescuer at the head, roll the patient to a lateral position on their side.
5. Position the backboard between the rescuers on the side and behind the patient's back.
6. Roll the patient onto the backboard and lower to the ground as a unit.
7. Apply a cervical collar.
8. Immobilize the patient to the backboard.

Patient is not breathing

- ***Speed is critical*** -

Do the following:

1. Gently place the patient's arm closest to you along side the patient's head.
2. Cross the patient's outside lower leg over the inside lower leg.
3. Use one hand to grip the patient's waist.
4. Using your other hand to support the head, roll the patient onto their back.
5. Begin the rescue breathing techniques described in basic life support (page 6-12).

Figure 16: One-rescuer roll for prone patient

If available, a second rescuer should stabilize the head at all times.

Procedure for standing take-down spinal immobilization

If the patient is standing and a spinal injury is suspected, immobilization can be performed safely while standing. This technique takes three responders. If a bystander is recruited, they should be used to support and control the backboard.

1. Talk to the patient to let them know what will be happening and to reduce their anxiety.
2. Have one patroller size and apply a cervical collar while the other maintains manual in-line stabilization.
3. Place the long spine board behind the person. Check the placement of the board from the front of the person to ensure it is aligned correctly. Check the alignment of the patient's head from the side to ensure the head is in a neutral position. Pad under the head or shoulders as needed to achieve a neutral head position.
4. With one patroller on each side of the injured person and facing in the direction of travel, each should place their arm closest to the patient, under the injured person's armpit and grasp the next highest handhold on the backboard. The responder's free hand supports and holds the patient's head in alignment throughout the lowering. In cooperation with the person maintaining spinal immobilization from the front of the patient, transfer responsibility for C-spine to patrollers at sides. The third responder moves around to the back of the board and holding the top edge, guides the board throughout its arc to the ground.
5. Have the patient hold their arms across their chest. The timing of the move to

the ground is set by the person supporting the backboard. Talk to the patient and reassure them throughout the process. Tip the patient backward and lower the person to the ground while holding the head stable. The patrollers will need to move from a standing to a kneeling position during the tip backwards.

6. Once the patient is horizontal and stable, transfer C-spine responsibility to the person at the head and complete the process of securing the patient to the backboard for transport. After the patient is completely immobilized and secured to the board, manual stabilization is released.


Applying cervical collar to a standing patient


Aligning backboard with patient's head


Patrollers at each side of patient, immobilizing C-Spine


Tipping the backboard


Transfer of C-Spine responsibility

Figure 17: Procedure for standing take-down spinal immobilization

Transportation of spinal injuries

Usually, transport spinal injuries with their head downhill.

Transportation speed is dictated by assessment of priority injuries but should be as smooth and controlled as possible.

It may be necessary to place the patient on a tilted backboard to assist in the drainage of fluids (vomitus) from the mouth. Build up padding under one side of the backboard until it is at an approximate 45-degree angle.

Secure the backboard into the toboggan.

Helmet removal

Any patient position that allows for the removal of a helmet while manual cervical spine control is applied and maintained is acceptable. If the patient is lying on the ground, the patient cannot be lying prone or on their side and be able to have their helmet safely removed. However, helmet removal may be performed safely with the patient sitting or standing.

Two rescuers are required to perform the task of removing the helmet adequately.

Do the following as required:

1. Decide whether or not the helmet needs to be removed. Ideally the patient should have been moved to a backboard first; however, circumstances will define the feasibility of this.
2. Manual control of the head during the removal of the helmet is mandatory. There are two effective techniques that may be used:
   a. hands over the clavicles, supporting the head on both sides along the jaw line and behind the ears, or
   b. a fore-and-aft grip where one arm lies on the sternum with the hand supporting the head along the anterior jaw line and the other arm lying on the ground with the hand supporting the head under the occiput.

Personal preference and situational peculiarities may favour one technique over the other.

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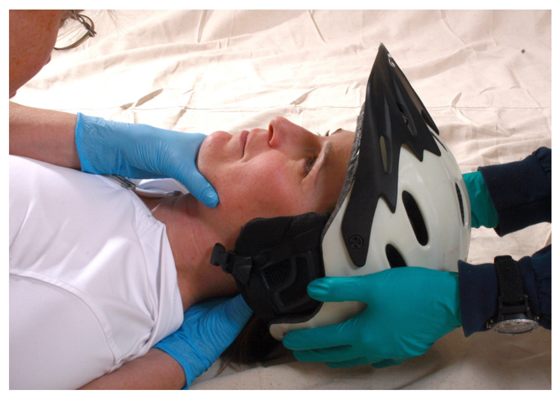

Figure 18: Rescuer stabilizing the head

3. Eye wear, chin straps and electronics should be removed before the helmet is pulled.
4. The person managing the head must be in a position to completely support the weight of the head once the helmet has been removed.
5. The person manoeuvring the helmet should hold the helmet by curling the fingers under the rim of the helmet at the point where the chin strap connects to the helmet. During the moving of the helmet off the head, some pull must be exerted outwards to alter the internal shape of the helmet, to help it clear the

ears. This is more of an issue with hard shell, full-coverage helmets such as motorcycle helmets than for many of the ski helmets currently on the market.

6. Slide the helmet off the back of the head (occiput) before tilting it back to clear the nose. When viewed from the side, the helmet will trace an S pattern in the process of being removed.

Figure 19: Rescuer slides the helmet off the back of the head

7. Once the helmet is removed, the patient's head will be off the ground by at least the thickness of the helmet. The person removing the helmet then takes over manual control of the patient's head and with gentle in-line pull moves the patient's head/neck into neutral alignment (ear canal in line with the middle of the shoulder when viewed from side). If this cannot be achieved due to pain or physical obstruction, the space under the head must be taken up by firm padding. A cervical collar can now be applied and the patient secured as per standard procedure.

Conclusion

Keep the following points in mind when dealing with spinal injuries:

Support the patient's head in a neutral position. Make sure that the airway is kept clear. Apply a cervical collar to all patients with suspected spinal injuries. Do this as soon as possible once the patient is supine or sitting and the head is in a neutral position.

If at any point, the patient displays signs of neurological deficits, the situations becomes a load and go.

Have enough rescuers to move the patient safely. The number of rescuers required depends on the size and shape of the patient.

Any movement must be slow and steady with continual monitoring of the patient.

Avoid any motion which produces spinal flexion or rotation. If the patient's legs must be straightened:

- immobilize the body, and
- apply steady axial immobilization between the head and hips before moving the legs.

To support the spine fully, place the patient on a backboard. A stretcher without the addition of a rigid support should only be used as a last resort.

If possible, people injured in vehicles should be immobilized before they are removed. It is best to leave them in their vehicles until qualified help is available, unless priorities dictate otherwise.

Place an unconscious patient so secretions can drain from the mouth by tilting the backboard sideways and supporting it with padding.

Monitor a patient with a spinal injury continuously, and administer high flow oxygen if required.

Notes...

Wounds

Upon completion of this chapter the student will be able to:

1. Describe the types of, and hazards associated with superficial wounds and deep wounds.
2. List the signs, symptoms and treatment of infected wounds.
3. Demonstrate the general treatment of wounds.
4. Demonstrate the specific treatment of impaled objects and amputations.

Learning outcome

Recognize, understand, and treat wounds.

A wound is an injury which damages the tissues, organs or bones of the body.

It may be closed, like a contusion or hematoma, or open with the skin broken making the wound susceptible to infection.

It may be superficial, a cut on the surface of the skin or a small bruise, or it may be deep, a cut exposing fat or muscle under the skin or a large bruise indicating damage to more than just surface tissue. Deep wounds usually involve notable bleeding, external or internal, and often require additional medical attention such as sutures.

In the presence of a wound, rescuers must take universal precaution to minimize exposure to infectious diseases for both themselves and the patient.

Types of wounds

- **Abrasion:** the skin, and possibly the tissues immediately below the surface, have been rubbed or scraped.

  Bleeding is generally easily controlled because only capillaries are affected. The patient may feel a great deal of pain because of the many nerve endings that are damaged and exposed
- **Avulsion:** a flap of skin is torn loose from the body. The flap may either remain hanging or be completely torn off. Avulsions may occur on any part of the body.

- **Laceration:** a break in the skin. A cut. This wound may affect underlying structures depending on the depth. Lacerations may cause significant bleeding if the wall of a blood vessel is broken, particularly an artery.
- **Puncture wounds:** A puncture wound is caused by a stab from a pointed object, such as a nail or ski pole. The opening in the skin may appear small, but the resulting wound could be very deep and could pose a serious infection problem. Internal organs can also be injured by this type of wound.
- **Impaled objects:** An impaled object wound is a puncture wound with an embedded object. The object should be stabilized and left in the wound. Efforts to remove it could cause severe hemorrhage, nerve damage and additional injury to underlying structures.
- **Amputations:** An amputation is the complete or partial severing of an extremity, such as a finger or a toe. It may be caused by a sharp object, such as a knife or wire, or by a squeezing action, such as between a lift cable and drive wheel.

  Amputations rarely bleed much unless the extremity is torn or crushed. The body's reaction is to vasoconstrict the blood vessels, which reduces hemorrhage in the case of a clean-cut amputation.

Hazards of wounds

There are three main hazards with wounds:

1. blood loss,
2. loss of function and tissue damage,
3. infection.

Blood loss

After priorities have been dealt with, treat bleeding from all non-life-threatening wounds as soon as possible.

> Estimate the amount of blood loss, keeping in mind the tendency to over-estimate.

This information will be useful to you and EMS if a patient begins to show signs of shock.

Loss of function and tissue damage

A major injury may cause immediate and possible long-term serious tissue damage and loss of function. Prevent further deterioration by taking action to stop any bleeding, splinting to prevent movement of major injuries and, if necessary, rapid transportation to advanced medical attention. This is particularly true where serious injuries may restrict the blood flow to parts beyond the injured site.

Infection

Infection is the growth of foreign bacteria. Any break in the skin carries the risk of infection, especially if it is exposed to foreign agents.

The risk of infection varies with:

- the size of the injury,
- the location of the injury,
- the extent of external contamination, and
- the time between the occurrence of the injury and reaching proper medical aid.

Contamination of the wound with dirt and soil introduces the risk of tetanus. Many other types of bacteria may be introduced. The incidence of infection can be reduced with the application of an antibiotic cream or ointment (if no known allergies to the antibiotic) if the wound is an abrasion or superficial. Cover the wound with a sterile dressing and refer to medical care as appropriate.

Signs and symptoms

Signs and symptoms include:

- Swelling.
- Redness.
- Tenderness.
- Heat.
- Pus which may indicate formation of an abscess.

Treatment

Do the following:

- Leave the wound intact.
- Cover with a sterile dressing.
- Recommend the patient seek further medical aid.

General treatment of wounds

There are several general principles regarding the treatment of wounds:

- Prevent further complications.
- Control bleeding.
- Prevent infection.

Procedure

- Examine for foreign material in the wound.
- Remove any loose material and flush with clean water, preferably tap water because of the benefit of water pressure to assist in cleaning the wound. If necessary, use a clean (sterile) gauze to gently remove debris while irrigating. Do not scrub vigorously, as this can cause more tissue damage.
- If the wound is an abrasion or a superficial wound, check if the patient has any known allergies to the antibiotic. If the patient has no known allergy, apply an antibiotic cream or ointment to the wound. When administering antibiotic ointments or creams, use an intermediate device (e.g. cotton tips) between any multi-use container and the patient or administer using single-dose packages (preferred).
- Place a sterile, non-adherent dressing over the entire wound.

  If this is not possible, use a clean, dry dressing, triangular bandage or some suitable cloth.

  Never use cotton batting as a dressing.
- Apply direct pressure to any continuous bleeding.
  - Use a bandage or tape to hold the dressing in place. Use a pressure bandage where bleeding continues.
  - Always check for PMS distal to the wound before and after bandaging.
- Elevate injury site.
- Splint if necessary to keep the wound from moving and disrupting the clotting process.
- Watch for signs of shock.
- Monitor vital signs.
- Recommend the patient seek further medical aid for any deep or significant wound.

Specific treatment of wounds

Specific types of wounds require specific treatment procedures. Taken from a first aid point of view, these include:

1. impaled objects (below), and
2. amputations (below).

Impaled objects

Do the following:

1. Control hemorrhage by applying pressure around the object but not on the impaled object itself.
2. Stabilize the impaled object with bulky dressings all around the wound site.
3. Unless the object is extremely unwieldy, do not attempt to shorten it. Movement may further damage nerves, blood vessels, and surrounding tissues.
4. Monitor for shock, activate EMS and transport to medical aid.

Amputations

There are two treatment procedures for amputations:

- Treatment of the patient, and
- Treatment of the severed part.

Treatment of the patient

Do the following:

1. Control bleeding by applying direct pressure to the injury site and elevating it as soon as possible.
2. Splint the area if it is possible that it may be fractured.
3. Treat the patient for shock.
4. Monitor the patient's vital signs.
5. Activate EMS and transport to medical aid.

Treatment of the severed part

Do the following:

1. Wrap the severed part in a sterile dressing.
2. Place the severed part in a sealed plastic bag to keep it dry.
3. Place the sealed plastic bag in cold water.
4. Transport the severed part with the patient.
5. Record date and time of amputation.

Chafing

Chafing is caused by repeated motion - specifically, skin rubbing against loose fabric or other skin. It most often occurs around the bra line (women), nipples (men), inner thighs, and under the arms. Moisture, either from sweat or rain, can worsen chafing.

Signs and symptoms

- Tender, red and raw skin.
- Painful stinging or burning sensation.
- Bleeding.

Treatment

If the skin is not broken, suggest the use of a lubricant such as petroleum jelly or Runner's Lube. A tongue depressor should be used to apply the lubricant to the wound.

If the skin is broken, treat the area like an open wound and cover the chafed area.

If the bandage or tape will not adhere to the skin due to sweat or sunscreen, use a semi-permeable dressing such as Hypafix.

Friction blisters

When it comes to minor friction blisters, generally no treatment is required other than a protective cover. Most blisters typically heal on their own in just a few days. Small unbroken blisters that don't cause discomfort can be left alone to heal. The best protection against infection is a blister's own skin.

With continued friction, blisters can be painful and become infected.

If you suspect a blister has been caused by a burn, refer to the section on burns (see "Burns" on page 17-21).

Always look for signs of existing infection first. These include pus drainage, red or warm skin surrounding the blister, or red streaks leading away from the blister. If present, apply a protective dressing and refer the patient to medical aid.

Treatment for undrained blisters

Do the following:

1. Clean the blister site with saline or anti-bacterial cleanser.
2. If there are no signs of infection, apply an appropriate bandage/cover to protect the blister. (see "General treatment of wounds" on page 12-3).
3. For continued activity, apply 2nd skin over the blister and then cover it with moleskin or appropriate adhesive covering (such as Hypafix). This will prevent additional friction.

Treatment for open blisters

Treat open blisters as you would an open wound.

Lancing or draining intact blisters may expose the dermis to bacteria and should not be performed in the field.

FOR INFORMATION ONLY

[A CSP Regular Member (Advanced First Aid (AFA) certified) is not trained in these procedures]

Some treating practitioners will aspirate or lance a very large blister using a sterile technique but those in the field with basic medical supplies should avoid contaminating an intact blister. At times this lancing is done to convert a non-ambulatory foot to an ambulatory one for the purposes of self-evacuation.

In the more extended time period beyond first aid, it may be necessary to identify and consider draining a blister showing signs of infection.

Splinter removal

A splinter is a sharp fragment of organic or man-made material that becomes embedded just below the top layer of the skin.

Splinters can become infected if left under the skin. The chance of a splinter becoming infected depends on what the splinter is. Organic material such as animal spines or plant thorns is more likely to cause infection or toxic reactions.

Signs and symptoms

- Redness
- Swelling
- Pus draining from the wound
- Severe pain even without movement

Look for signs of infection before trying to remove a splinter.

If the splinter has become infected, is deeply embedded, or close to the eye, do not attempt to remove it. Cover the wound and recommend the patient seek additional medical aid.

Treatment

To remove a splinter, do the following:

1. Clean the wound and entire wound area thoroughly with saline or antibacterial cleanser.
2. Before trying more invasive methods, gently squeeze the splinter from both sides and the bottom to try and work it back the way it came.
3. If the splinter is under the skin or hard to grab: use a sterile packaged pin or needle (or Splinter Out). Gently remove skin over the splinter.
4. Use tweezers to grab the splinter. Carefully pull it out at the same angle it went in.
5. Once the splinter is out, clean the wound again.
6. Pat dry, and cover the wound to protect against infection.

If the patient is hesitant to allow the removal, treat as a minor wound, cover with additional padding.

An updated tetanus shot may be advisable.

Dental injuries

If a sensitive dental nerve is exposed, and the patient is alert, have him cover it with gauze to protect it from cold air. Do not clean the avulsed tooth, as this could damage the tissues.

The avulsed tooth may be placed in a balanced salt solution. If not available, the tooth may be placed in propolis, egg white, coconut water, ricetral, whole milk, saline or phosphate buffered saline (in order of preference).

If none of these solutions is available, it may be reasonable to store an avulsed tooth in the injured person’s saliva (not in the mouth). Recommend the patient seek further medical aid.

When possible, an avulsed tooth should be re-implanted by an oral surgeon within 30 minutes.

Bleeding from specific sites

Bleeding from specific wound sites require specific treatment procedures.

Open fracture

An open fracture is a condition where the bone has broken through the skin causing a wound. Whether the bone protrudes or not determines the course of treatment.

Bone protrudes from the fracture site

1. Attempt to restore the bone ends under the skin by applying gentle traction. (see "General procedure - limb fractures" on page 14-6)
2. Cover the bone with a dry, sterile dressing, avoiding pressure on the tip of the fractured bone.

3. Apply padding along either side of the injury.
4. Bandage the wound carefully.

Remember **no encircling bandages under the splint.** You must be able to inspect the wound site without losing the integrity of the splint.

5. Continue the splinting sequence.

Bone does not protrude from the fracture site

1. Cover the fracture site with a sterile dressing.
2. Bandage carefully.
3. Continue the splinting sequence.

Nose

Nose bleeds are common and occur for a variety of reasons which differ in patients of all ages. The vast majority will respond promptly to treatment.

Patients who bleed heavily in spite of treatment should be referred to medical aid.

Treatment

Do the following:

1. Have the patient sit so that his head is bent slightly forward. Do not tilt the head backward.
2. Have the patient pinch their nostrils together. Apply pressure for five to 10 minutes.
3. Loosen any constrictions around the neck.
4. Caution the patient to avoid swallowing blood for it could cause nausea or vomiting. Have them spit the blood out after it gathers in the mouth.
5. Caution the patient to avoid sniffing or blowing their nose during and after the bleeding.
6. If bleeding continues, apply an ice cube or cold compress over the nose.

In all cases where you observe fluid or blood coming from a nose, inform medical authorities in a note attached to the patient stating quantity, duration, and colour.

Ear

Blood, clear fluid, or a mixture of both, coming from the inside of the ear may be evidence of a suspected fracture of the base of the skull.

If you suspect a head, neck or spine injury, treat as such. If you do not, do the following:

1. If other injuries permit, position the injured person in a lateral side-lying recovery position with the affected ear down so that fluid can drain from the ear.
2. Cover the ear with a sterile or clean dressing.
3. Caution the patient to avoid blowing their nose.
4. Recommend the patient seek further medical aid.

In all cases where you observe fluid or blood coming from an ear, inform medical authorities in a note attached to the patient stating quantity, duration, and colour.

Face and scalp

Bleeding from the face and scalp often appears worse than it really is. However, face and scalp bleeding may be serious enough to have significant blood loss. Note that the scalp is very vascularized and even a small laceration will bleed a lot. Treat this type of bleeding like other cases.

When treating bleeding from the face and scalp, though, be careful not to depress a possible underlying fracture. This danger is remote except when the skull is severely fractured and is no longer rigid. In these cases, common sense dictates that only light pressure be applied.

Always consider the possibility of an associated neck injury.

1. Examine carefully for signs of skull fracture and head or spine injury. If found, treat as such. If these injuries can be ruled out, then continue.
2. Apply sterile or clean dressings to the wound and bandage the wound securely in place.
3. Apply sufficient pressure to stop bleeding without causing unnecessary pain.
4. Monitor vital signs.
5. Recommend the patient seek further medical aid.

Mouth or tongue

Bleeding from the mouth or tongue is easy to diagnose, but may be difficult to treat in the case of a small patient, such as a child.

Do the following:

1. Examine carefully for signs of neck, head or spine injury. If found, treat as such. If these injuries can be ruled out, then continue.
2. If the injury is inside the mouth between the teeth and lips and the patient is conscious, have them hold a gauze pad against the wound.
3. Position the head so that blood does not flow into the esophagus and trachea. Elevate the head and position it forward only if a neck injury is not suspected.
4. Apply sterile gauze padding if bleeding is a result of teeth being knocked out.

> Do not put anything in the mouth if the patient is dazed or unconscious. If conscious, caution them to avoid swallowing any blood.

5. Recommend the patient seek further medical aid.

Neck

Lacerations of the neck may involve a severed artery.

Treatment for lacerations if a major artery is involved

Do the following:

1. Place your fingers both above and below the wound using both hands.
2. Push the artery toward the back of the neck using your fingers.

Do not apply pressure sideways. Sideways pressure may constrict the airway.

3. Treat as a load and go.
4. Activate the EMS.
5. Maintain constant pressure throughout transport.

Treatment for lacerations if a major artery is not involved

Do the following:

1. Cover with sterile gauze.
2. Bandage lightly.
3. Transport to medical aid.

Varicose vein ulcer

People of all ages may suffer from advanced varicose veins on their legs which may bleed profusely, either spontaneously or as a result of trauma.

Do the following:

1. Lay the patient down and remove any constricting garments or clothing from around the leg.
2. Raise the leg as high as possible to reduce the blood flow in the veins.
3. Apply a sterile dressing to the wound and a suitable bandage to hold pressure on the injury. Monitor the patient.
4. Transport to medical aid.

Bites

All breaks in the skin caused by animal or human bites require immediate medical attention because of the probability of infection.

Do the following:

1. Apply a dry sterile dressing.
2. Recommend the patient seek further medical aid.

Special wounds - evisceration

A massive laceration of the abdominal wall may result in the extrusion of intestines through the opening.

Do the following:

1. Do not replace the intestines inside the body.
2. Cover the intestines with a warm, moist, sterile or clean cloth. Hold the cloth in place with broad triangulars. Use as many as required.
3. Administer high-flow oxygen.
4. Transport the patient in the supine position with their knees and upper torso slightly elevated.
5. Monitor the vital signs carefully.
6. Give nothing by mouth.
7. Treat for shock, activate EMS and treat as a load and go.

Conclusion

Wounds are a visible evidence of injury.

Persons with wounds that develop redness, warmth or become painful; or persons with wounds who develop fever should seek medical attention.

Complications such as ruptured blood vessels and severed nerves are of immediate danger to the patient.

Significant wounds should receive immediate medical attention because of the dangers of infection and loss of a large amount of blood.

If blood loss is significant, monitor the patient's vital signs, treat for shock and always consider activating EMS and treating as a load and go.

Notes...

Dressings, Bandages and Slings

Upon completion of this chapter the student will be able to:

1. Recognize and apply various types of dressing bandages and slings.
2. Describe the different types of dressings and their appropriate uses.
3. Explain the basic principles of bandaging.
4. Demonstrate how to properly fold a triangular bandage.
5. Describe and demonstrate the different types and applications of bandages and slings.
6. Demonstrate the application of a cravat bandage to:
   a. control bleeding;
   b. secure dressings;
   c. cover an open fracture; and
   d. apply traction.

Learning outcome

Recognize, understand, and apply dressings and bandages for the treatment of injuries.

A dressing is the material placed next to a wound to absorb and stop blood or other fluid loss.

A bandage is a wrapping used to secure the dressing onto the wound. Some bandages are manufactured with dressings attached (e.g. Band-Aids).

A sling is a support used to immobilize or support an injured limb.

Types of dressings

There are two types of dressings:

- **Sterile dressing** (commercially-available), and
- **Non-sterile dressings**, that may be improvised dressings under the circumstances.

Dressings are held in place with tape, a bandage or gauze.

Sterile dressings (gauze)

Sterile dressings are applied directly to a wound. They are available in various sizes (four-by-four or three-by-three inches) and thicknesses. Large and bulky dressings are known as abdominal pads, sometimes known as ABD pads. Manufacturers supply these sterile dressings sealed in paper.

Dressings with a non-stick outer layer are preferable as they will not stick to the wound when being removed.

Sterile dressings are only sterile if the wrappings are kept sealed, intact and dry.

Sterile dressings help prevent the introduction of bacteria into the wound and provide protection against further injury.

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When applied to an actively bleeding site, use a non-adherent dressing (Telfa, or similar) to place directly on the wound to prevent gauze becoming adherent to the wound because of clotting. Adherent dressings such as gauze can be used as reinforcement, or to clean an injury before the more permanent non-adherent dressing is applied.

Non-sterile/improvised dressings

If it is the cleanest-available covering and you can avoid contamination by handling, you can improvise a dressing from such things as:

- the inside of a clean, ironed, folded handkerchief,
- a freshly-laundered towel,
- a linen washcloth, or
- a bed sheet.

Avoid using wool and cotton batten, since their easily dislodged fibres can contaminate the wound.

Types of bandages

Bandages are made from cloth, elastic, adhesive and gauze materials. They should be as clean as possible.

Use bandages to:

- Secure splints or to hold a dressings in place.
- Protect an injured area.
- Exert pressure on an injured area.
- Give support to a part of the body.
- Limit movement of a part of the body in place of a splint.

When properly applied, bandages promote healing, prevent complications and provide comfort to the patient during transportation.

Basic principles of bandaging

A bandage

- Should not be applied so tightly that it restricts circulation or so loosely that it allows a dressing to slip. It is important that a bandage be properly placed and well secured.
- Must be tight enough to control hemorrhage or immobilize the wound without constricting circulation to any parts distal to the injury.
- Must be applied so that pressure to the wound is evenly distributed.
- Must cover the entire sterile dressing.

Where possible, leave the fingers or toes of the bandaged extremity exposed enabling you to recheck distal pulses, motor response and sensation.

Knots must be accessible.

Place padding between the knots and the body. This will minimize possible pressure and sores.

Never use encircling roller bandages underneath a splint; they may impair circulation.

Signs and symptoms that a bandage is too tight are:

- The skin distal to the bandage becomes pale or cyanotic (bluish).
- The patient complains of pain usually only a few minutes after the bandage has been applied.

- The skin distal to the bandage may be cold.
- The skin distal to the bandage may be tingling and numb.

Triangular bandages

Triangular bandages are made from strong cotton cloth that is usually unbleached.

A 100-cm by 100-cm (40-inch by 40-inch) square, cut diagonally from corner to corner, makes two triangular bandages.

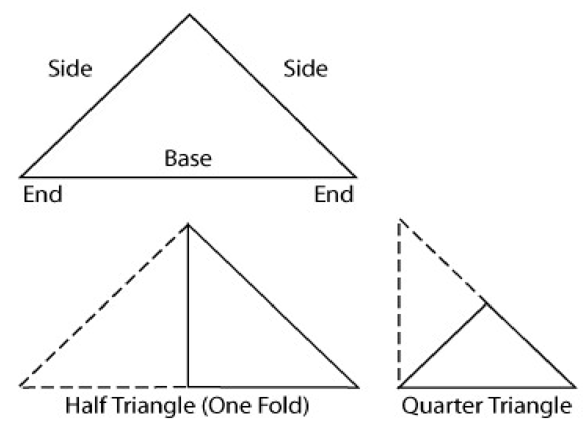

Figure 1: Triangular bandage configuration

Triangular bandages are used to:

- support injuries (slings),
- cover joint injuries (elbow, knee, shoulder), and
- cover large or rounded surfaces (torso, head, hips, foot, hand).

Folded triangular bandages

Triangular bandages may be folded as required. For example the half triangle and quarter triangle may be used for the application of slings and bandages on small children.

Common examples of folded triangular bandages are:

- broad bandage,
- cravat bandage,
- roll cylinder bandage,
- ring pad,
- padding, or storage, bandage.

Broad bandage

Broad bandages are often used as transportation bandages and are used to:

- wrap,
- tie over regions that require a wide area of support, and
- serve as a sling.

To make a broad bandage:

1. Fold the point of the triangular bandage to the base.
2. Fold a second time.

Cravat bandage

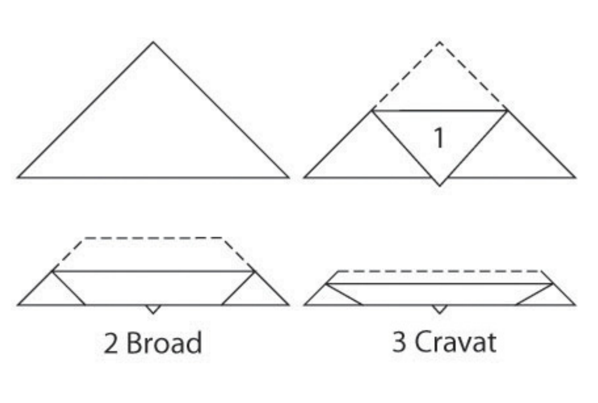

Figure 2: Folding a triangular bandage

Cravat bandages are used for securing splints and tying to a backboard as detailed below:

- wrap,
- tie over areas for increased pressure,
- tie for immobilization, and
- provide belt-like support.

To make a cravat bandage:

1. Fold the point of the triangular bandage to the base.
2. Fold a second time.
3. Fold a third time.

Roll cylinder

Used roll cylinders (gauze) to pad or make large circle pads.

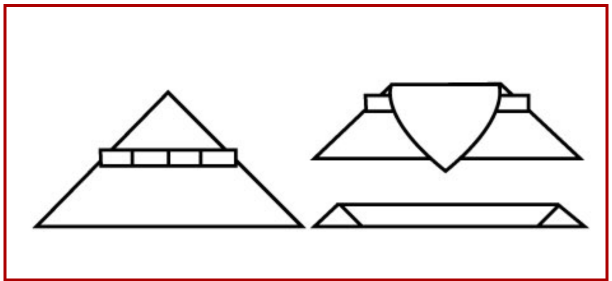

Figure 3: Roll cylinder

Ring pad

Use a ring pad to pad and elevate the bandage above the injury, such as might be used to protect a protruding compound fracture.

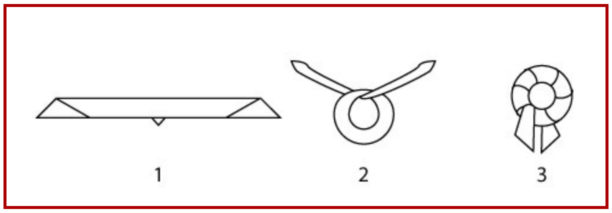

Figure 4: Ring pad

To make a ring pad:

1. Pass one end of a cravat bandage once or twice around the fingers.
2. Bring the other end of the bandage through the loop thus formed.
3. Continue to pass it around again and again until you use the entire bandage and have formed a firm ring.

In an urgent situation, wrap a cravat bandage around your hand to make a ring pad.

Open or close your fingers, according to the size of the ring required.

Padding or storage

Use this type of folded bandage to pad injuries, or when placing bandages in storage (e.g. stacked in a first aid cabinet or packed in a first aid kit).

To make a padding or storage bandage:

1. Tie a cravat bandage (see above).
2. Fold the ends of the cravat to the centre.
3. Fold the ends to the centre a second time.
4. Fold the bandage in half.

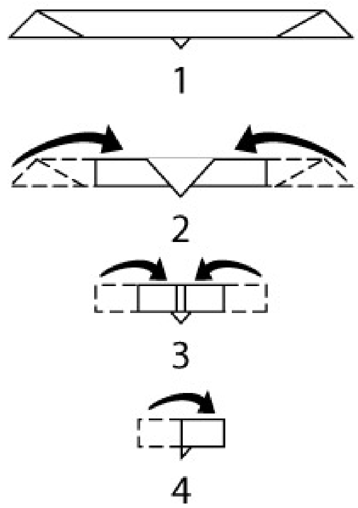

Figure 5: Padding or storage

Make sure the point of the bandage remains visible. This is the most efficient method of folding.

Unfolding bandages

To unfold a triangular bandage for use:

- Grip the protruding point and shake the bandage. The bandage will open quickly and efficiently. In many instances you will only have one hand free to open a bandage.

To unfold the bandage for use as a cravat:

- Grasp the middle and shake.

To open the bandage for use as a broad bandage:

1. Grasp the middle and shake. This forms a cravat bandage.
2. Open the cravat.

Roller bandages

Rolls of form-fitting, non-elastic, self-adhering bandages are available in various widths.

You may secure roller bandages easily with overlapping wraps, which may then be cut and tied, or held in place with adhesive.

Use gauze strips (e.g. Band-Aids) for smaller wounds. These should also be kept in their sealed paper covers. When applying bandages, take care not to restrict circulation.

Tourniquet

A tourniquet is a band or belt around the limb used to constrict blood vessels to control the flow of blood from a severely bleeding wound. In the recent past, it was considered a last resort for controlling bleeding. Tourniquet use has increased in light of recent military actions and its effectiveness at preventing loss of life due to extremity blood loss is well proven.

Improvised bandages

Such common items as belts, scarves, sweaters, shirts and jackets can all be used as bandages.

Bandage usage

Bandage usages include:

- Triangular bandage for the head.
- Triangular bandage for the shoulder.
- Triangular bandage for the hip.
- Bandage for the chest and back.
- Triangular bandage for the elbow and knee.

- Triangular bandage for the open hand and foot.
- Pressure bandage for the hand.
- Cravat bandage.
- Cravat bandage for the eye, back of the head or forehead.
- Cravat for the ear and cheek.
- Covering bandage for open fractures and other uses.
- Stirrup bandage and
- Modified stirrup bandage.

Triangular bandages for the head

Use this type of bandage to retain large sterile dressings in position on the top of the head, when the scalp is lacerated.

Applying a bandage to the head

1. Cover the wound with a sterile dressing.
2. Use an unfolded, fluffed-up triangular or other suitable padding over the sterile dressing to help stabilize it.
3. Fold a narrow hem along the base of the open triangular bandage.
4. Place the centre of the base immediately above the eyebrows.
5. Bring the ends to the back of the head covering the ears and cross them under the slight bulge at the back of the head.
6. Carry the ends around the head and tie on the forehead over the centre of the bandage.
7. Pull down the point of the bandage snugly.
8. Fold the point over the crossed ends and pin it above the cross-over at the back of the head.

Figure 6: Bandage for the head sequence

Ensure that the bandage does not obstruct the patient's view.

Triangular bandage for the shoulder

Use this type of bandage to retain a large dressing on the shoulder. After bandaging, place the arm at rest and secure using a small arm sling.

Applying a bandage to the shoulder

1. Apply a sterile dressing and a fluffed-up triangular to help hold it in place.
2. Place an open triangular bandage over the dressing with the point toward the ear.
3. Fold a hem along the base of the bandage.

Figure 7: Bandage to the shoulder

4. Cross the ends on the inside of the upper arm, then tie the ends on the outside of the arm.
5. Place the arm in a small arm sling.
6. Pass the point of the triangular bandage under the knot of the sling.
7. Carry the point over the dressing and pin it in position.
8. Recheck distal pulse, motor response and sensation.

Triangular bandage for the hip

Use this type of bandage to retain a dressing on the hip.

Figure 8: Bandage to the shoulder

This bandage is applied similarly to the shoulder bandage.

Applying a bandage to the hip

1. Tape any sterile dressing in position, if required.
2. Use an unfolded, fluffed-up triangular over the gauze to assist stabilizing it, once the bandage is applied.
3. Place an open triangular bandage over the dressing with the point to the waist.
4. Fold a hem at the base of the bandage.
5. Cross the ends on the inside of the thigh, then tie the ends on the outside of the thigh.
6. If the patient is not wearing a belt, form one around the waist with a cravat bandage.
7. Tie the knot on the injured side.
8. Tuck the point of the triangular bandage under this knot.
9. Fold the point of the open bandage over the knot of the "belt" and pin it in position.

Bandage for chest and back

Use this type of bandage to hold a dressing in place on the chest or back.

Figure 9: Chest and back bandage (front and back views)

Applying a bandage to the chest and back

1. Tape any sterile dressing in position, if required.
2. Use an unfolded, fluffed-up triangular over the gauze to assist stabilizing it, once the bandage is applied.
3. Place the point of the triangular bandage over one shoulder allowing the open bandage to hang over the chest or back.
4. Carry the ends around the trunk of the body, tying them so the knot is located below the shoulder on which the point is resting.
5. There will be one long end after the knot is tied.
6. Carry the long end up to the shoulder and tie it to the point of the bandage.
7. Make sure the bandage does not restrict breathing.

Triangular bandage for elbow and knee

Use this type of bandage to hold a dressing in place on the elbow or knee.

Applying a bandage to the elbow

1. Tape any sterile dressing in position, if required.
2. Use an unfolded, fluffed-up triangular over the gauze to assist stabilizing it, once the bandage is applied.
3. Fold the two ends of an open triangular bandage together, making a half-size triangular. A full-size bandage is usually not necessary to cover the elbow.
4. Bend the injured elbow slightly and, with the sterile dressing in position, place the point of the bandage to the back of the arm above the elbow.
5. Carry the ends around the forearm, cross in the fold of the elbow, and carry to the back of the arm above the elbow.
6. Tie the ends together.
7. Fold the point over the knot, and pin it in position.
8. Recheck distal pulse, motor response and sensation.

Figure 10: Bandage to the elbow sequence

Applying a bandage to the knee

1. Tape any sterile dressing in position, if required.
2. Use an unfolded, fluffed-up triangular over the gauze to assist stabilizing it, once the bandage is applied.
3. Place the open triangular bandage over the knee with the point toward the upper part of the thigh.
4. Fold a narrow hem along the base of the bandage.
5. Carry the ends around the leg, below the knee.
6. Cross the ends behind the knee and bring them up and around to tie on the lower part of the thigh.

Figure 11: Applying a bandage to the knee

7. Fold the point down over the knee and pin it in position.
8. Recheck distal pulse, motor response and sensation.

Triangular bandage for the open hand and foot

Use this type of bandage to hold a dressing in place on the hand or foot. This bandage is not suitable to control a severely bleeding wound.

Figure 12: Open hand bandage for the hand

Applying a bandage to the top or bottom of the hand

Do not use this bandage if you need to evaluate the distal pulse.

1. Tape any sterile dressing in position, if required.
2. Use an unfolded, fluffed-up triangular over the gauze to assist stabilizing it, once the bandage is applied.
3. Fold a narrow hem along the base of an open triangular bandage.
4. Place the hand in the middle of the bandage, palm side down so that the fingers are directed toward the point and the wrist is across the centre of the base.
5. Carry the point of the bandage over the hand and place it on the forearm.
6. Fold the sides in on either side of the hand.
7. Cross the ends over the hand, carrying them completely around the wrist and tie on top of the wrist.
8. Fold the point down over the knot and pin it in position.

Applying a bandage to the foot

1. Place the foot in the middle of an open triangular bandage with the toes directed toward the point and the heel about seven cm (three inches) from the base.
2. Carry the point over the foot to the front of the leg.
3. Fold the bandage in on either side of the foot.
4. Cross the ends over the foot, carrying them completely around the ankle
5. Tie the ends on the front of the leg, just above the ankle.
6. Fold the point over the knot and pin it in position.

Pressure bandage for the hand

Figure 13: Pressure bandage for the hand sequence

Use this type of bandage to control severe bleeding from the palm of the hand.

The purpose of this bandage is to apply pressure on the cut, as opposed to closing the wound.

Therefore this bandage should be used to control severe bleeding regardless of the direction of the wound.

Applying a pressure bandage to the hand

1. Place a sterile dressing over the wound and add a small pad on top of the sterile dressing about the size of a folded triangular bandage.
2. Have the patient grasp the pad firmly with the thumb exposed, if possible.
3. Hang a cravat over the wrist.
4. Take the thumb side end around and over the knuckles.

5. Carry the end back to its starting point at the wrist.
6. Take the other end around and over the knuckles, leaving the thumb exposed.
7. Cross ends under wrist.
8. Snug up both ends to apply pressure.
9. Tie a reef knot over the closed fingers spreading the bandage so that it pulls the fingers in towards the palm of the hand. **Do not cut off the circulation to the hand.**
10. Recheck distal pulse, motor response and sensation in the thumb.
11. Place the arm in a body sling for elevation. see "Body sling" on page 13-18.

Cravat bandage

Use this type of bandage:

- To secure splints and dressings in position.
- As a pressure bandage to control severe bleeding. When applying a pressure bandage to control severe bleeding, use one hand. Keep your other hand on the wound to apply direct pressure.

Applying a cravat bandage

When applying this bandage, do not move the injured limb needlessly until an examination of the injured area is completed.

If there are no other injuries to the area, elevate the limb and support it as much as possible.

Figure 14: Applying a cravat bandage

1. Open the folded triangular into a cravat and place a dry pad and a sterile dressing in the middle of it. The pad distributes the pressure increasing the effectiveness of the bandage.
2. Apply the cravat, pad and sterile dressing to the wound as a unit, as the other hand is removed.
3. Wrap both ends around the limb and tie them directly over the dressing.

Cravat bandage for the eye, back of the head or forehead

Use this type of bandage to secure a sterile dressing on a specific wound.

This method applies to injuries of the temple, back of the head or forehead. see "Special considerations for the eye" on page 13-13 below.

Figure 15: Cravat bandage to the head

Applying a bandage to the eye, back of the head or forehead

1. Place the centre of a cravat bandage over the dressing on the injury.
2. Wrap the ends around the head, crossing at the back.
3. Tie the ends lightly on the forehead without causing unnecessary pressure.

Special considerations for the eye

- If one eye is injured, cover it to prevent irritation.
- Leave the other eye uncovered so the patient can see.
- Do not tie the knot over the eye, tie the knot over the forehead.

Figure 16: Cravat bandage to the eye

Cravat for the ear and cheek

Use this type of bandage to secure a sterile dressing on a wound to the side of the face (e.g. ear or cheek).

Applying a bandage to the ear and cheek

1. Place the centre of a cravat bandage over the dressing.
2. Carry the ends around the head, crossing them on the opposite side of the head.
3. Tie the ends firmly over the dressing. Do not obstruct the airway.

Sometimes wounds to the cheek area are best treated by having the patient apply direct pressure themselves.

Covering bandage for open fractures and other uses

Use this type of bandage to cover an open fracture wound, or to cover burns and abrasions where you may need to avoid direct contact and pressure.

Figure 17: Covering bandage sequence

Applying a covering bandage

1. Apply sterile dressings, if required.
2. Hold the dressings in place with tape or padding. (The padding will be secured in place by the completed bandage.)
3. Place a pad above and below the injury site.
4. Prepare two triangular bandages by folding a hem as necessary.
5. Place the two prepared triangular hems on the pads.
6. Pass the ends of the triangular bandages under and cross in the back.
7. Tie the bandages on the top as firmly as necessary.
8. Tuck the ends in and fold the points back over the knots.

Stirrup bandage

Use this type of bandage together with the ski pole splint, backboard splinting and any other splint technique to apply traction at the feet (see "Splints" on page 15-1).

Applying the stirrup bandage

1. Tie two cravat bandages together.
2. Place the knot on the edge of the sole at one side of the boot.
3. Place the bandage under the sole and up the other side of the boot.
4. Have the patient hold the short end of the bandage.
5. Using the longer end, pass the bandage on top of the foot (in front of the ankle) and over the bandage held by the patient.
6. Pass the bandage behind the ankle (above the heel) and bringing it forward over the starting point in front of the ankle.

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Figure 18: Stirrup bandage sequence

7. Insert the end under the loop in a direction from the foot toward the knee.
8. Fold down both ends of the bandage, away from the patient.
9. Position the loops on each side of the ankle so they are exactly in line with the centre of the lower leg. That is, the loops are neither toward the front nor the back of the ankle.
10. Using this bandage, hold traction (as illustrated).

When this bandage is applied there may be a tendency to elevate the leg inadvertently. The pull must be in line with the tibia and fibula.

Modified stirrup bandage

This is a modification to the stirrup bandage, above.

Figure 19: Modified stirrup bandage sequence

Applying the modified stirrup bandage

1. Fold two cravats in half.
2. Pass the folded end of one cravat under the patient's ankle(s).
3. Lay the other cravat over the top of the instep with the folded end on the opposite side. The points of each should point toward the feet.

4. Thread the tails of each cravat through the folds of the other cravat in a direction away from the feet, toward the patient's knees.
5. Gently pull on the tails to snug the bandages to the ankle, in line with the centre line of the leg (This minimizes the chance of rotation during traction).

Slings

Use slings to support and help immobilize injured limbs.

Types of slings

Sling types include:

a. small arm sling (below),
b. large arm sling (page 13-17), and
c. body sling (page 13-18).

Small arm sling

Use the small arm sling for all upper arm injuries between the elbow and the shoulder in which the arm can be bent at the elbow. This sling permits gravity traction when required.

1. Place the injured arm across the body of the patient by holding onto their elbow and positioning the lower arm at 90 degrees to the patient's body.
2. Slide one end of a broad bandage up through the hollow that has been created at the patient's elbow.
3. Pass the top inside part of the bandage up and over the shoulder on the uninjured side around the neck and over the shoulder of the injured side.

Figure 20: Small arm sling

4. Place the bandage so that the front edge covers the base of the little finger. The broad bandage should support the arm from the base of the fingers to above the wrist, to prevent the wrist from flexing.
5. Tie the two ends together with the knot located in the hollow just above the collar bone on the injured side.
6. Tuck in the loose ends when the sling is completed.

Figure 21: Small arm sling

7. Pad under the knot for comfort.
8. Recheck distal pulse, motor response and sensation.

Large arm sling

Use the large arm sling for all lower arm injuries from the elbow to the fingertips except in cases of severe bleeding.
As above, this sling also is used for cases where the arm can be bent at the elbow.

1. Place the injured arm across the body of the patient by holding onto his elbow and positioning the lower arm at 90 degrees to the upper arm.
2. Open the bandage to a full triangle. Slide one end of the triangular up through the hollow that has been created at the patient's elbow. Make sure the point of the triangular bandage is directed toward the elbow.
3. Pass the top of the inside part of the bandage up and over the shoulder on the uninjured side around the neck and over the shoulder on the injured side.

Figure 22: Large arm sling

4. Fold a hem along the inside of the base to strengthen it and work it gently toward the hand so that the front edge covers the tip of the little finger.
5. Tie the two ends together with the knot located in the hollow just above the collar on the injured side.
6. Tuck in the loose ends.
7. Pull the point snug and pin or tie in front of the sling. Throughout the procedure the injured arm should be supported either by the patient or an assistant.

Figure 23: Large arm sling

8. Pad under the knots for comfort.
9. Recheck distal pulse, motor response and sensation.

Body sling

Use the body sling to elevate the wrist or hand, especially in the case of severe bleeding.

Applying the body sling

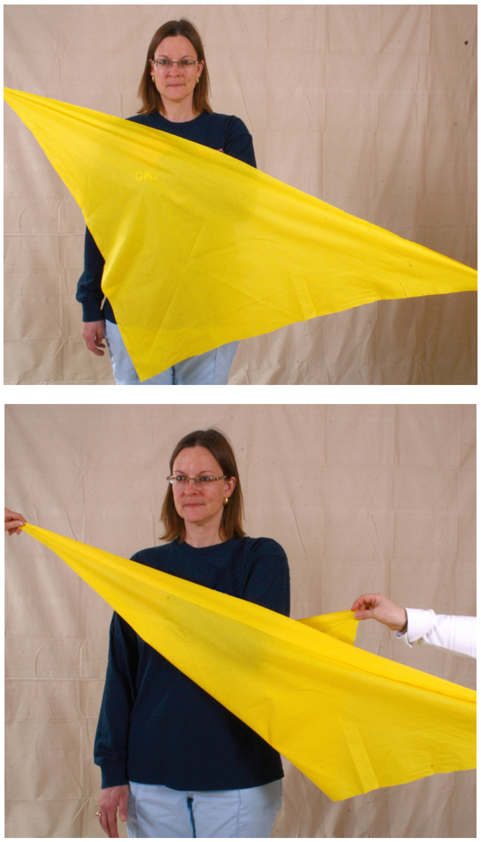

Figure 24: Applying the body sling

1. Holding onto the elbow and moving the hand, place the forearm diagonally across the chest with the fingers pointing toward the opposite shoulder, close to the collarbone.
2. Place a triangular bandage over the injured arm with the point of the triangular directed downward. The top side of the bandage should be parallel to, and even with, the top of the forearm.
3. Carefully pass the base of the bandage well up under the forearm. Do not disturb the elbow and injured arm.

Figure 25: Body sling sequence

4. Twist the lower end and point of the triangular together, then wrap toward the back.
5. Carry the lower end across the back and tie the two ends together in the hollow just above the collar bone on the uninjured side. The arm should be supported in a well formed pocket.
6. Pad under the knot for comfort.
7. Recheck distal pulse, motor response and sensation. Blood circulation may be impaired at the elbow or under the upper arm.

When using the body sling, keep the thumb exposed and frequently check the radial pulse and skin colour and warmth.

Tourniquet

A tourniquet is a band or belt around the limb used to constrict blood vessels to control the flow of blood from a severely bleeding wound. In the recent past, it was considered a last resort for controlling bleeding. Tourniquet use has increased in light of recent military actions and its effectiveness at preventing loss of life due to extremity blood loss is well proven.

Situations which may necessitate the use of a tourniquet:

- Multiple injury sites on the same limb.
- Penetrating trauma from firearms and stabbings.
- Multiple casualty incidents where resources are limited.
- Injuries in remote areas where resources are limited and transportation to definitive care may be delayed.
- Industrial or farm accidents.

There are several tourniquet devices in the commercial market. These devices may be used by CSP patrollers following the manufacturer's recommendations for application.

Although commercial products are available, an improvised tourniquet utilizing a broad bandage, a rigid rod such as a tree branch, scissors, etc. and a cravat bandage is quite effective. Continue to apply direct pressure to the wound while applying the tourniquet.

Applying a tourniquet

1. Apply the broad bandage around the limb, 10 cm (4 inches) above the wound if possible, and against the skin. Tie the bandage tightly using an overhand knot.
2. Tie in the rod over top of the first knot, using a reef knot.
3. Twist the rod to twist the bandage to constrict the tissues of the extremity until blood flow ceases. The application of a tourniquet is painful to the patient.
4. Secure the rod to prevent untwisting using the cravat bandage.
5. Note the time of tourniquet application. Write the time directly on the patient's skin, close to the tourniquet.

Note: The application of a tourniquet may be very painful for the patient.

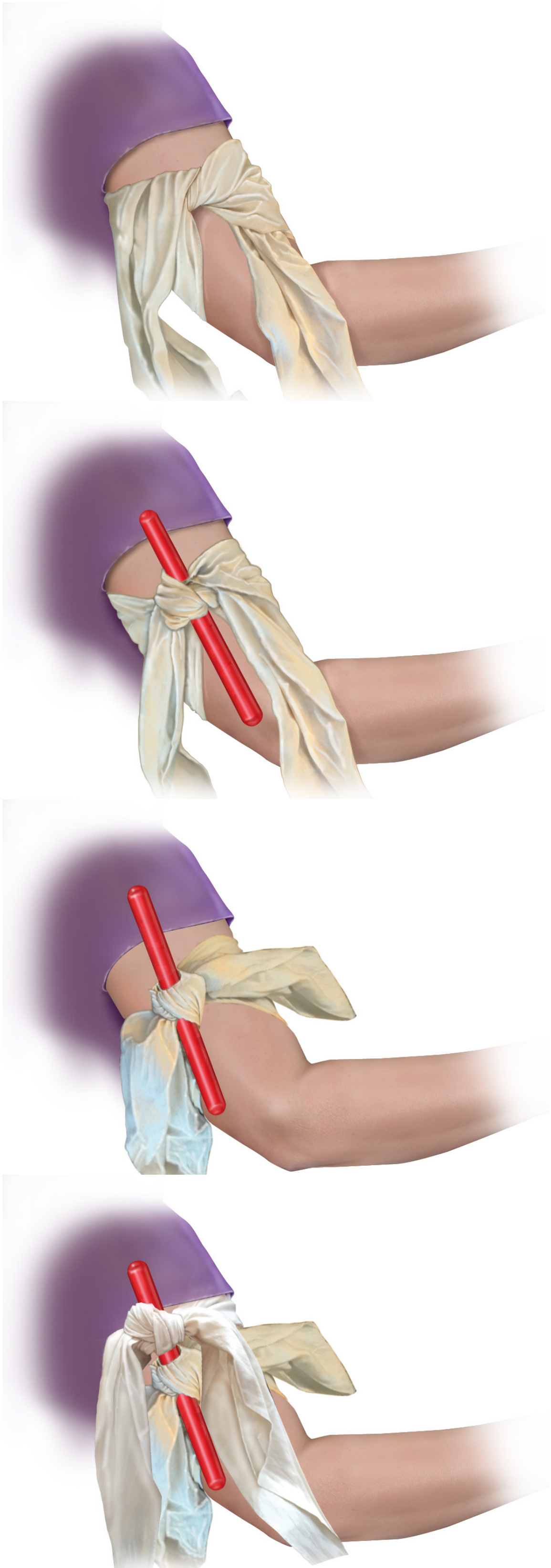

Figure 26: Tourniquet sequence.

Conclusion

Dressings are used for the initial covering of open wounds to prevent further contamination. Bandages are materials used to hold the dressings in place. All open wounds require dressing and bandaging to prevent contamination, to absorb blood and wound secretions, and to control bleeding. A combination of dressings and bandages is used to control bleeding through direct pressure; this is the first choice for controlling heavy bleeding.

Triangular bandages are used to cover dressings and to make slings. Slings can be used for immobilizing fractures and other injuries, usually of the upper limbs. This helps to prevent further damage to tissue.

Fractures, Dislocations and Soft Tissue Injuries

Upon completion of this chapter the student will be able to:

1. Explain the different types of fractures.
2. Describe the signs, symptoms and treatment of fractures.
3. Describe the purpose and appropriate use of traction.
4. Describe the signs, symptoms and treatment of dislocations.
5. Identify the differences between strains, sprains and tendon injuries.
6. Explain the basic treatment of strains, sprains and tendon injuries.

Learning outcome

Recognize, understand, and explain the treatment of fractures, dislocations and soft tissue injuries.

Fractures

A fracture is a traumatic disruption of the normal architecture of a skeletal bone. In other words, it is any break in a bone. It is usually caused by trauma and, less frequently, by muscle action. It can also result from a diseased condition within the bone.

Some fractures may simply be cracked bones with no evidence of deformity; other fractures may show evidence of considerable displacement or angulation.

A soft tissue envelope which consists of the muscles, tendons, neurovascular structures (nerves and blood vessels), fascia and subcutaneous fat and skin surrounds the bone. Aside from the surface of the skin, this is a sterile environment that protects, nourishes and functions in harmony with skeletal bone.

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Definitions of common terms used in fracture management and communication with health care providers

Diaphysis - The centre portion of a long bone made up of cortical bone and commonly called the shaft of the bone. This is comprised of a ring of very dense bone around a fatty intramedullary canal.

Metaphysis - The metaphysis is the wider portion of a long bone that contains the epiphyseal plate in growing children. It is comprised of cancellous bone with its characteristic honeycomb architecture.

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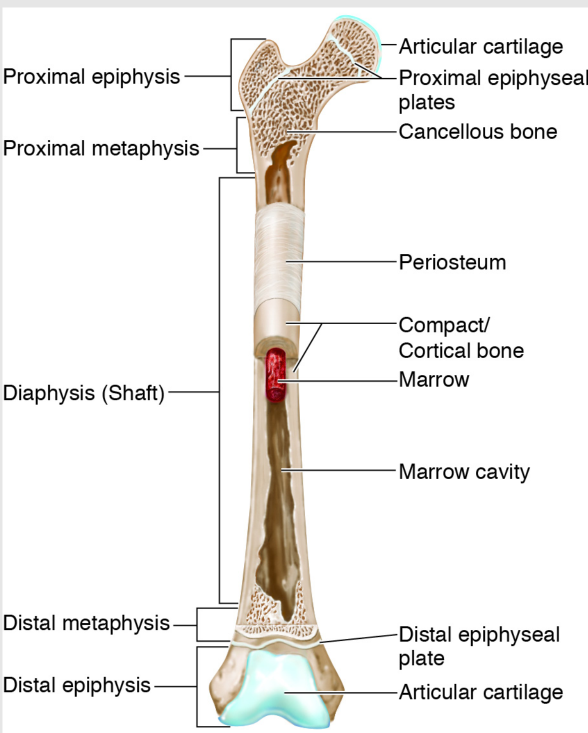
continued...

Epiphysis - The end of a long bone that connects with a joint. It is comprised of cancellous bone, subchondral bone and articular cartilage.

Epiphyseal plate - The cartilaginous layer found within the metaphysis of growing children from which bone growth occurs. Cartilage cells divide and ossify (harden into bone) in both the diaphysial and epiphyseal direction (length and thickness) giving bone further length and size. Knowledge of this layer is important as it is weaker than the surrounding bone and often a site of fractures in growing children. The epiphyseal plates ossify between 15 and 21 years of age which is characterized by the plate being no longer being present or visible on x-rays, and the cessation of growth.



Fracture types

Closed fractures

Closed fractures are those in which the soft tissue envelope remains intact. They do not result in an open wound, therefore they do not become exposed to the environment and hence represent little danger of infection.

Open fractures

Open fractures are those in which the soft tissue envelope and the skin are breached resulting in an open wound, for example, a puncture wound or a protruding bone. It may also be an abrasion resulting from the fracture.

It is possible that the wound was caused by interaction with the external environment. For example, a puncture from a tree limb or a laceration from a ski caused the fracture. A fractured bone may also have been driven through the soft tissue and skin, causing the wound. In any case, the bone does not need to protrude or have appeared outside the skin for the fracture to be classified as open.

Due to the open nature of the wound, the fracture is exposed to bacteria which could result in an infection. An infected fracture is a serious problem that is difficult to manage. This underlines the importance of initial management of open fractures by first responders.

Categories

Fractures may be further categorized as follows:

Figure 2: Fractures

Greenstick: This is a soft bone fracture where the bone cracks or bends through the shaft, rather than breaking completely through. This is most commonly found in children.

Transverse: This is a fracture that is perpendicular to the diaphysis (shaft) of the bone.

Oblique: This is a fracture occurring at an angle to the diaphysis (shaft) of the bone.

Spiral: This is a fracture in which the fracture lines spiral around the diaphysis (shaft) of the bone.

Comminuted: This is a fracture consisting of more than two pieces.

Impacted: This is a fracture where the broken ends have been driven into one another and usually occurs in metaphyseal cancellous bone (i.e. tibial plateau).

Extra-articular: This is a fracture that does not involve the joint surface.

Intra-articular: This is a fracture where the joint surface is affected, and can lead to long-term consequences of arthritis.

In describing fractures you can use a combination of all above terms (for example, an open, comminuted, impacted, intra- articular fracture.)

Fracture management

Definitions for fracture management

For the purpose of this chapter some definitions and principles of trauma will be made in the context of a non-hospital environment where x-rays and advanced diagnostics are not available.

Traction: the use of physical force (usually a pull) on a limb for the purpose of handling a limb from a deformed position to a realigned position in preparation for splinting or transport.

In-line traction: the principle of using a physical force on a limb initially in the direction of the deformity with a goal of decreasing the deformity to a near-normal position. This force is maintained while a splint is applied and may be continued in most lower extremity fractures. It maybe released for transport in most upper extremity fractures.

Counter-traction: the force used to stabilize the skeletal frame of the injured person while traction is being used to realign the limb involved.

Maintained in-line traction: for femur fractures and tibia fractures in-line traction may be maintained during transport and appropriate splints designed for this purpose should be used.

Force of traction: varies with the size of the patient, the limb involved, the amount of deformity, the ease or difficulty of realignment and the experience of the first aider.

Realign: the procedure of taking a deformed fracture to a near-anatomical position. This is not the definitive treatment of the fracture but optimizes the tissues' environment and improves the ease of splinting and transport.

Anatomical position: the natural or neutral position of uninjured bones and joints. This position is often depicted as a person in a supine position with arms at their side and legs straight and extended. This is a visual perception in the field and is not an exact position.

Further assessment, imaging and management, including definitive fracture reduction and possible fixation/ immobilization will often be necessary in a hospital environment.

Signs and symptoms

As the first aid provider, you should assess the situation and gather as much information as possible either by asking the patient directly or by asking bystanders.

Questions that you should ask include:

- Is or was the patient unconscious?
- Where does it hurt?
- Can the patient bear weight on the injury?
- Is the patient protecting any particular part of their body?
- Did the patient hear a noise such as a crunch or snap?

Assess if there is:

- Swelling at the injury site.
- Skin discoloration.
- Inability to move the injured limb.
- Deformity of the limb.
- A wound.
- Point tenderness at the injury site.
- Unwillingness to move the injured area (guarding).

Some serious fractures have been known to produce few signs or symptoms.

A fracture may give very little pain as long as the patient does not move.

Treatment overview

Because of the diversity of this type of injury, the treatment of fractures is more generalized than some of the other topics discussed in this manual.

General fracture treatment has the following characteristics:

- basic aims,
- general procedures for fractured limbs, and
- specific treatment steps.

Details of the application of splints for specific fractures or dislocations are shown starting on page 15-1.

Basic aims

The following are the goals for the treatment of fractures:

- Pain relief.
- Detecting and alleviating pressure on blood vessels and nerves by bone ends or joints.
- Preventing closed fractures from piercing the skin during handling or applying a splint incorrectly.
- Reducing the possibility of an open fracture becoming infected.
- Preventing internal injuries from fractured bones.
- Caring for associated conditions such as hemorrhage and shock.

Rationale for realignment of fractures

Pre-hospital care realignment of a deformed limb decreases the morbidity and improves the outcome of the injury at many levels.

- **Pain:** Realigned limbs have less pain. Pain scores pre- and post- realignment are encouraged and should be documented and tracked (e.g. verbal 1-10 pain score).
- **Hemorrhage:** A shortened and angulated long bone fracture has greater potential of blood loss (e.g. femur). Realignment and traction will decrease hemorrhage.
- **Skin:** Tenting of the skin over a deformity can cause local ischemia and mechanical damage that can cause local breakdown of the skin. This can have a significantly negative impact to the management and outcome of the limb in hospital care. This includes increasing the risk of infection, compromise of surgical incisions and causing wound healing problems.
- **Nerves:** Prolonged tenting of a nerve over a deformed fracture can cause local ischemia in the nerve and can also cause either bruised nerves (neuropraxia) or nerve death. Realignment can prevent temporary or permanent nerve damage.
- **Arteries and veins:** Tenting of arteries and veins over a deformity can cause loss of blood supply (ischemia) and venous pooling below the fracture. This can lead to muscle death, increase the risk of compartment syndrome and can have systemic effects from muscle death.
- **Soft tissue envelope:** Muscle, tendon and fascia can be permanently damaged by being tented over a deformed fracture, with possible long term repercussions. Realignment of the soft tissue envelope will decrease muscle death and decrease the chance of tendon rupture.
- **Bones and joints:** Maligned limbs can cause decreased blood supply to bones and joints. This can lead to tissue death (avascular necrosis) in some joints and increased risk of arthritis.

General procedure - limb fractures

When encountering a patient with a suspected fracture, a first aider needs an approach to managing the injured limb(s).

1. **Priority assessment:** The initial survey and life-saving measures take priority over fractures. Once an initial survey and life-threatening injuries are dealt with, the manage the fracture(s).

2. **Examine the limb:** Check for breaks in the skin, indicating an open fracture, and the presence of distal circulation and nerve function when and where appropriate. Do a distal pulse, motor and sensation (PMS) check.

3. **Handling the limb:** In-line traction is the best means of handling a limb (deformed or not) to enable proper wound management if an open fracture, and for the application of splints and packaging for transportation. Exercise gentle and slow movement at all times.

   If there is a significant deformity in the limb, the soft tissues and neurovascular structures may be compromised with the risk of long-term disability. Reducing the deformity of a fracture in the field can significantly reduce the possibility of further damage to the whole soft tissue envelope, including the neurovascular structures, muscles and tendons and the skin envelope itself. There is also a substantial reduction in pain.

4. **Realign the fracture:** For non-deformed fractures, use gentle in-line traction to stabilize the limb for wound management, splinting, and preparation for transport.

- **For a deformed fracture:** After an inspection of the skin and a neurovascular exam are complete, one first aider stabilizes the limb above the fracture site (counter-traction) while another one pulls the limb with appropriate and sufficient force of traction. Realigning the angulation involves two steps. First, one pulls in-line with the deformity. Secondly, the distal limb is then gradually and slowly moved back towards its normal anatomical shape. The amount of force applied depends on the size of the patient, the bone and site involved and the experience of the first aider.

- While maintaining traction, the wound can be managed and a splint can be applied to the limb.

- The goal of the realignment is to restore the shape of the limb which optimizes the environment of the bone and the soft tissue envelope, making it easier to manage the wound and splint the fracture resulting in increased patient comfort for transport.

- Traction may also be used with fractures that have occurred close to joints. In the field, it is impossible to know if a fracture is intra- or extra-articular. A joint fracture, such as a tibial plateau fracture at the top end of the tibia, is best managed by traction to realign the knee and then immobilize. An elbow fracture is the only joint that may be more comfortable to splint in a flexed position, but it is also acceptable to attempt to straighten it to immobilize.

- Sometimes it is not possible to move the limb to its normal anatomical position due to the pain this causes the patient or the inability to move the bones. In that case, splint in a position of comfort.

Figure 3: Traction

5. **Wound management**: If a wound is open in a winter environment, covering the wound with a sterile gauze dressing is often most practical. If bone ends are protruding from the skin it is best to deliver the bone end back inside the skin envelope. This often occurs during realignment of the fracture with traction but occasionally needs the help of a gloved finger to tuck it in. Despite being contaminated, this is the best environment for the bone and will help prevent infection and loss of blood supply to the bone ends.

   In a warmer first aid environment, especially if the wound is grossly contaminated, it is best to wash the wound with saline or water and apply a moist saline gauze dressing to help keep the soft tissues viable.

6. **Splinting the fracture**: With the splinting materials and devices available, the principle is to immobilize the fractured bone, including the joint above and below the deformity. Once secured in a splint the manually applied traction is most often gently released for transport.

7. **Maintained traction**: Traction also can be maintained to keep the alignment of the limb, most commonly seen with the femur and tibia. A Sager splint is an example of a splint used to maintain traction for a femur fracture and a Sun Valley splint is an example for a tibia fracture.

8. **Re-examine pulse, motor and sensation**: Once realigned and splinted, if possible, reassess the pulse, motor and sensation response of the limb. If there is a loss of pulse, motor or sensation either prior to or after splinting a limb the first aider should consider loosening restrictive splinting, but most importantly there is

an urgent need to get to advanced medical care, documenting and communicating any perceived loss.

9. **Package for transport**: Appropriately pad and secure the patient for transport.

Treatment for open fractures

The same principles of using traction to realign the fracture are used.

- Prior to splinting, the wound can be irrigated if saline is available and a moist saline dressing is applied.
- If a bone is penetrating the skin, it is best put back under the skin to a healthier environment for transport, preventing bone death.
- Rapid administration of antibiotics is important to prevent infection. Communication to the transport crew of an open fracture speeds up the preparation of an intravenous and antibiotics.
- Once the wound is dressed, apply a splint with the usual principles involved.

Dislocations

A dislocation is the displacement of a bone end out of its normal position in a joint. It may result in severe nerve and blood vessel damage and can be very painful.

Dislocations are usually caused by falls, impacts or muscular effort. The surrounding ligaments and other soft tissues always suffer some injury.

The joints most frequently dislocated are the shoulder, elbow, knee, ankle, wrist, thumb and fingers.

Reduction is the process of relocating the bone end in the joint.

Signs and symptoms

- Deformity around the joint.
- Swelling around the dislocated area.
- Severe pain.
- The inability to move or use the joint.

Treatment

The principles of the treatment of dislocations are the same as fractures. It is often not clear in the field if an injured extremity is dislocated, fractured or both. The principle of inline traction and realignment applies to all extremity injuries. It should be noted however that some dislocations are difficult to reduce in the field and may require analgesia, a more experienced practitioner or physician assistance. Many dislocations will not be reducible in the field, unlike the realignment of most fractures. The decision on whether to attempt an out-of-hospital reduction of a dislocation will depend on the experience of the first aid team, the cooperation and consent of the injured person and the logistics of the time and type of transport to hospital care. Examples of dislocations that often require an experienced team are dislocations of the elbow and hip. Both can be technically difficult to reduce, may require substantial force and often analgesia prior to the reduction attempt.

If a field reduction is not performed or is unsuccessful:

- Assist the patient in keeping the limb in the most comfortable position.

- Immobilize the limb in the position in which it is found or in the most comfortable position for the patient.
- Assess the neurovascular status by means of a distal pulse, motor and sensation (PMS) check, before and after any attempted reduction.

If distal circulation is absent or decreased, activate EMS and treat as a load and go.

- Recommend the patient seek further medical aid.

Dislocations often cause the limb to protrude in an awkward position. You may be forced to improvise in order to immobilize a dislocation effectively, such as using blankets to fill in the space between the limb and the body.

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[A CSP Regular Member (Advanced First Aid (AFA) certified) is not trained in these procedures]

Relocating joint dislocations is not part of the CSP scope of practice. However, patrollers may witness or be asked to assist with relocations (reductions). The basic process is extension of the joint by traction on the distal bone, followed by manipulation of that bone end back into its normal position within the joint. The sooner the reduction occurs post injury, the easier the reduction process generally is.

Strains, sprains and tendon injuries

The bone ends forming a joint are held in position by strong bands of tissue called ligaments. The joints are moved by muscles. The muscles are connected to the bone by tendons.

Differences between strains, sprains and tendon injuries

Many people often confuse strains, sprains and tendon injuries.

Strains: an over-stretching or over-exertion of muscles or tendons. Pain is usually the main symptom associated with this injury.

Sprains: the wrenching or twisting of a joint, with injury to or partial rupture of its ligaments. There may also be damage to the nearest blood vessels, muscles, tendons and nerves. Sprains commonly occur at the ankle, elbow, knee, wrist and thumb.

Signs and symptoms

- Pain (can be so extreme in some cases that the patient will refuse to move the joint),
- Swelling,
- Reddish or blue discoloration (bruising) due to hemorrhage from ruptured blood vessels.

Tendon injuries: Tendon injuries are caused by over-stretching a tendon beyond its limit of elasticity, or repetitive microtrauma. Common causes of tendon injuries are sudden muscular exertion, such as lifting or falling, which twists or wrenches the joint beyond its normal range of movement.

Signs and symptoms

- Swelling,
- Inability to move the limb,
- Deformity,
- Reddish or blue discoloration (bruising) in the area of injury due to hemorrhage from ruptured blood vessels.
- Severe pain at the site of the injury at the time of injury,
- Increased pain with attempted use of the limb, and
- Stiffness.

Treatment

Treat sprains, strains and tendon injuries as fractures. Support the limb but do not pull it. Recommend the patient seeks further medical aid.

They should be treated by remembering the acronym **RICE**:

- **R**est,
- **I**ce,
- **C**ompression, and
- **E**levation.

R	Rest	Rest is accomplished by restricting movement and splinting, as appropriate.
I	Ice	Ice is applied by means of a cold pack, or a plastic bag filled with snow, for no longer than ten to 15 minutes at a time. Do not apply the cold pack directly to the skin without an insulating layer such as clothing or a towel; however, it may be applied with compression (see below). Remove the cold pack if the patient complains of discomfort. Frequently examine for signs of cold injury. When used successfully, it can be applied indefinitely in a cycle of: • Ten to 15 minutes on, and • Ten to 15 minutes off. Cold has the advantage of reducing both pain and swelling. Contraindications to the application of cold include the lack of distal circulation, snake bites and cold injuries.
C	Compression	Compression is applied by elastic-type compression bandages. Take care to check distal circulation before and after applying compression. Compression also helps relieve pain and reduce swelling.
E	Elevation	Elevation also helps reduce swelling, particularly when the injured area can be elevated above the level of the heart.

Figure 4: RICE

Repetitive Strain Injuries (RSI)

Repetitive Strain injuries (RSIs) involving shoulders, arms, elbows, hands and wrists as well as knees, feet and legs, are a common sight at any sporting event.

Examples of repetitive strain injuries include:

Tennis elbow / Golfer's Elbow / Tendonitis: any repetitive activity that stretches the tendons in the elbow beyond capacity to the point where they become inflamed.

Iliotibial (I.T.) Band Pain: knee pain felt on the outside of the knee or full length of the thigh, generally due to overuse.

Patella Tendonitis (Jumper's Knee): the inflammation, degeneration or rupture of the patellar ligament and the tissues that surround it, leading to pain and discomfort in the area just below the knee cap.

Runner's Knee (Patellofemoral Pain): pain in the patellofemoral area caused by placing heavy stress on the knee.

Anterior Tibialis (Shin) Splints: pain localized around the front of the lower leg, along the tibia, caused by continuous stress or jarring of the bones, muscles, and joints without appropriate periods of rest.

Plantar Fasciitis: a painful condition caused by overuse of the plantar fascia (arch tendon) that connects your heel bone to the base of your toes. It can become chronic if not treated.

Heel Spurs: a heel spur is a growth of bone on the bottom of the heel.

Signs and symptoms

Symptoms tend to develop gradually and become more severe over time.

- Pain,
- Dull ache,
- Throbbing,
- Tingling,
- Numbness, and
- Tightness.

Treatment

1. Rest
2. Ice
3. Refer to a qualified injury specialist or seek medical aid

Conclusion

Unless a life-threatening condition exists, fractures, dislocations and soft tissue injuries are usually categorized as a stay and treat situation and should be treated only after the secondary assessment has been completed. Always consider that fractures to major bones or the spine are very serious but are not classified as a load and go unless other life threatening conditions are present such as major bleeding, respiratory distress, etc. If life threatening conditions exist, treat these first and declare a load and go.

Fractures of the femur(s) or the pelvis are load and go injuries due to their potential to put the patient into shock.

Notes...

Immobilizing Fractures, Dislocations and Soft Tissue Injuries

Upon completion of this chapter the student will be able to:

1. Define and characterize splints.
2. List commonly used splints
   - Demonstrate the treatment for the injuries found in this chapter.

Learning outcome

Recognize, understand, and demonstrate the treatment of fractures, dislocations and soft tissue injuries.

Splints

Immobilization means any method which holds part, or all, of the body still and prevents movement. This could include:

- fastening a person to a backboard,
- splinting to prevent fractured bone movement, and
- using a pressure bandage to keep injured soft tissue from moving, and so forth.

A splint is a material or a device used to immobilize a suspected fractured bone and the joints above and below the fracture.

Purpose of splints

The purpose of a splint is to:

- protect the injured area,
- give support and prevent further injury to the injured area, and
- where possible, immobilize the joint above and below the fracture.

Characteristics of splints

A splint must be:

- long enough to immobilize the joints above and below the injured area,
- wide enough to protect the injured area,
- strong enough to provide the required support, and
- well padded to immobilize the injury without causing further pain or pressure.

Commonly-used splints

The most common and suitable splints are:

- **Backboards:** Usually, these are used to immobilize the whole body and head. They are most useful for neck, upper body, pelvic, hip, femur, multiple fractures, multiple injuries and all load and go situations.
- **Prepared wooden splints:** Usually these are used for leg injuries.
- **Sun Valley splint:** This is a common leg splint that is typically covered with a soft foam that makes padding easier.
- **Metal splints:** These are usually used for upper limb injuries. A variety of metal splint is the SAM splint, which is covered with soft foam.
- **Improvised splints:** These are objects such as corrugated cardboard, blankets, pillows, skis, ski poles, rolled-up magazines used in lieu of commercially-available or specially-manufactured splints. see "Improvised splint" on page 15-21.

Other considerations

Splint material must be chosen according to the job it has to do.

This section describes alternative methods of splinting the same injury. Choose from among the methods shown, taking into account the specifics of the injury, the location of the suspected fracture, and the equipment at hand.

In some cases, the body of the patient can be used as a splint. For example, a fractured arm can be tied securely to the body. Another example is securing a fractured leg to the uninjured leg if no other materials are available.

Splinting techniques vary from sport to sport, as the patient's clothing and footwear is very different. Speed skates, soft shoes or bare feet require an alternate approach, specifically when considering a lower leg splint. Plastic corrugated, air or vacuum splints should be considered. These splints come with specific instructions. Reference these instructions prior to their use.

Always:

- Check the pulse and colour distal to the injury before and after applying a splint to ensure that it has not restricted circulation. If distal pulse is absent after splinting, loosen the splint but **do not** remove it. If distal pulse is still absent, do not attempt to restore circulation by repositioning the injured limb. This may cause further damage. Activate EMS and treat as a load and go.
- Check for motor response and sensation to ensure there is no interference of nerve function that has occurred during splinting.

Specific Treatments

This section discusses how to splint:

- Lower jaw (see "Lower jaw" on page 15-3),
- Clavicle (see "Clavicle (collar bone)" on page 15-3),
- Scapula (see "Scapula (shoulder blade)" on page 15-4),
- Shoulder dislocations (see "Shoulder dislocation" on page 15-4)
- Humerus (see "Humerus (upper arm)" on page 15-5,

- Lower arm
  (see "Lower arm (forearm, wrist, hand)" on page 15-6),
- Elbow
  (see "Dislocated or fractured elbow" on page 15-7),
- Finger
  (see "Fractured finger" on page 15-8),
- Ribs
  (see "Ribs" on page 15-8),
- Pelvic girdle
  (see "Pelvic girdle fractures" on page 15-8),
- Hip
  (see "Once the patient is placed on a backboard, follow the manufacturer's recommendations for splint application." on page 15-10),
- Femur
  (see "Femur fractures" on page 15-10),
- Patella
  (see "Patella (knee cap)" on page 15-13), and
- Lower leg
  (see "Lower leg" on page 15-14).

Lower jaw

Injuries to the lower jaw are generally the result of impact (trauma). (see "Jaw fractures" on page 10-2).

Clavicle (collar bone)

This common injury is produced by a fall on an outstretched hand or on the point of the shoulder.

The collar bone acts as a spreader to brace the shoulder back.

Signs and symptoms

- The point of the shoulder rolls forward, inward and down.
- Possible extreme pain.
- Deformity.
- Protruding bone.
- The patient will usually support their forearm, across the front of their body, with their other hand.

Treatment

The standard treatment is using a large arm sling and a transportation bandage.

Figure 1: Large arm sling with transportation bandage

The position of a clavicle fracture can be greatly improved by encouraging the patient to assume a position with shoulders back and chest out (not a slouched position). This optimizes the length of the clavicle and makes it less likely to tent the skin.

Do the following:

1. Apply a large arm sling.

2. Immobilize the injured arm to the patient's body - in the most comfortable position - with a transportation bandage over the elbow and hand.
3. Tie the transportation bandage on the side opposite the injury. Use padding if necessary.
4. Recheck the distal pulse and sensation.
5. Transport the patient in a position of comfort.

Scapula (shoulder blade)

Injuries to the shoulder blade are generally the result of impact (trauma).

Signs and Symptoms

- pain at the injury site, and
- the point of the shoulder will roll slightly back.

Treatment

Do the following:

1. Apply a large arm sling holding the patient's arm in the most comfortable position (See Figure 1).
2. Recheck the distal pulse and sensation.
3. Transport the patient in a position of comfort.

Shoulder dislocation

Shoulder dislocations are the result of the arm being wrenched from its socket. Generally, shoulder dislocations happen as a result of the patient's body tumbling.

Signs and symptoms

- localised pain at the injury site, and
- the inability to bring the arm down to the patient's side.
- deformity.

Treatment

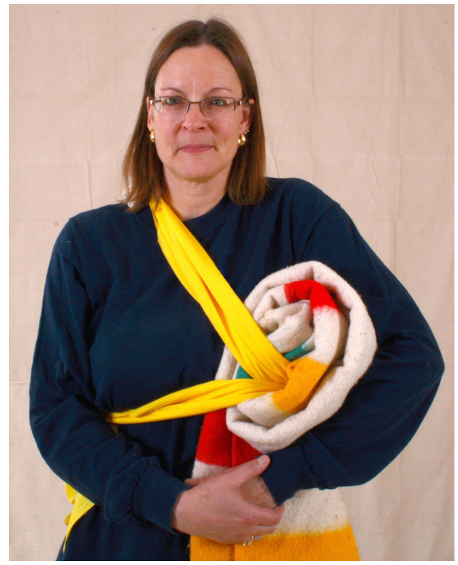

Figure 2: Padding for shoulder dislocation

Do the following:

1. Allow the patient to support their arm in the most comfortable position. If this is not possible, have a helper support the arm.
2. Secure a blanket, padding, pillow or clothing with a bandage to support the arm in a position of comfort.
3. Check the distal pulse after treatment is complete.
4. Allow the patient to continue holding his arm in the most comfortable position.

Humerus (upper arm)

Humerus refers to a fracture between the elbow and shoulder joint.

Signs and Symptoms

- deformity,
- swelling,
- severe pain, and
- the inability to move the arm.

Treatment

Figure 3: Small arm sling, fracture of the humerous

Immobilize the arm according to the following:

If the arm can be bent at the elbow:

1. Manual traction can be applied by gripping the elbow and pulling along the long axis of the humerus. Once the small arm sling and transportation bandage(s) are applied, manual traction can be released.
2. Place the arm in a small arm sling in a position of comfort. This allows the elbow to hang free, thus providing traction by gravity to the broken bone.
3. Pad between the elbow and the chest for comfort.
4. Further immobilize the arm with two transportation bandages. Place one over the elbow and hand, keeping the shoulder in line with the rest of the body. Place the other as high as possible on the arm.

Figure 4: Transportation bandage for the small arm sling

Remember to always check the distal pulse and sensation after treatment is completed.

Transportation

If there are no other injuries that dictate otherwise, to maintain traction by gravity, the patient should be transported sitting up.

If the elbow cannot be bent

Immobilize the arm straight alongside the body, tying it at the chest and hips, and check the distal pulse and sensation after completing the treatment.

The patient will have to be transported supine.

Lower arm (forearm, wrist, hand)

Any fracture of the arm below the elbow requires a lower arm splint. The method of stabilization, however, will vary according to size of limb and the injury.

Signs and Symptoms

- Swelling.
- Deformity.
- Pain.
- Discolouration at the injury site.
- Inability to use the limb.

Treatment

Figure 5: Lower arm splint

Do the following:

1. If the forearm, wrist or hand is in a deformed position with obvious angulation apply inline traction to realign the deformity towards an anatomical position. If the limb does not realign with attempted inline traction then splint in the deformed position.

Figure 6: Overhand, handshake and underhand grips to apply inline traction

2. Ensure the arm is stabilized by another first aid provider throughout the splinting process, whenever possible. Place the arm in a padded splint which covers both the anterior and posterior of the lower arm and hand. The splint should extend beyond the fingertips and elbow.

3. Apply the first bandage as close as possible to the elbow, ensuring that circulation is not impaired. Place the centre of the bandage on the outside of the splint. Pass the ends around and tie on the outside of the splint with a reef knot.
4. Tie a figure-of-eight bandage around the wrist and hand to stabilize the wrist.

   Start with the centre of the bandage at the bottom of the splint at the wrist and bring the ends around to the top of the splint still at the wrist. Cross the ends and bring them back down to the bottom. Cross again and bring back the bandage in front of the thumb and tie. Note that the fingers and thumb should be exposed to check for circulation.
5. Apply a large arm sling to support the splinted lower arm.

Figure 7: Transportation bandage for the lower arm splint

6. Apply a broad transportation bandage around the elbow and cross it above the splint and tie it on the uninjured side. Pad under the knot as necessary.
7. Recheck the distal pulse and sensation.

Dislocated or fractured elbow

Signs and symptoms

- Swelling.
- Deformity of the joint.
- Pain.
- Possible numbness in lower arm or wrist.
- Discoloration at injury site.
- Pain or inability to use the limb.

Treatment

Do the following:

1. Verify radial pulse before treatment. Distal pulse checks are especially important before and after treatment to ensure proper circulation is not lost during the process.
2. Maintain the arm in a position of comfort.
3. If possible, place the arm in a large arm sling.

   Fully support the arm during treatment and keep manipulation to a minimum.

   If it is not possible to use a large arm sling, immobilize the arm against the body in the position found, using transportation bandages. Pad all hollows.
4. Apply transportation bandages over the large arm sling and over both the upper and lower arms to prevent excess movement during transportation.

   Alternatively, a smaller version of the bent-knee splint may be used to immobilize a dislocated elbow.
5. Recheck distal pulse and sensation upon completion. If the pulse is absent

after treatment, reposition the arm and recheck.

6. Transport to medical aid.

Do not cause additional discomfort to the patient when tying the bandages. Treat the inability to restore the distal pulse as a Load and Go.

Fractured finger

Injuries to the wrists, hands and fingers are common even in minor mishaps, such as slow-speed falls.

Signs and symptoms

- Pain.
- Swelling.
- Deformity.
- Inability or unwillingness to move the injured part.

Treatment

Figure 8: Immobilizing a fractured finger

Do the following:

1. Realign any deformity with inline traction.
2. Either splint using a tongue depressor, or tape a good finger to the injured finger.
3. Apply a body sling to elevate the injury.

Ribs

One or more ribs may be broken by a blow, a fall, a crush, or even by a squeeze. (see "Rib fractures" on page 8-2)

Continuously monitor breathing. Be prepared to upgrade the situation to a load and go if breathing becomes increasingly difficult and ABCs are compromised.

Pelvic girdle fractures

The pelvis consists of six bones (three per side) all fused together. The three bones are the ilium, the ischium and the pubis. The suture line of the three bones runs through the acetabulum (the socket for the head of the femur). The right and left sides are joined together at the back with the sacrum of the spinal column and are bound against a cartilage pad in the front.

Fractures of the pelvis are usually the result of direct impacts at high speed against solid objects. Large blood vessels and nerves go through the pelvis. As a result fractures of the pelvic ring can bleed significantly. The other issue is that the pelvis is on the outside of the abdominal sac (peritoneum). Therefore pelvic bleeding travels on the outside of the abdominal contents, most often up the back and/or down the legs. The patient does not present with the same set of symptoms as an abdominal injury, only shock and instability on pelvic palpation.

If instability or crepitus is felt during palpation of the pelvis, **do not** attempt to test the pelvis further.

Signs and symptoms

- inability to stand or walk,

- deformity, crepitus or unnatural mobility of the pelvic structure on assessment,
- tender abdomen,
- severe pain,
- inability to void, or blood may be seen in the urine or feces.

Treatment

The patient must be handled with great care to prevent further injuries. Try to move the patient as little as possible during treatment.

Splinting the pelvis

Compressing the bones of the pelvis together is the method of treating this injury. Stabilizing the pelvis by compression will help to control potentially catastrophic bleeding. It will also help to minimize the chances of further bleeding from the uncontrolled movement of pelvic bones.

1. Pad between the legs for comfort. Secure the feet. Place a broad bandage over the knees.
2. Lay out two broad bandages on a backboard. Lift or roll the patient onto the board such that the bandages will sit one above the other with the topmost edge below the crests of the hips.(One broad bandage around the hips may be sufficient for children or very small adults.)
3. Apply sufficient tension on each bandage to elicit pain reduction and relative comfort for the patient.
4. Tie each bandage on the side opposite the injury.
5. Secure the patient to the board, avoiding pressure on the pelvic area. If necessary, use extra padding along the sides of the patient and place a blanket or small pillow under the knees to maintain flexion. Apply Canadian C-Spine rule and use spinal immobilization if a spinal injury cannot be ruled out (see "Tie down procedures using triangulars" on page 11-10).

Figure 9: Splinting the pelvis using triangular bandages

6. Monitor for progression of shock.
7. Activate EMS and transport to medical aid.
8. If blood is noticed in urine, report to the doctor in writing.

> **Note:** Pelvic injuries can cause major discomfort. Be aware that, dependent on the severity of the pelvic injury, the patient's condition may deteriorate rapidly. Carefully monitor the patient's condition and treat as a Load and Go.

Use of pelvic circumferential pressure devices

There are several devices in the commercial market that are designed to splint a fractured pelvis .They include the Traumatic Pelvic Orthotic Device (T-POD) and the SAM Sling. They consist of a wide non-elastic belt that goes around the pelvis and a tensioning device; a ratchet for the SAM Sling and a corset-like closure device for the T-POD. These devices may be used by CSP patrollers.

Figure 10: Pelvic circumferential pressure devices

Once the patient is placed on a backboard, follow the manufacturer's recommendations for splint application.

Hip injury

A fracture of the upper end of the femur is often called a broken hip. Hip injuries are common in older people whose bones have become fragile. They are usually caused by a fall.

It is often difficult to differentiate between an upper thigh fracture and a pelvic fracture.

Signs and symptoms

- tendency for the leg to roll outward so that the foot points laterally while the opposite foot points forward,
- loss of distal circulation,
- shortening of the injured limb,
- swollen thigh on injured limb,
- pain in the groin,
- inability to move the injured limb.

Treatment

Do the following:

1. Use inline traction to realign the extremity.
2. Splints or the other leg can be used to immobilize the limb.
3. Traction can be maintained with the appropriate splinting devices.
4. Transport to medical aid. see "Pelvic girdle fractures" on page 15-8.

Note: Hip injuries can cause major discomfort. Be aware that, dependent on the severity of the hip injury, the patient's condition may deteriorate rapidly. Carefully monitor the patient's condition and be prepared to treat as a Load and Go.

Femur fractures

Fractures of the femur are the result of high energy transfer. In some cases, the process of breaking the femurs absorbs energy, preventing damage to the core of the body. Femurs may also be at higher risk of breaking as a result of bone thinning due to calcium loss (osteoporosis). The combination of significant energy transfer and the bleeding potential into the thigh make femur fractures a life-threatening injury. Therefore patients with femur fractures are to be treated as load and go priority patients.

With an intact femur, the thigh is a cylinder. When the femur is fractured, muscular contraction converts the shape of the thigh from a cylinder to a sphere. A sphere has a much greater volume potential and the internal pressure is lower, increasing the likelihood and potential volume of bleeding into the space. Remember that the various muscle compartments of the thigh are surrounded by fascia. The fascia can hold blood in the compartment like a balloon.

Traction restores the cylindrical shape of the thigh. As a cylinder, the volume of the thigh is smaller. Bleeding increases the internal pressure of the thigh, which eventually stops the flow of blood into the injury site. Because this process occurs with a lower volume, the amount of blood loss is less and the likelihood of shock is further reduced than if the thigh is left in a spherical shape.

The patroller will likely feel crepitus as the traction is begun and a negative reaction initially from the patient. Perseverance is key, as is a steady pull.

If the knee and lower leg are intact and accessible, the patroller may grasp the ankle above the medial and lateral malleoli (ankle bones at the end of the tibia and fibula) and apply the pull through the lower leg. If for some reason this site is not accessible or usable, grasping just above the knee at the distal end of the femur is a good alternative. This is also the preferred site to use if there are multiple fractures of the femur.

The amount of pull is the amount required to realign the leg depends on the size of the patient and the experience of the patroller. If manual traction is going to be applied on a slope, ensure that both the tractioning patroller and the patient are in a stable position that can be maintained until the splint is secured. When to start applying traction is a judgment decision based on the response time of appropriate splinting equipment to the site, the degree of injury, the ability of the patroller to maintain traction once applied and the pain/physiological status of the patient.

If the fracture is displaced and the leg misaligned, re-alignment should be attempted prior to splinting. With both sides of the fracture site stabilized manually, apply a pull along the long axis of the bone (in its normal setting) first and then, move the distal end of the limb back into its normal position. If the leg has been rotated as part of the mechanism of injury, rotating the leg and foot back to its pre-injury position prior to splinting is appropriate.

If the leg cannot be re-aligned (pain tolerance, physical resistance to re-alignment despite the application of manual traction, etc) splinting the limb in the position as is will be required. Doing this successfully will require patroller ingenuity and the ability to improvise a workable solution.

Signs and symptoms

- swelling,
- instability of the leg, which may not be aligned properly, and
- severe pain.

Treatment

1. Place the patient onto a backboard.
2. Using two broad bandages passed between the legs at the groin, secure each to the side of the backboard at a handhold above the patient's hip. This forms a sit harness that prevents the patient from sliding along the board and provides an anchor point for the traction that is being applied.
3. Apply a stirrup bandage to the lower leg on the affected side. Ensure that the stirrup bandage pulls on the tibia/fibula, not across the bones of the foot.
4. Apply traction along the long axis of the leg and secure the stirrup bandage to the foot end of the backboard. Let

patient comfort guide the amount of traction that is needed.

5. Place a blanket between the legs for padding.
6. Secure the injured leg to the uninjured leg with cravat bandages.
7. Give oxygen, if available.
8. Transport to medical aid, head downhill.

The same technique can be used with bilateral (both) femur fractures. The goal is to restore the limb to a near-anatomical position. This will provide comfort and stability.

Monitor the patient constantly for signs and symptoms of shock as a result of internal bleeding into the thigh.

Note: Femur injuries can cause major discomfort. Be aware that, due to internal bleeding, the patient's condition may deteriorate rapidly. Carefully monitor the patient's condition and treat as a load and go.

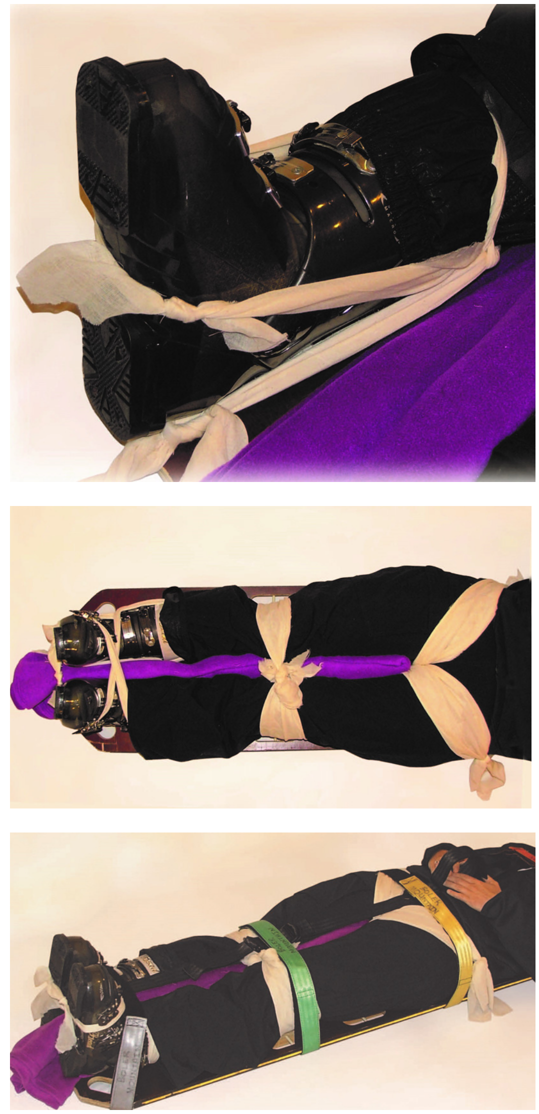

Figure 11: Femur fracture - traction

Alternative method (if a backboard is not available)

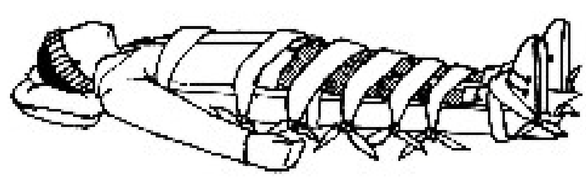

Figure 12: Alternate splinting method

Do the following:

1. Place the uninjured leg alongside the injured limb.
2. Place a well-padded splint between the legs which extends from the groin to beyond the feet.
3. Place a second well-padded splint on the injured side which extends from the armpit to beyond the feet. Secure this splint with bandages in the following order:
    a. a broad bandage around the chest, just below the armpits.
    b. a broad bandage around the pelvis in line with the hip joint; if the fracture is close to the head of the femur this bandage will have to be moved up.
    c. a cravat around the upper end of the short splint, the injured thigh, and the long splint.
    d. a figure-of-eight around both splints and the ankle on the injured leg.
    e. a cravat around both ankles and feet.
    f. a broad bandage around both thighs above the fracture or directly below the break if it is near the head of the Femur.
    g. a broad bandage around both thighs below the fracture and two cravats at the lower legs.

Patella (knee cap)

The patella may be broken or dislocated by a direct blow or a fall on the knee, or by a strong sudden pull of the powerful thigh muscles, as in an attempt to recover from a slip.

The bone usually breaks transversely with considerable tearing of the surrounding soft tissue.

In the case of a dislocation, the leg folds up like a jackknife.

Immobilize in a straight line if possible.

Commonly, due to swelling, the knee cannot be straightened and the leg must be splinted as found.

Signs and symptoms

- intense pain at the location of the injury,
- swelling,
- inability to straighten the leg or move the joint,
- inability for the leg to bear the patient's weight.

Treatment

Do the following:

1. Place the patient in the supine or sitting position, causing as little discomfort as possible.
2. Raise and support the injured leg in a comfortable position.
3. If possible, check the distal circulation by noting the following: pulse, skin colour, skin temperature, and sensation.
4. If the leg **can be straightened:**
    - apply a straight leg splint,
    - do not apply traction.

Figure 13: Bent knee splint sequence

If the leg cannot be straightened using gentle effort :

Apply the bent-knee splint:

a. Have an assistant stabilise the injured leg.
b. Prepare the first cardboard splint by folding it lengthways into an L shape.
c. Slide the folded cardboard into position, between the legs.
d. Pad at the groin area.
e. Roll a blanket or other material, ensuring that its width is the same width as the leg and the lower portion of the splint.
f. Pass a triangular bandage through the centre of the roll.
g. Place the roll alongside the knee and unroll it until it fits snugly under the knee.

5. Place the excess padding in the hollows and above the foot.
6. Slide the similarly folded second splint in position. This splint should extend up past the hip.
7. If necessary, place a third cardboard splint to extend the outside of the splint beyond both the hip and the foot.
8. Use the second splint to form the completed bent knee splint.
9. Slide bandages in from the end of the splint to minimise any movement.
10. Place bandages at the thigh, just below the knee, and the foot.
11. Tie the bandages on the outside of the splint in the following order:
    - at the thigh,
    - just below the knee,
    - figure-of-eight bandage at the foot, and,
    - a support bandage at the knee. The support bandage should not push up on the knee.
12. Check distal pulse and sensation.

Do not elevate the splint.

Lower leg

The tibia and fibula are side-by-side and extend from the knee to the ankle. Fractures of the upper end of the tibia may extend completely or partially across the bone or into the knee joint.

Spiral fractures of the lower one-third of the tibia are a common skiing injury. Sometimes the fibula is not broken and acts as a splint, reducing deformity and shortening. Frequently, both bones are broken.

In alpine skiing, a slow twisting force may cause a boot-top fracture if the bindings do not release.

Locating an injury

Locate the site of the fracture by running your hands gently along the front of the lower leg searching for the painful or deformed areas. The limb is often numb immediately after the accident. Fractures of the lower end of either or both bones are called fractures of the ankle.
This injury is frequently mistaken for a sprain until x-rayed: therefore, it should be splinted.

Signs and symptoms

- deformity,
- swelling,
- severe pain, and
- the inability to move the injured part.

Treatment

Figure 14: Lower leg splint sequence

Do the following, according to the nature and circumstances of the injury:

1. Have an assistant apply and maintain traction to gently align the leg to its anatomical position. Move the limb slowly. Tying a stirrup bandage around the ankle or lower leg will make applying and maintaining traction during splinting easier.
2. Support the foot of the injured leg in its anatomical position. Align the leg, not the boot.

   If the patient has forward-lean boots, do not try to place the sole of the boot at right angles to the splint.
3. Check distal circulation and sensation.
4. If another assistant is available, have them support the leg on either side of the fracture by grasping the patient's pant leg and lifting slightly while the splint is placed in position.
5. Place padding at the groin and under the knee, if there is a hollow between the knee and the knots on the outside of the splint.
6. Slide the bandages in from the end of the splint to minimize movement.
7. Place the bandages in the following positions:
   - a cravat bandage at the thigh, as close to the top of the splint as possible.
   - a cravat bandage on the lower thigh.
   - a cravat bandage above the fracture.
   - a cravat bandage below the fracture.
   - two cravat bandages tied together for a figure-of-eight at the ankle.
8. Tie all bandages from the thigh down with reef knots on the outside of the splint.

9. Tie the figure-of-eight bandage around the ankle:
   a. Pass the ends up and around, crossing on top of the ankle, being careful not to put any pressure on the toe of the boot
   b. Continue around the splint, crossing underneath the boot and back on top of the splint below the boot. Tie off below the boot.
10. Maintain or release traction slowly, depending on the splinting device used.
11. Recheck distal circulation and sensation.
12. Elevate the splint, if circulation and sensation are good.

Open fractures

A protruding bone or deformity at a fracture site may block or damage blood vessels, restricting the flow of blood to the extremity. All open fractures are contaminated with bacteria and are at risk of infection. After cleaning off gross contamination, realign the limb and attempt to deliver the bone ends under the skin and in the soft tissue envelope. This is the best environment for the bone in pre-hospital care.

If the bone was protruding, notify the doctor of that fact.

> In the case of an open fracture, the proper application of traction may return the bone to its normal position (within the wound). Apply a sterile dressing and bandage in the usual way. If the bone does not retract into the wound, apply a sterile dressing, then pad around the wound and secure with bandages.

Ski boots

While in place, the ski boot may be acting as a splint for an ankle or foot injury.

Removing the boot is only permitted in the patrol room. It is done only to assess the injury site.

Removing ski boots

The procedure for removing a ski boot requires two patrollers and is as follows:.

1. Patroller 1 stabilises the leg, as close to the boot as possible.
2. Patroller 2:
   a. releases the buckles on the boot, pries open the boot as much as possible, and
   b. removes the boot with a rotation towards the patient to reduce flexing of the ankle or foot of the injured leg.

Rental equipment policy

Check with the area where you are skiing to establish the procedure to be followed when the patient has to go to a hospital with rental equipment. One frequently used procedure is to remove the boot from the uninjured leg and leave it at the area.

Typical splints

Treating lower leg injuries may require improvising splints from commonly available ski-related gear.

Typically, these include:

- Sun Valley Splint (See below),
- Modified Sun Valley Splint (see "Modified Sun Valley splint" on page 15-17),

- Standard Ski Pole Splint (see "Standard ski pole splint" on page 15-18), and
- Alternative Ski Pole Splint (see "Alternative ski pole splint" on page 15-20).

Sun Valley splint

The Sun Valley splint is made of two boards connected along the bottom edge by canvas.

Foam rubber padding lines the inside of both boards. The top edge is either notched and has a cord attached for lacing the splint, or some splints have straps and quick fasten clips.

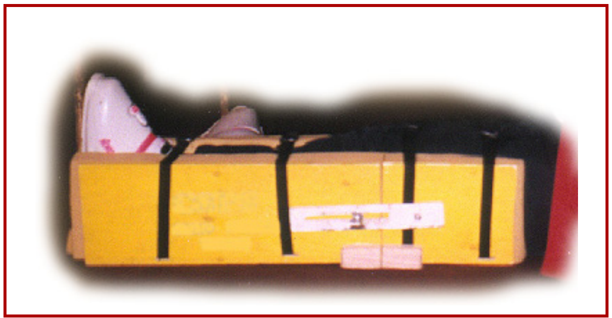

Figure 15: Completed Sun Valley splint

Using the Sun Valley splint

1. Examine the leg as usual.
2. Apply traction, if required.
3. Open the splint so the splint lies flat.
4. Size the splint on the uninjured leg.
5. Slide the splint under the leg. The splint should extend beyond the sole of the boot.
6. Close the splint around the leg and fasten.
7. Ensure the closure system does not loosen during transport.
8. Elevate the splint.

Modified Sun Valley splint

The Modified Sun Valley splint is similar to its predecessor. It has been modified to include a metal hinge. The splint can be used for lower leg fractures and for knee injuries where the knee cannot be straightened.

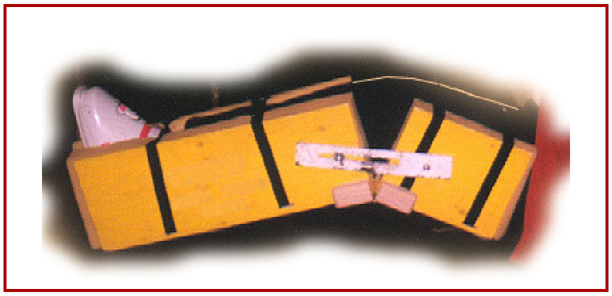

Figure 16: Completed Modified Sun Valley splint

Using the Modified Sun Valley splint

Do the following:

1. Examine the leg as usual. Apply traction, if required.
2. Open the splint and loosen the wing nuts so the splint lies flat.
3. Slide the splint under the leg, using the same technique as for the cardboard splint, with the cord toward the upper body. The splint should extend past the sole of the boot.
4. If the knee is bent, shape the splint to conform to the leg.
5. Tighten the wing nuts securely to hold the splint in this shape.
6. Close the splint around the leg and hold firmly together. Lash the splint together with the cord or fasten the straps, depending on the type of splint being used.
7. Check the distal circulation and sensation.
8. Do not elevate the splint.

Standard ski pole splint

The standard ski pole splint is most often used when no other splinting material is available or when the maintenance of traction is necessary throughout transportation to medical aid.

The finished length of the splint makes transportation more difficult. If two people are available, you should apply traction as soon as possible and maintain it until taken by the tightening of the windlass. Apply the stirrup and tighten the windlass as soon as possible to stabilize the leg as much as possible.

The standard ski pole splint can be used for a femur injury in the absence of a backboard or long splint.

Using the standard ski pole splint

Do the following:

1. Do not remove the patient's boot.
   If the boot has been removed, or the patient is wearing street shoes or cross-country boots, apply additional padding over the instep so that circulation will not be impaired.
2. Apply a stirrup bandage for traction.
3. Apply the thigh bandage as follows:

If the poles have straps

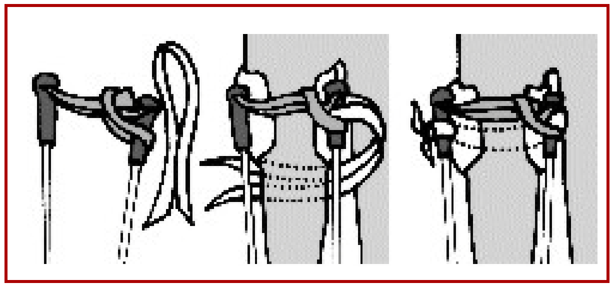

Figure 17: Tying the poles together

a. Pass the strap of one pole through the strap of the other pole and fold it back over its own hand grip.
b. The pole with the folded strap goes on the inside of the injured leg; the other pole goes on the outside of the injured leg with the tied-together straps passing under or over the thigh.
c. Loop a cravat bandage around the hand grip of the inside pole in such a way as to lock the pole strap in place.
d. Pad the hand grips as necessary.
e. Slide both ends of the bandage over or under the thigh and tie to the outside pole hand grip.

If the poles are strapless

a. Tie a cravat bandage around the hand grip of one pole in such a way that the bandage won't slide off the end of the pole.
b. Place this pole on the inside of the injured leg in such a way that the knot of the bandage is away from the leg.
c. Pass one end of the bandage over the leg and the other end under the leg.
d. Place the other pole on the outside of the injured leg and tie the bandage to its hand grip.

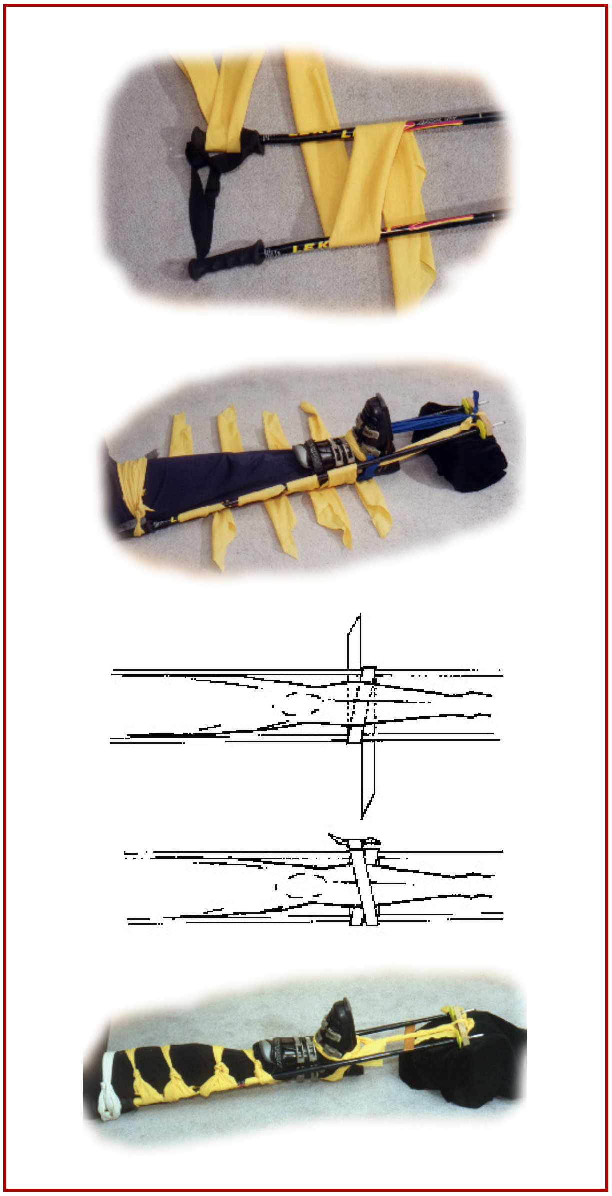

Figure 18: Standard ski pole splint sequence

4. Place five cravat bandages at the same angle under the leg and over the poles (using hollows and sliding into position) with the short end on the inside in the following locations:
   - at the thigh,
   - just above the knee,
   - above the fracture site,
   - below the fracture site, and
   - at the ankle.
5. Tie the ends of the stirrup bandage to the end of the ski poles beyond the baskets or to a pole spreader if available. Tie these ends as tightly as possible.
6. Elevate the ski poles (basket ends) to above the centre line of the leg. Maintain the ends in this position by packing under the poles.
7. Using a lever for a windlass, apply traction by winding the stirrup bandage. Watch the patient's face for any signs of additional pain or relief of pain. Fasten the windlass in place to prevent slipping or unwinding.
8. Tie each bandage as follows:

   Bring the short end from the inside of the leg under both poles to the outside of the leg.

   Bring the long end from the outside of the leg under both poles to the inside of the leg and then over the leg and both poles back to the outside of the leg. Tie the two ends together at the outside pole.
9. Tie the five bandages in the following order:
   a. above the fracture area,
   b. below the fracture area,
   c. at the thigh,
   d. at the ankle, and
   e. at the knee.

   This sequence insures stabilization around the fracture point and knee joint.
10. Check all bandages for tightness and even tension and continuous support.
11. Ensure you keep the pole tips elevated to prevent the leg from resting on the ground. This would nullify the cradle effect of this splint.

Alternative ski pole splint

This splint is a modification to the standard ski pole splint. The alternative ski pole splint uses a pre-built bandage as the supporting mechanism.

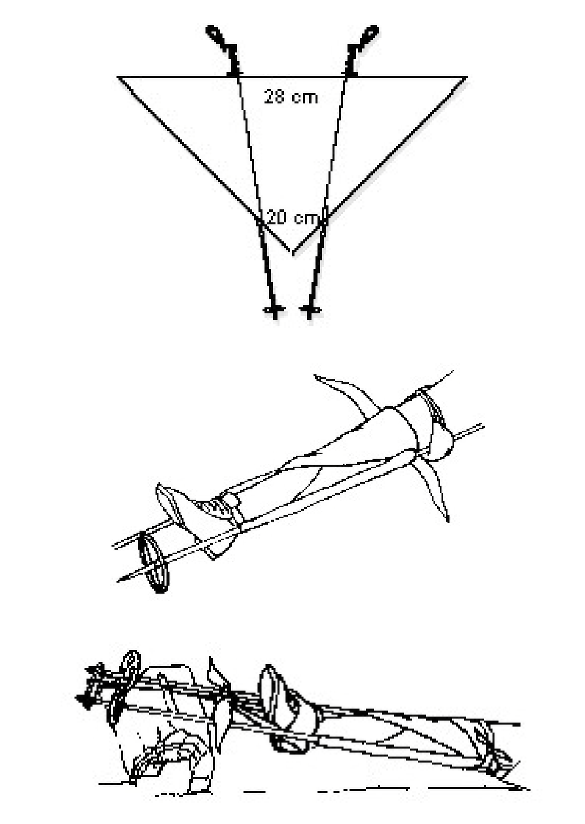

Figure 19: Alternative ski pole splint sequence

Do the following:

1. Do not remove the patient's boot. If the boot has been removed, or the patient is wearing street shoes or cross-country boots, apply additional padding over the instep so that circulation will not be impaired.
2. Insert the ski pole grip-end first through the pouches from the point of the triangular bandage toward the base of the bandage.
3. Apply a stirrup bandage for traction.
4. Tie the thigh bandage as previously seen above.
5. Tie the ends of the stirrup bandage to the end of the ski poles, beyond the baskets or to a pole-spreader if available. Tie these ends as tightly as possible.
6. Elevate the ski poles (basket ends) to above the centre line of the leg.

   Do not raise the foot or leg off the ground until the splint is completed.
7. Bring one end of the bandage across the leg and under the pole.
8. Bring the other end across the leg and under the pole.
9. Bring the ends of the bandage up on the outside of the poles, across the leg and tie on top of the thigh. Use padding under the knot.
10. Using a strong piece of material for a windlass apply traction by winding the stirrup bandage.

    Watch the patient's face for any signs of additional pain or relief of pain.
11. Fasten the windlass in place to prevent slipping or unwinding.
12. Ensure you keep the pole tips elevated to prevent the leg from resting on the ground. This would nullify the cradle effect of this splint.

Foot and ankle

Figure 20: Foot and ankle immobilization

Fractures of these bones may be caused by crushing or rotating forces. Immobilize foot and ankle fractures in the position of comfort.

A pillow, blanket or a cardboard splint will provide adequate immobilization.

Wire mesh splints

Fold and shape to conform to the injury. Pad ends so as to not cause further injury. Tie off in accordance with usual splinting procedures.

Improvised splint

Circumstances and necessity often dictate what is available for splinting. The following are some suggestions for splints and padding using commonly-available items that may be found at the scene of the incident:

- corrugated cardboard,
- speed splints,
- vacuum splints,
- skis,
- boards.
- pillows,
- blankets,
- magazines,
- sweaters,
- coats,
- jackets, and
- shirts.

Note that some of these splints only immobilize and cannot maintain traction.

Notes...

Medical Conditions

Upon completion of this chapter the student will be able to:

1. Recognize the signs, symptoms and explain the treatment for the medical conditions found in this chapter:
   - Demonstrate the treatment for the conditions found in this chapter.

Learning outcome

Recognize, understand, and explain the treatment of common medical conditions.

The patroller is likely to be exposed to a variety of medical conditions, both on and off the ski hill. Many are serious or life-threatening, and the patroller should be ready to intervene and transport rapidly. The most common conditions are discussed in this chapter:

- Angina (see "Angina (angina pectoris)" on page 16-2)
- Anaphylaxis (see "Anaphylaxis" on page 16-3)
- Asphyxia (see "Asphyxia" on page 16-6)
- Asthma (see "Asthma" on page 16-6)
- Diabetes (see "Diabetes" on page 16-7)
- Epilepsy
- (see "Epilepsy" on page 16-10)
- Heart Attack (see "Heart attack" on page 16-12)
- Aspirin Administration (see "Aspirin administration" on page 16-13)
- Hyperventilation (see "Hyperventilation" on page 16-14)
- Stroke (see "Stroke" on page 16-15)
- Syncope (see "Syncope" on page 16-16)
- Unresponsiveness (see "General treatment for the unresponsive patient" on page 16-17)

Angina (angina pectoris)

Angina is pain resulting from a deficiency of blood supply - and therefore oxygen - to the heart muscle. If coronary artery disease is present, the narrowed arteries cannot provide the increased requirement for blood during strenuous physical activity or emotional distress. The heart muscle then becomes starved for oxygen, which may cause chest pain. This pain may vary from just a discomfort or tightness to very severe.

The notable thing about angina is that the pain will usually ease or disappear if the patient rests. Generally, angina attacks will not last for more than 15 minutes after the stress stops. It is that fact which distinguishes an angina attack from a heart attack. Also, frequently the patient will have had previous episodes, and may be on medication.

Signs and symptoms

The signs and symptoms of an angina attack may vary from one person to another, but will normally be the same for any one person. If there is a change in this person's signs and symptoms, a heart attack should be suspected.

- Sub-sternal pain, which may start suddenly or build up gradually.
- Pain is usually described as moderate to heavy pressure or squeezing.
- Pain may radiate across the chest, into the left or right arm, up into the neck or jaw, or into the back.
- The attack may show up as a feeling of indigestion.
- Pain usually lasts less than 15 minutes.
- Pain is relieved almost immediately by medication.
- Pain will **not** be influenced by changing the rate of respirations, coughing, or movement.

Treatment

1. If the patient has medication, assist the patient in taking it. (See instructions below)
2. Keep the patient at rest.
3. Give oxygen, if available.
4. Take a medical history.
5. Check for MedicAlert identification.
6. Evaluate vital signs.
7. Monitor vital signs during transportation.
8. If the patient does not improve with medication, or shows signs of getting worse, activate EMS and treat as a load and go.
9. Be prepared to treat the patient if they lose consciousness.

Angina medication instructions

Angina patients use nitroglycerin. It comes in three different delivery options, patches, pills and a spray, although the use of pills is now relatively rare.

Care must be taken when examining any patient having a suspected angina attack that you do not accidentally roll their patch and come in direct contact with the nitroglycerin. More likely the patch is already attached to the patient's skin near the shoulder on either the chest or back.

Along the same vein, when assisting with the delivery of a spray type of medication, the nozzle needs to be pointed at the patient. The patient does not inhale the spray, but rather spurts it onto the underside of the tongue. Our standard practice of using gloves will ensure that you do not come into contact with the patients' medications.

It is important to note that the patient should not administer more than three doses of either pills (placed directly under the tongue) or sprays (as directed) over a ten minute period. Sprays are not to be administered if the patient has used erectile dysfunction pills such as Viagra, Levitra or Cialis within the last 24 hours.

Anaphylaxis

Anaphylaxis is caused by a serious and rapid allergic reaction that usually involves more than one part of the body. The reaction can be severe enough to kill. It can be triggered by various things such as asthma or allergies to latex, bee stings,or to certain foods such as nuts, some types of fruit, fish and sometimes spices. Anaphylaxis usually happens quickly.

Signs and symptoms

- Respiratory distress (wheezing).
- Rapid breathing and pulse.
- Throat tightness and closing.
- Difficulty swallowing.
- Dizziness.
- Faintness and unresponsiveness.
- Cool and clammy skin.
- Swelling.
- Vomiting.
- Red watery eyes.
- Abdominal cramps.
- Diarrhea.
- Tingling feeling in the lips or mouth.
- Itchy rash.
- Sense of doom.
- May be wearing MedicAlert identification.

Treatment

Epinephrine (adrenaline) is one of the drugs that will work against all the effects of dangerous substances released in anaphylaxis. For serious attacks, it's a vital treatment. During a potentially life-threatening allergic reaction, there is no reason epinephrine should not be used. Special injector (syringe) kits such as the EpiPen, Allerject or Twinject are available and carried in a robust and clearly marked container by most patients who have a history of anaphylaxis.

The dosage required varies according to the age and size of the patient. Injection kits are dispensed in the following pre-loaded dosage:

• Adult dosage for persons weighing more than 30 kg, delivers 0.3 mg of epinephrine.

• Child dosage for persons weighing between 15 kg and 30 kg, delivers 0.15 mg of epinephrine.

An injection should be given when:

• There is obvious evidence of a general reaction.

• There is evidence of deterioration.

• Death seems imminent.

In some cases, a second dosage of epinephrine may need to be administered. Many patients will carry a second dose that the patroller can assist with administering. In some cases these may be a separately packaged self-administration needle, and in other cases it may be a second needle, syringe and vial package attached to the original self-administration needle (such as Twinject). After assisting with the administration of the first dose, the patroller should remain available to reassess and assist the patient as needed with the administration of their medications.

> **CAUTION:** Epinephrine is a vasoconstrictor and a bronchodilator, in certain cases it can be extremely dangerous. The first vasoconstriction effect is required to control the rapid onset of shock (without the presence of bronchospasms) caused in certain individuals by a severe allergic reaction. The severity of the shock varies according to the type of allergen and the person. If you accidentally inject yourself with a dose, you have now become a load and go patient. Consult the emergency services immediately. It is impossible to know how you will react to the injection. You may experience a vasoconstriction causing necrosis. If you injected yourself in a finger, toe, penis or nose you could potentially lose it. Even worse, you may have infected yourself with a tainted needle. (see "Infectious diseases" on page 3-1)

General treatment

1. Activate EMS.
2. Assist the patient to administer the injection in the thigh muscle (no other area).
3. Hold the injector at a 90-degree angle to the skin and press against the thigh muscle.
4. Monitor vital signs closely.
5. Administer oxygen if available.
6. Be prepared to assist ventilations or perform AR.
7. Treat for shock.
8. Transport to medical aid. The used injector(s) should be sent with the patient for proper disposal at a medical facility. This will also show the medical personnel what medication has already been administered.

The second dose can be given as early as five minutes after the first dose if there is no improvement in symptoms. Do not administer an additional dosage if signs of improvement are present. If ABCs are compromised, treat and transport as a load and go.

EpiPen administration

EpiPen is a disposable, pre-filled automatic injection device that can be used to administer epinephrine in the event of a severe allergic emergency.

There are two dosage strengths:

• EpiPen (0.3 mg) for adults and children weighing 30 kg or more.

• EpiPen Jr. (0.15 mg) for children weighing 15 kg to 30 kg.

Figure 1: EpiPen and EpiPen Jr.

Assist the patient with the administration of EpiPen as follows:

1. Remove the EpiPen auto-injector from carrier tube.
2. Hold firmly with orange tip pointing downward.
3. Remove blue safety release.

Figure 2: Removal of blue safety release

4. Help the patient swing and push the orange tip firmly into their mid-outer thigh until you hear a click.

Figure 3: EpiPen pushed firmly into mid-outer thigh

5. Hold on thigh for several seconds.
6. When the EpiPen auto-injector is removed, the orange needle cover automatically extends to cover the injection needle.

Figure 4: Orange cover extends to protect from needle

For more information go to:

www.epipen.ca

FOR INFORMATION ONLY

[A CSP Regular Member (Advanced First Aid (AFA) certified) is not trained in these procedures]

While the most important medication to use in an emergency, epinephrine (adrenaline) may be rapidly metabolized in the body and lose its effectiveness. A repeated dose may be needed and some self-administration kits now include a second dosage as a part of the standard set. Many patients will also carry a second separate dosage. Another option for longer-term stabilization to be considered by a person properly trained and certified in this area (not a CSP AFA-certified member), particularly when access to advanced care is likely to be delayed more than two hours or in remote areas, is the co-administration of an antihistamine. These are far less effective than epinephrine in the emergent case, but longer lasting. An example of a fast-acting and long-lasting antihistamine is cetirizine (brand name Reactine and others), and it has the additional advantage of being non-sedating. An older and well-known option is diphenhydramine (Benadryl), but it is slower acting and sedating.

Asphyxia

Asphyxia is suffocation due to decreased oxygen and increased carbon dioxide in the blood. This causes respiratory arrest. Asphyxia can be due to trauma such as airway problems or blunt trauma to the chest. Non-trauma causes can be drowning, suffocation due to lack of air, or lack of oxygen in the air.

Signs and symptoms

- a bluish tint (cyanosis) or a very pale appearance to the skin and lips,
- a deteriorating level of consciousness.

Treatment

Do the following:

1. Remove the patient to an area of clean air immediately.
2. Establish an airway and administer oxygen, if available.
3. Begin assisted ventilations or artificial respiration if required.
4. Monitor the patient.
5. Activate EMS and treat as a load and go.

Asthma

Asthma is caused by an acute reactive constriction of the bronchi, and, in the late stages, is caused by the swelling of mucous membranes in the bronchial walls and the plugging of the bronchi by thick mucous secretions. An asthma attack may be brought on by allergic reactions, respiratory infections, emotional stress, cold weather or exercise.

Signs and symptoms

Suspect an asthma attack if you observe the following:

- whistling or high pitched wheezing during respiration,
- anxiety,
- over-inflated chest,
- shallow, rapid respiration,
- increased pulse.

The patient may also:

- breathe through pursed lips, as if sucking in air through a straw,
- appear to be air hungry,
- use accessory neck muscles to assist breathing, and/or
- prefer sitting forward.

Treatment

If you suspect an asthma attack, immediately do the following:

- reassure the patient,
- maintain an open airway,
- be prepared to assist breathing,
- administer high-flow oxygen,
- put the patient in the most comfortable position,
- assist the patient to take medication if they have any,
- if the patient is markedly recovered with the use of medication, recommend the patient seek further medical aid, if not, transport to a medical aid.

Asthmatics may use a variety of inhalers to deal with the onset of an asthma attack. The most common examples of the puffer type are Ventolin, and Atrovent. They look basically the same in shape and size therefore the way to tell them apart is they are colour coded: Ventolin is blue, Atrovent is green. They operate in the same manner mechanically. The asthmatic will remove the cover, place the opening in their mouth, start inhaling and then press down on the inhaler to administer a metered dosage of the drug. They will continue to inhale to ensure that the medication gets down into their lungs where it is designed to work.

Two other types of inhaler, the Rotohaler and the Turbohaler, will seldom be seen in an emergency first aid situation. They are primarily used for control of respiratory conditions rather than sudden attacks. These systems crush a small tablet when activated by turning a dial on the delivery device and are then inhaled in the same manner as the puffer.

Diabetes

Diabetes is a disorder which affects the body's ability to regulate the level of blood sugar (glucose). Diabetics have an increased risk of heart disease, atherosclerosis of the blood vessels (a buildup of plaque in the inner lining), high blood pressure, stroke, kidney damage, impaired vision, and infections. The complications of diabetes are usually related to the patient's inability to control the blood sugar level by diet, medication, or insulin injections.

Approximately one in 20 Canadians have diabetes.

All body cells require glucose for their functioning. The use of glucose by the cells is controlled by insulin, which is a hormone produced by the pancreas. Insulin allows glucose to move from the blood stream into the cells where it is then used to produce energy.

When the body cannot produce enough insulin, cells are unable to take up and utilise the glucose. On the other hand, if there is too much insulin in the blood stream or not enough glucose, the energy within the cells become depleted, and they begin to malfunction.

Excess amounts of insulin or lack of sugar intake (low blood sugar), leads to rapid onset of hypoglycemia - also called insulin shock. Hypoglycemia results from lack of glucose in the brain. With too much insulin in the blood stream, glucose will move so rapidly out of the blood and into the body cells that there will be insufficient glucose left to maintain normal brain function. The brain is highly dependent on glucose, and permanent brain damage or death can result if immediate emergency care is not provided.

Lack of insulin can cause the blood sugar level to become high, but the cells will not be able to utilise the glucose. This forces the body to use fat as the main energy source, and causes an accumulation of waste product in the blood stream. This condition is called hyperglycemia or diabetic coma.

Hyperglycemia over time can damage many of the organs of the body. To function normally, a diabetic patient should regulate their sugar intake and/or supplement the lack of insulin by the use of a stimulant to increase insulin production (medication), or by the use of external insulin, i.e insulin injection.

The treatment of diabetes consists of appropriate diet, exercise and medication. An imbalance of these factors may lead to either of the two diabetic emergencies described above.

Hypoglycemia (insulin shock) - severe low blood sugar

Hypoglycemia is the most common complication of insulin use. It is extremely dangerous. The signs and symptoms appear quite similar to those of shock. Treatment must be rapid, since the brain cannot tolerate low glucose levels for long.

The condition can develop over a period of minutes or hours. Too much insulin circulating in the blood is caused by one or more of the following:

- delayed or missed meals,
- vomiting,
- prolonged exercise without extra food, or insulin adjustment,
- overdose of insulin,
- excessive alcohol ingestion,
- emotional distress, or
- illness.

Sign and symptoms

- cold, clammy skin,
- combativeness,
- confusion or disorientation,
- irritability,
- hostility,
- slurred speech,
- trembling,
- shakiness of hands,
- seizures,
- reduced level of consciousness,
- unresponsiveness
- tingling or numbness of lips and mouth,
- thickening of the tongue,
- a sensation of forceful heartbeats, or skipping a beat,
- poor co-ordination,
- headache, and/or
- hunger.

Treatment

Do the following:

1. Check for MedicAlert identification.

2. Activate EMS.
3. Provide sugar immediately. The patient may be carrying fast-acting sugar.

   The following are some suggested sources of sugar:

   - fruit juice or non-diet soda pop (one cup),
   - Lifesavers (five or six lozenges).
   - honey (two tablespoons),
   - sugar (three packets or teaspoons),
   - glucose (three tablets), or
   - dextrose (three tablets).

If the patient is alert, urge the patient to eat or drink as quickly as possible and if symptoms do not subside within 10 minutes, repeat the treatment. Diabetics often recognize their own symptoms of low blood sugar and are able to treat themselves. Many are equipped to measure their sugar levels to confirm that they are low.

Recommend the patient seek further medical aid. Some diabetics wear a pump on a belt to provide a constant infusion of insulin through a needle placed in the abdominal wall.

Unresponsive patients

An unresponsive known diabetic is an exception to the nothing by mouth if unresponsive rule. (see "General treatment for the unresponsive patient" on page 16-17).

Do the following:

1. Ensure there is an adequate airway.
2. Place the patient in the semi-prone position.
3. Check for MedicAlert identification.
4. Place liquid sugar source into downside cheek (sugar, honey, etc.).
5. Wait three to four minutes and repeat.
6. Monitor vital signs continuously.
7. Activate EMS and treat as a load and go.

If patient regains consciousness:

1. Continue sugar by mouth.
2. Give a more complex carbohydrate, such as bread, crackers, cheese, meat or peanut butter, to avoid another drop in blood sugar.
3. Avoid excessive activity.
4. Transport to a medical aid.

Hyperglycemia (diabetic coma) - severe high blood sugar

Hyperglycemia is the other serious complication of uncontrolled diabetes; it generally develops slowly, over a period of days. The patient is usually dehydrated and confused, and looks quite different from those in insulin shock (hypoglycemia). Appropriate medical attention is the key to treatment.

Causes of high blood sugar may include:

- missed or insufficient doses of insulin,
- increasing resistance to insulin, possibly as the result of infection,
- inability to take medications and follow diet properly, and
- un-diagnosed diabetes.

Signs and symptoms

- fatigue,
- dry, warm, flushed skin,
- extreme thirst,
- dehydration,
- frequent urination,

- rapid, weak pulse,
- rapid, deep breathing,
- fruity odour on breath
  (Fruity-breath odour is caused by ketones, a byproduct of the process where lack of insulin forces the body to use fat. Sometimes this is referred to as an acetone odour"or apple cider odour.),
- nausea,
- abdominal pain,
- irritation and agitation, and/or
- confusion, eventually leading to unconsciousness and coma.

Treatment

Do the following:

1. Monitor vital signs.
2. Check for MedicAlert identification.
3. Transport to medical aid.

Summary of diabetes considerations

- Although diabetes is common, the two major emergency complications, hypoglycemia and hyperglycemia, are less common.
- When in doubt, give sugar. A little extra sugar will do no further harm if sugar levels are already high, but may save a life if they are low.
- Do not assist the diabetic to take their insulin shot. This may be the wrong treatment.
- The majority of diabetics are very well informed about their condition. Many are equipped with a device to measure their blood sugar levels.
- Most diabetics know how to handle imbalances in their blood sugar.

Epilepsy

Although usually well-controlled by drug therapy, epilepsy affects approximately one in 200 people. An epileptic seizure is the physical result of uncoordinated electrical activity in the brain.

A focal seizure affecting a portion of the brain, may be localized to one limb, one side of the body, above or below the waist. A generalized seizure affects the entire brain and results in a petit mal or grand mal seizure. If epileptic seizures last longer than five minutes, the condition is called status epilepticus, and is considered a medical emergency.

An epileptic seizure may be brought on by:

- emotional strain,
- fatigue,
- flashing lights or loud noises,
- alcohol intake, or
- failure of the patient to take the prescribed medications.

Signs and symptoms

A generalized epileptic episode may be of two different levels of intensity:

a. **Petit mal seizure** or absence attacks, offers no obvious physical signs.

   Typically, the patient suddenly stops talking and assumes a trance-like gaze for a short period of time.

   Petit mal patients may not remember the event.

b. **Grand mal seizures** (tonic-clonic movements) always produce a loss of consciousness.

The signs include:

- convulsions - violent, involuntary contractions of voluntary muscles. Also called seizures.
- an onset of involuntary muscular contractions which may affect only one side, only one limb, involve only muscular contractions, or involve rapid muscle spasms. Tonic-clonic refers to the repetitive contraction and relaxation of muscle groups in a seizure.
- loss of consciousness,
- slowness to regain consciousness and to become oriented and alert,
- possible temporary loss of bowel or bladder control,
- possible temporary cessation of breathing with some cyanosis,
- fatigue and desire to sleep,
- pupil response may not be appropriate during recovery, or
- possibly have no recollection of the event.

Treatment of grand mal episodes

Do the following:

1. Lay the patient down -even during a seizure- to prevent further injury.
2. Remove any sources of potential injury.
3. Be prepared to support breathing with artificial respiration.
4. Never place any fingers or any other object in a patient's mouth during a seizure.
5. Check for MedicAlert identification and get additional information from available family members or friends.
6. After the end of the convulsion, check breathing and pulse, and maintain an open airway.
7. Transport the patient to a medical aid facility with a record of vital signs, a description of the seizure, and a personal history, if possible.
8. Reassure the patient.

Status epilepticus

Grand mal seizures lasting more than five minutes are uncommon but do occasionally occur. This is known as status epilepticus. Be prepared to perform assisted ventilations or artificial respiration during relatively quiet intervals.

Status epilepticus is a medical emergency. Treat it as a load and go.

Heart attack

A heart attack, also called myocardial infarction or MI, occurs when the circulation to a part of the cardiac muscle becomes impaired, resulting in an inadequate oxygen supply. The cardiac muscle may lose its ability to function effectively.

Prevention research has identified many risk factors for cardiovascular disease. You cannot change some of these factors, such as age, sex or family history. But you can change your lifestyle to be "heart smart" by making healthy choices. Some of the choices you can make are listed below:

- **Quit smoking**

  Cigarette smokers are two-to-four times as likely to have a heart attack as non-smokers. Giving up smoking greatly decreases your risk of heart attack.

- **Lower your blood pressure**

  High blood pressure puts undue strain on all components of the cardiac system. It is possible to lower your blood pressure with proper diet, and regular exercise.

- **Lower your saturated fat levels**

  High levels of saturated fats in your diet can lead to atherosclerosis (narrowing of the arteries). Moderating your intake of saturated fats can lower this risk factor of heart attack.

- **Weight control and exercise**

  Controlling your weight and exercising regularly can help lower your stress level and blood pressure. The increased circulation of blood through the heart may increase your chance of surviving a heart attack.

Signs and symptoms

- The patient has pain in the chest radiating down one or both arms, to the jaw, neck or back. The pain might be described as:
- squeezing,
- crushing,
- stabbing, or
- vice-like, and
- the pain may have occurred when the patient was resting or during physical or emotional exertion.

The patient may be:

- apprehensive,
- in denial about the possibility of a heart attack,
- experiencing laboured breathing,
- sweaty, or nauseous.

The patient's face may be pale and ashen and the skin may have a bluish tint (cyanosis).

The severity of signs and symptoms varies.

Treatment

Appropriate treatment depends on whether the patient is conscious or unresponsive.

Conscious patient

1. Activate EMS and treat as a load and go.
2. Transport the patient in a position of comfort (usually semi-sitting) to medical aid.
3. Do not allow the patient to exert themselves in any way.
4. Give oxygen, if available.
5. Keep the patient calm and still.

6. Loosen restrictive clothing.
7. Take a medical history.
8. Check for MedicAlert identification.
9. Evaluate vital signs.
10. Assist the patient to take their own medication.
11. Keep the patient warm, but do not overheat.
12. Monitor vital signs during transportation.
13. Be prepared to treat the patient if they lose consciousness. (see "General treatment for the unresponsive patient" on page 16-17)

Aspirin administration

Taking ASA (acetylsalicylic acid) within the first four hours of a heart attack can reduce a person's risk of fatality by 25 per cent. ASA works by reducing the tendency of blood platelets to clump and clot, thereby decreasing the possibility of artery blockage.

Time is of the essence in treating heart attacks. Given the environment in which some patients are found, medical help is not always readily available. Aspirin (one of the most common brands of ASA) is one of the most cost-effective ways to treat heart attacks.

Administering Aspirin or an ASA product is **not** permitted if any of the following conditions exist:

1. The patient is already taking blood thinning medication such as warfarin/Coumadin.
2. Sign and symptoms indicate a possible stroke.
3. The patient has a recent history of gastrointestinal bleeding

Administering Aspirin or an ASA product is only permitted when you suspect a myocardial infarction (heart attack) or Angina attack and the five following conditions are present:

The patient is:

- conscious and alert.
- able to provide an accurate medical history.
- able to chew and/or swallow the medication.
- not allergic to Aspirin or ASA products.
- **not** asthmatic.

If all conditions above are met, do the following:

1. Check for MedicAlert identification.
2. Ask questions concerning allergies or chronic respiratory conditions.
3. If available and upon consent of the person, the patroller should assist with administering two 81 mg chewable ASA (Aspirin-Quick Chews) or one regular adult strength (not enteric coated) 325 mg ASA tablet for the patient to chew.
4. Monitor and communicate the patient's response to the medication and any possible complication.
5. Continue to be available to assist the patient with the use of their own medication.

Rescuers may not recommend the use of Aspirin or ASA products in any other circumstance, for example headache, or sprains and strains.

However, rescuers can assist an individual in taking their own medication.

Areas may decide to package children Aspirin with the oxygen and/or trauma packs. Aspirin and ASA products can also be available at area clinics but such storage must adhere to all local and provincial legislation.

The rescuer may also administer ASA that is available from a reliable source.

Unresponsive patient

If the patient is unresponsive,

1. Establish and maintain an airway.
2. Loosen restrictive clothing.
3. Administer oxygen, if available.
4. Provide AR or CPR if needed. (see "Basic Life Support" on page 6-1)
5. Activate EMS and treat as a load and go.

Hyperventilation

Hyperventilation is the only breathing problem that is not a pre-hospital medical emergency. Hyperventilation often occurs in the wake of highly emotional or stressful situations, or due to pain or nausea. It can also occur for no obvious recognizable reason.

Hyperventilation involves breathing too quickly, to the point that the oxygen and carbon dioxide gases in the blood are altered from their normal balance, bringing on the symptoms discussed below. Treatment is aimed at calming the patient, in order to restore the patient's blood gases to normal.

Frequently this condition occurs in teenagers and young adults - an age group not generally as susceptible to the serious underlying causes of breathing problems as other age groups.

Signs and symptoms

- tingling and numbness in the hands and around the mouth,
- deep, rapid respiration with rapid pulse,
- marked anxiety, often escalating to panic,
- dizziness, syncope, or
- fingers and hands drawn into a characteristic claw-like spasm called carpopedal spasm.

Unlike many other respiratory ailments, the patient does not wheeze or make other abnormal breathing sounds.
The symptoms often generate increased anxiety, making the syndrome a self-perpetuating cycle. Hyperventilation is not just breathing fast. Do not assume that all rapid breathing represents hyperventilation.

Do not treat hyperventilation with re-breathing (paper bag, hands cupped over face etc.). It is contraindicated and therefore no longer used for this problem.

Treatment

Do the following:

1. Calm and reassure the patient.
2. Explain to the patient what is happening.
3. Help the patient slow their breathing by having them mimic your breathing as you start off quickly and gradually slow your own rate down.

4. If oxygen is available, you may administer it to the patient. This does not affect the hyperventilation, but may relieve other problems if the patient is not hyperventilating.

Stroke

A stroke is also known as a cerebral vascular accident (CVA). A stroke is the result of a reduction in the supply of blood to a section of the brain due either to blockage or rupture of the artery supplying the area.

The signs and symptoms depend upon where the brain damage has occurred.

A forerunner and warning sign of possible future stroke is a transient ischemic attack or TIA for short. Signs and symptoms of a TIA are similar to a stroke, but they disappear spontaneously within minutes or hours. The most common are visual disturbances, headache, brief episode of speech disturbances, clumsiness, dizziness and/ or nausea.

Signs and symptoms

- Patient may be unable to talk.
- Patient is confused, or unable to express themselves by gesturing or by writing.
- Pulse may be quite strong, though slow.
- One side of the face may not have any muscle tone and will appear flaccid or drooping. On examination, one pupil may be dilated in comparison to the other.
- Patient may have a history of:
  - high blood pressure (hypertension),
  - short duration fainting spells,
  - "mini-strokes", known as transient ischemic attacks (TIAs),
  - headaches,
  - periods of dizziness, or
  - visual disturbances.
- Patient may have muscle paralysis on one side, or reduced muscle power on one side of the body.

Remember F.A.S.T

Facial drooping: A section of the face, usually only on one side, that is drooping and hard to move.This can be recognized by a crooked smile.

Arm weakness: The inability to raise one's arm fully

Speech difficulties: An inability or difficulty to understand or produce speech

Time: If any of the symptoms above are showing, time is of the essence; call the emergency services or go to the hospital.

Treatment

Appropriate treatment depends upon whether the patient is conscious or unresponsive.

Conscious patient

If the patient is conscious:

1. Maintain an open airway.
2. Administer oxygen, if available.
3. Reassure the patient.
4. Keep the patient calm.
5. Monitor vital signs.
6. Activate EMS and treat as a load and go.
7. Give nothing by mouth.

Unresponsive patient

If the patient is unresponsive,

1. Maintain an open airway.
2. Administer oxygen, if available.
3. Monitor vital signs.
4. Activate EMS and treat as a load and go.

Syncope

Syncope - simple fainting - is caused by a dilation of blood vessels in the extremities of the body. Blood pools in these vessels leaving the brain without sufficient circulation. It may be caused by fear or emotional stress.

Signs and symptoms

Syncope is frequently preceded by:

- the patient looking pale,
- profuse sweating,
- dizziness, or
- weakness.

Treatment

1. Lay the patient down, with the head lower than the heart and apply a cool cloth to the forehead or neck.
2. Loosen clothing.

Unresponsiveness and lowered levels of consciousness

A lowered level of consciousness is the abnormal state of inappropriate response or complete lack of response to sensory stimuli. For the purposes of the primary assessment (page 4-2), level of consciousness is determined by the patient's response to your verbal stimulus such as "*I am a member of the Canadian Ski Patrol. May I help you?*"

The following categories simplify and better describe the level of consciousness:

- A - Alert: fully conscious response,
- V - Verbal: responds to loudly spoken verbal stimulus,
- P - Pain: responds to pain stimulus, and
- U - Unresponsive (no response).

Hence the name AVPU scale.
An explanation of each step in these categories of level of consciousness is listed below.

If the patient responds appropriately to your introduction, the patient is alert and conscious. If not, apply first a verbal stimulus, and then if necessary a pain stimulus to the patient and note the level of response. Throughout the rest of your time with the patient, repeat the assessment looking for changes in the level of consciousness and changes in the reaction to the stimuli you used.

Record your results along with the time and type of stimulus used.

Alert

A patient who is alert is able to correctly answer questions about their name, where they are, what time of day or day of the week it is and what has happened in the past several minutes.

Verbal

A patient who is not alert, but responds in some way to a loud voice is said to be responsive to verbal stimulus. The patient will not react spontaneously, but only responds to your stimulus. This is called "responds to verbal stimulus," even though the patient may not produce intelligible words, or the words may not make sense.

Pain

If there is no response to verbal stimuli, administer a painful stimulus. The stimulus must create a pain sensation without being damaging. You may:

- firmly pinch the trapezium muscle between the shoulder and the neck,
- firmly rub your knuckles over the patient's sternum, or
- squeeze an object like a pen over the top of a fingernail.

Apply only the minimal stimulation necessary to obtain a response.

The normal reaction to pain is to withdraw from it or to attempt to push it away. Anything else is an abnormal reaction. Abnormal reactions in response to the painful stimulus include:

- not responding at all, or
- either flexing or extending the arms in addition to trying to point the toes and arch the back.

Unresponsive

If the patient shows no reaction to either verbal or painful stimuli, they are said to be unresponsive.

General treatment for the unresponsive patient

Note: The rule is to give nothing by mouth (solids or liquids) if the patient is unresponsive.

If there is a suspected spinal injury, the injured person is unresponsive and is face down and has difficulty breathing because of copious secretions or vomiting, requires CPR, or needs to be moved due to an unsafe environment, maintain spinal motion restriction by manually stabilizing the head and neck (e.g. placing one hand on either side of the injured person's head to hold it still), so that the motion of the head, neck and spine is minimized before turning the injured person face up or moving the injured person. Move the injured person only as needed to open the airway or to reach a safe location.

If the patient is unresponsive:

1. Establish the presence of airway, breathing, and circulation. If any are absent, start resuscitation procedures.
2. Administer oxygen as soon as possible.
3. If the patient is breathing and has a pulse, monitor vital signs.
4. If a spinal injury can be ruled out, move the patient to a semi-prone position. (see "Semi-prone (also known as three-quarters prone or recovery position): lying face down, on one side." on page 2-3).
5. Continue to monitor and record the patient's vital signs, including

a description of the level of consciousness.

6. Establish the reason for unresponsiveness.
7. Check for MedicAlert identification.
8. Activate EMS and arrange for transportation to medical aid as soon as possible.

Causes of unresponsiveness

Typical causes are:

- Altitude sickness
- Angina
- Asphyxia
- Asthma
- Diabetes
- Epilepsy
- Heart attack
- Hyperventilation
- Lightning strikes
- Poisoning
- Stroke
- Syncope

Conclusion

The success of the first aid provider's efforts to assist the patient depends largely upon a systematic application of certain learned skills. The patroller's thoughts, decisions and actions in a situation could mean the difference between life and death.

Notes...

Environmental Injuries

Upon completion of this chapter the student will be able to:

1. Recognize the signs, symptoms and explain the treatment for the environmental found in this chapter:
   - Demonstrate the treatment for the conditions found in this chapter
2. Explain how to avoid and prevent environmental injuries.
3. Recognize that the Workplace Hazardous Materials Information System (WHMIS) is a national system to provide information on hazardous materials used in the workplace.
4. Recognize that all controlled products fall into WHMIS classes as noted on a material safety data sheet (MSDS).

Learning outcome

Recognize, understand, and explain the treatment and avoidance of environmental injuries.

The patroller is most likely to be called to treat environmental injuries, both on and off the ski hill. Many are serious or life-threatening, and the patroller should be ready to intervene and transport rapidly. The most common conditions are discussed in this Chapter:

- Altitude Sickness (see "Altitude sickness" on page 17-1)
- Cold Exposure Injuries (see "Cold exposure injuries" on page 17-5)
- Heat Exposure Injuries (see "Heat exposure injuries" on page 17-14)
- Exposure to hazardous materials (see "Exposure to hazardous materials" on page 17-17)
- Electrical Shock (see "Electrical shock" on page 17-26)
- Lightning Strikes (see "Lightning strike" on page 17-26)

Altitude sickness

Altitude sickness can be categorized into three groups:

- Mild acute mountain sickness,
- High altitude pulmonary edema (HAPE), and
- High altitude cerebral edema (HACE).

Mild acute mountain sickness

Mild acute mountain sickness due to hypoxia can show up at elevations as low as 2,100 to 2,400 metres (approximately 7,000 to 8,000 feet), or occasionally even lower. The signs and symptoms will vary according to the:

- physical condition of the patient,
- patient's acclimatization to higher elevations,
- rapidity of the ascent, and
- length of time spent at higher elevations.

Signs and symptoms

- mild headache,
- mild insomnia,
- loss of appetite, or
- shortness of breath when exercising.

Treatment

The symptoms should disappear within 24 hours. If they do not, have the patient descend to a lower altitude until the symptoms disappear. If the symptoms persist or get worse, give oxygen and refer the patient to medical care.

High altitude pulmonary edema (HAPE)

A continued shortage of oxygen (hypoxia) causes a narrowing of the arteries of the lungs. In turn, this increases the pressure in the narrowed arteries. The increased pressure results in damage to the lung capillary walls and alveoli, which in turn causes an accumulation of fluid and a reduction in oxygen uptake of the blood. It can quickly develop into a life-threatening condition. Pulmonary edema (HAPE) is about 10 times as frequent as cerebral edema (HACE), which is discussed below.

Signs and symptoms

- marked breathlessness on exertion and at rest,
- headache,
- cough.

Signs of advanced pulmonary edema include

- severe respiratory distress, cyanosis, audible gurgling sounds in the chest,
- severe cough with abundant sputum,
- rapid pulse.

Treatment of high altitude pulmonary edema

Do the following:

1. Take the patient to as low an altitude as possible immediately.
2. Give oxygen, if available, during the descent and while in transit.
3. Try to keep the patient at rest.

High altitude cerebral edema (HACE)

In the brain, swelling can occur due to cell wall damage. The swelling and consequent intracranial pressure can eventually lead to cerebral edema. Cerebral edema generally develops slowly, over a few days. It will probably not develop if a patient is exposed to high altitude for a two or three day period, such as a weekend.

Signs and symptoms

- severe headache,
- insomnia,
- nausea and vomiting,
- ataxia (loss of co-ordination),
- lassitude (weariness and weakness), or
- irrational behaviour.

Treatment

Do the following:

1. Take the patient to as low an altitude as possible immediately.
2. Give oxygen, if available, during the descent and while in transit.
3. Try to keep the patient at rest.

> If there is evidence of a pulmonary or cerebral edema, it is a medical emergency. Treat as a load and go.

Heat and cold injuries

The systems of the body function less effectively as the internal body temperature falls below its normal temperature (37 C). The body may also be severely damaged if the internal temperature rises above normal.

Body temperature

The temperature-regulating mechanisms of the body continuously attempt to maintain a balance between internal heat production (metabolism) and external heat gains or losses.

Heat injuries may be systemic such as heat stroke, or localized such as burns. Cold injuries may also be systemic, such as hypothermia, which affects the body as a whole, or localized such as frostbite, which affects only a part of the body.

Heat transfer mechanisms

Basic heat transfer mechanisms are identical whether applied to cold or heat injuries.

Heat flows from a warmer object or environment to a cooler object or environment.

This means that, in a cold environment, heat will be lost by the body to the outside; and conversely, in a hot environment, the body will be heated from the outside.

Heat transfer occurs as a result of:

- radiation,
- conduction,
- convection,
- evaporation, and
- respiration.

Radiation

Radiation is the transfer of heat - without physical contact - from a warm object to a cooler one. Radiation of heat, especially from the head, is the most serious type of body heat loss. At temperatures below 5 C, more than half of the body's total heat production can be lost from an uncovered head.

Conduction

Conduction is the transfer of heat by contact from a warmer object to a cooler one (e.g. from the skier's body to a chair on the lift in cold weather, or a hot water bottle warming a cold body area).

Convection

Convection is the transfer of heat between an object and its fluid environment through the surrounding layer of air or water. For example, in cold weather and as the layer of air closest to the skin is warmed by the body, it rises away from the body by convection and it is replaced by cooler air or water. In the case of air, wearing clothing with closures at the neck and waist reduces this flow (e.g. turtlenecks, zip-together ski suits).

Evaporation

Evaporation of water requires heat. Evaporation of moisture on the skin draws heat from the body, thereby cooling it. Evaporation is most pronounced in a dry, hot environment, but is also significant in a dry, cold environment.

Respiration

Respiration heat loss is a combination of convection and evaporation, as inhaled cold dry air is warmed by the body to 37 C and humidified. Heat and moisture are lost on exhalation. Increased respiration during exercise and at higher altitudes increases the rate of heat loss and contributes to dehydration.

Other factors affecting body heat balance

Additional factors can affect the basic heat transfer mechanisms discussed above. They include: wind, water, clothing, and nutrition.

Wind

Wind vastly increases the amount of heat loss from the body due to convection. It removes the insulating layer of warm air surrounding the body; even light winds can change mild temperatures into uncomfortably cold conditions.

Wind chill temperature

The wind chill temperature is the theoretical temperature which would result in the same heat transfer rate as the combination of actual temperature and wind speed. In simple terms: it's how cold the wind makes the air feel.

Water

Water conducts heat away from the body 32 times faster than air of the same temperature. If the water is moving or the patient is swimming, heat loss is further increased as a result of convection. Any time moisture comes in contact with the body (e.g. rain, immersion in water, perspiration-dampened clothing, etc.), the body loses heat at a rapid rate.

Clothing

Clothing traps a thin layer of air next to the body. The air is prevented from escaping by closures at the neck, waist, wrist. Windproof clothing prevents removal of this insulating layer of air by keeping the underlying layers of clothing dry for maximum insulating value. Multiple layers of clothing are better than a single thick layer, because they trap more layers of air. To avoid overheating, individual layers can be removed without causing excessive cooling.

Food and nutrition

Diet greatly affects the internal production of body heat (metabolism). Food fuels the metabolism. The process of digestion also creates heat. If exposed to cold temperatures, meals should be regular, and frequent snacks should be eaten. Alcohol should be avoided - it dilates peripheral vessels, thus increasing heat loss through the skin, and reduces blood sugar levels. Similarly, smoking should be avoided because it constricts the peripheral vessels, thus pre-disposing the extremities to cooling and frostbite.

Cold exposure injuries

Hypothermia

Hypothermia is a serious cold injury which occurs when the body loses more heat than it can produce or retain. The nervous, cardiovascular, respiratory and digestive systems function less efficiently as the core body temperature falls below the normal 37 C. Should the core temperature continue to fall, these functions may cease and death may follow.

Core body temperature refers to that part of the body comprising the brain, heart, lungs, and abdominal organs. There is no good way of measuring core body temperature in the field; the mouth, ear, and armpit temperatures are not accurate because they measure surface temperatures. However, reference to the table on page 17-8 will allow a good estimate of the patient's condition.

Hypothermia does not necessarily occur only in winter. It can occur at any time of the year as a result of inadequate heating, clothing, or nutrition. Hypothermia can be classified into two general categories according to the rate of heat loss:

- Acute, and
- Chronic.

Acute hypothermia

Acute hypothermia may develop over a short period of time as a result of immersion in cold water, or over a period of up to 12 to 24 hours exposure to cool or cold weather conditions.

Cooling rates vary widely in patients exposed to cold weather according to the amount and type of clothing worn, the level of exercise (heat production) maintained, the state of nourishment, and body size. In severe exposure, if the condition is left untreated, death may occur within hours of the onset of the first symptoms of hypothermia.

In the case of cold water immersion, the average patient may remain conscious for up to 1.5 hours in water at 0 C. Sudden death on immersion in cold water is not a result of hypothermia, but of drowning or cardiovascular problems. Cardiovascular problems occur because, in the case of water immersion, the muscles of the larynx will spasm violently to seal off the airway and protect it from further aspiration. This protects the lungs, but will lead to asphyxiation due to lack of oxygen and ultimately cardiac arrest.

Chronic hypothermia

Chronic hypothermia develops over a period of time. This is seen most commonly in the elderly as a result of aging processes, certain diseases, medications taken and inadequate heating in their homes.

As people age, their body circulation system may lose its ability to constrict blood vessels in the skin and extremities in order to reduce heat loss and may also lose the ability to shiver to increase heat production. Subtle changes in behaviour may be the only signs present.

Prevention of hypothermia

Accidents happening on the ski hill or trail can result in the patient suffering from hypothermia, if their body is cooling rapidly and not handled properly.

The following are a few points to remember:

- Place insulating material between the patient and the snow to reduce conductive heat loss while waiting for a toboggan and administering treatment.
- If clothing has been removed or undone during the examination, replace it to prevent further heat loss (e.g. replace hats, close jackets).
- Put a layer of warm clothing on top of the patient. If it is very windy or cold, provide some shelter and warmth by huddling.
- Remove the patient from the hill or trail as soon as possible.

Reaction of the body to cold

Initially, the extremities become very cold while the body attempts to maintain a normal core temperature. Once the core temperature begins to fall as heat loss exceeds heat production, the signs and symptoms listed below start to appear.

Early signs of heat loss

The body's initial response to exposure to cold is to prevent further heat loss. To prevent further heat loss, the body constricts blood vessels in the skin and extremities. This is called vasoconstriction. Vasoconstriction reduces the flow of warm blood from the core to the skin and extremities, and of the cool blood returning to the core. As a result, the temperature of the extremities falls. Cold hands and feet, numbness and ultimately loss of sensation to touch or pain ensues.

The body's other response to cold exposure is to increase heat production by shivering. Shivering is a surface muscle activity which generates warmth. However, shivering uses energy, and if the exposure to cold continues, it will contribute to further deterioration of the patient.

Continued response to heat loss

The muscles below the skin weaken and peripheral nerve function becomes impaired. This leads to loss of co-ordinated movement, especially in the extremities. The loss of heat from the body core is delayed because the cool shell of skin and surface muscles acts as an insulating layer for deeper tissues. As the exposure to cold continues, the body will sacrifice the limbs first, then deeper and deeper tissues, in an effort to maintain the temperature of the vital organs (the body core).

Once the core starts to cool, the activity of the brain, heart and lungs is impaired. If their temperature reaches a critical point, they will cease to function and death will result.

Impairment of brain activity has serious consequences, as judgment may be affected. The patient may not recognize the seriousness of the situation and therefore treat his or her own hypothermia improperly.

Final response to heat loss

When the temperature drops below a critical point, the core temperature falls rapidly. If this occurs, a patient is incapable of producing heat to re-warm the body. Heat must be supplied to the body, but this should normally be done only in a hospital setting.

Summary of hypothermia signs

The table on pages 17-8 to 17-10 summarizes the progression of hypothermia. More detailed descriptions of the signs and symptoms, and suggested treatments are found in that table.

General treatment of hypothermia

The best treatment of hypothermia is prevention through good preparation. This means proper clothing, preferably layered, so the amount of insulation can be adjusted. It also means avoiding windy or humid conditions and not allowing the body to perspire freely. If you find a patient who is suffering from hypothermia, or find yourself in the process of becoming such a patient, take steps to reduce heat loss immediately. The longer the body core loses heat, the more difficult it is to re-warm.

1. Ensure that the patient's airway, breathing and circulation are adequate. After the primary assessment, begin specific treatment.
2. Prevent further heat loss. Place the patient out of the wind - or remove from the water - in the best shelter available. Replace wet clothing with dry clothing, or cover with blankets or sleeping bags.

   Place as much insulation as possible between the patient and the ground. Make sure the patient's head and neck are covered.
3. For patients in mild to severe condition, add heat to re-warm the patient's body. Build a fire, use a camp stove to warm the air around the patient, use external warmth such as heat packs or hot water bottles applied to the head, neck, chest, and groin areas.

   If more sources of warmth are available, place them along the sides of the trunk. The bottles and packs should not be put directly on the skin to avoid burns. Leave on an undershirt or insert a towel to prevent damage.

Do not use hot baths or any heating method which will cause vasodilation. (see "Re-warming and after-drop" on page 17-11)

4. If the patient is fully conscious, give fuel in the form of hot, sweet drinks (tea, soup, warm sweetened juice) and sweetened foods (chocolate, candy, dextrose tablets). Sugar is the food most quickly transformed into heat and energy. **Do not** administer alcohol because it dilates the superficial blood vessels and further reduces the core temperature.
5. Handle the patient gently to avoid mechanically forcing the cold blood which has pooled in the extremities, back to the heart. Such action will further reduce the core temperature, and can precipitate fibrillation, a condition in which the heart muscle contracts rapidly without resulting in adequate pumping action.
6. If the patient in unresponsive, place the patient in a semi-prone position. Monitor to ensure an open airway is available, prevent further heat loss, and transport to medical aid as soon as possible. An unresponsive patient should be considered a load and go.

Early stage of hypothermia	**36 C**	
• The patient increases activity to warm up. • The ability to perform complex tasks is impaired. • Shivering becomes intense. • Skin starts to become cold and pale. • Muscles become tense. • Fatigue and signs of weakness.		1. Follow steps one to four of the general treatment procedure. 2. In the early stage, limited exercise may help generate some internal warmth, however, it depletes energy reserves. 3. Check other members of the group for signs of hypothermia.
Mild hypothermia	**35 C to 34 C**	
• Uncontrolled intense shivering. • Movements become less coordinated. • The patient is still alert and able to help themselves, but signs of speech difficulty, sluggish thought and amnesia become apparent. • The coldness creates some pain and discomfort. • Cold, pale skin. • Fatigue and signs of weakness.		1. Follow steps one to four of the general treatment procedure. 2. In the early stage, limited exercise may help generate some internal warmth, however, it depletes energy reserves. 3. Check other members of the group for signs of hypothermia.

Moderate hypothermia	33 C to 32 C	
• Shivering slows and muscles become clearly rigid. • Mental confusion and apathy sets in; total amnesia may show. • Drowsiness, strange behaviour may occur. • Speech becomes slow, vague and slurred. • Breathing becomes slower and shallow. • Cold, possibly waxy skin. • The patient is generally still able to maintain posture and may appear in contact with the surroundings.		1. Follow steps one to four of the general treatment procedure. 2. Plan to keep the patient warm for several hours. 3. Offer sips of warm, sweet non-alcoholic liquids only if the patient is: • fully-conscious, • beginning to re-warm, and • able to swallow. 4. Arrange, or advise, for the patient to be examined by a doctor. 5. Check other members of the group for signs of hypothermia.
Severe hypothermia	**31 C to 29 C**	
• Shivering has stopped; muscle rigidity continues. • Marked weakness and lack of coordination, appears exhausted. • Patient becomes irrational, very clumsy, speech is slurred and appears to be drunk, denies problem and may resist help. • Pulse and respiration are slowed. • Gradual loss of consciousness.		1. Follow steps one to six of the general treatment procedure. 2. Exhale warm air near the patient's mouth and nose, and introduce warm steam in the area. 3. Try to keep the patient awake. 4. Ignore pleas of: “Leave me alone, I'm OK.” 5. Keep the patient's temperature from dropping, but avoid too rapid a temperature rise. 6. Obtain medical advice as soon as possible. 7. This patient is in serious trouble. Maintain a continuous watch over the patient as their condition is serious and check other members of the group for signs of hypothermia.

Critical Hypothermia	< 29 C
• Patient is unresponsive, and may appear dead. • Little or no apparent breathing. • Heartbeat becomes erratic and slower. • Skin cold, may be bluish-grey colour, • Pupils may be dilated. • The patient is very rigid. • Use extreme care. Rough handling may cause cardiac arrest.	1. Always assume patient can be revived. Don't give up. 2. If there is any breathing or pulse, no matter how faint or slow, do not give AR or CPR, but keep a close watch on vital sign changes. 3. Keep the temperature even with external heat sources. **Do not** try to re-warm the patient. 4. If there is no breathing or no pulse for one or two full minutes, begin AR or CPR. 5. Treat as a load and go. Medical help is imperative and hospitalization is needed.

Warnings

- Treatment for severe and critical hypothermia is to stabilize the temperature only. Rapid re-warming may be fatal. Rough handling may cause cardiac arrest.
- A number of experts suggest that if there is a good possibility of getting a patient to medical attention within one or even two hours, the patient should be rushed there without receiving re-warming treatment.
- A severe or critical hypothermic patient, who has been kept alive by artificial respiration and CPR, is more likely to recover given the re-warming techniques available at the hospital.
- The low body temperature will keep demand for oxygen - by the brain and other organs - to a minimum until the patient receives treatement.
- If it is clearly impossible to get the patient to medical help within a reasonable time frame, start re-warming in the field after the resuscitation treatment.
- In hypothermia, the carotid pulse may not be easily detected. It may be weak and slow, with a rate of 20 or even lower. Therefore the pulse should be checked every one to two minutes. You will have to estimate temperature. The easiest and most accurate temperature estimate in the field is found by using the signs in the table above. This will help you to decide whether the hypothermia is mild, moderate,severe or critical.

Transporting hypothermia patients

The transport medium used in mild and moderate hypothermia should be as warm as possible.

In severe and critical hypothermia, the temperature in the vehicle should be between 18 C and 22 C with as smooth of a ride as practically possible.
If ventilation must be assisted, use mouth-to-mask, as opposed to bag-to-mask, to maximize core temperature increase.

Re-warming and after-drop

After-drop is the phenomenon where the body temperature continues to fall even though active re-warming is in progress.

After-drop, also called re-warming shock, happens when the outside areas of the body and the extremities are warmed before the core. What happens is that the blood vessels near the surface start dilating. The blood from the core flows into these peripheral vessels. The heart is still too cold to cope with the increased circulation demands, and the body core including the heart becomes even colder as the cold blood from the peripheral vessels is returned to the core. This can lead to cardiac arrest.

Localized cold injuries

These include:

- Non-freezing cold injury
- Superficial frostbite
- Deep frostbite

Non-freezing cold injury and localized hypothermia

Under conditions of prolonged cooling of a body part, the blood becomes thicker and capillary circulation comes to a halt, even though the tissue is above the freezing point. If the part is not re-warmed promptly, the flow of blood to adjacent tissue is reduced and the chilling spreads. This condition can occur with prolonged exposure to above-freezing temperatures. It is often experienced by survivors of an aircraft crash or shipwreck or by patients injured or marooned in an unheated ski cabin.

A non-freezing cold injury requires several hours to a day or two to develop at above-freezing temperatures. Damage from this condition is called localized hypothermia, also known as frostnip, immersion foot or trench foot. It occurs because of decreased blood flow and the resulting lack of oxygen and nourishment to the tissues at above freezing temperatures. Immersion or trench foot occurs from prolonged exposure to cold water. It is quite common among hikers and hunters.

Signs and symptoms

The skin of the part in question is cold to the touch and pale, but not frozen. Feeling is usually still present to some extent. Usually there will be tingling, pain and redness during the re-warming.

Treatment

1. Remove the patient from the exposure.
2. Remove wet clothing.
3. Re-warm the part. This can be done by contact with a warm body part such as a hand or armpit, or immersion in warm water.

Frostbite and superficial frostbite

Frostbite

Frostbite is the freezing of body tissue which occurs when the body-warming processes no longer function. Frostbite is usually restricted to the extremities, or to areas like the ears, nose, chin, toes and cheeks. The severity of the injury depends on the intensity of the initial exposure and the length of time before adequate circulation returns. Tissue damage in superficial frostbite is minor and the response to treatment is good.

If the tissue temperature falls below freezing, the tissue starts to freeze and crystals form. As the crystals form, water is drawn from the tissue. This dehydrates the cells, increases the concentration of salts within them and finally causes their destruction. Continued exposure to the cold will result in deeper freezing until blood vessels, nerves and even the bones are frozen. This process may be accelerated if the patient is in a state of panic or shock from another injury.

Frostbite and burns are similar in the kind of damage they result in and in their treatment. Both frostbite and burns destroy the skin and/or tissue.
The difference is one of cause -
the general treatments are similar.
Frostbite frequently results in a long term reduction of the patient's tolerance to cold by the injured part.

Superficial frostbite

Superficial frostbite may include true tissue freezing. It occurs when there is sufficient heat loss in the local area to allow ice crystals to form and extract cellular water. The skin surface is hard, but the tissue underneath is soft. Superficial frostbite involves only the skin and the tissues directly under the skin. It frequently occurs on the tip of the nose, earlobes, cheeks, toes and fingers.

Signs and symptoms

Frostbite usually has a slow onset with the patient unaware until they experience a loss of sensation. The skin initially reddens and then blanches and becomes white. As the freezing progresses, the skin will become firm, white and waxy in appearance. The tissue underneath is soft and resilient.

The patient often complains of a tingling sensation or sharp pain in the area. Sometimes there will be no pain at all, if the nerves have been frozen; or the pain may stop suddenly as the nerves are frozen.

During re-warming, expect the patient to complain of a tingling or a burning sensation. The injured part may become numb and then swell and may become warm, and tender or painful.

Treatment

Do the following:

1. Warm the affected area.
2. Keep the patient rested and elevate the affected area if swelling and loss of function occur.
3. Protect the injured area with dressings.
4. If problems persist, transport to medical aid.

The damaged area can be treated immediately by using body heat, such as covering the frost-bitten area with a warm hand or having the patient place injured fingers in their armpits. Frost-nipped toes can be treated by placing them on the abdomen of a friend under the clothing. Be prepared for some swelling of the injured part.

After re-warming, the injured part may become numb, then swell and become warm, tender and sting. This may stop the patient from being able to walk.

Evidence of discoloration or blister formation indicates more than superficial freezing.

Transport the patient to medical aid. Note that this phase may not become apparent for several days.

Deep frostbite

Deep frostbite occurs when tissue freezes down into, and beyond, the subcutaneous layers. Irreversible damage occurs if the condition is not arrested. Any evidence of discoloration or blister formation indicates that more than a superficial freezing injury has occurred. However, this phase of injury may not be apparent for several days.

Re-warming is best undertaken where medical help is available for both pain relief and dressings.

Signs and symptoms

- The injured cannot feel the frozen area.
- The skin surface is white, hard and the tissue underneath is hard.

Treatment

- Due to the seriousness of the injury, the most effective treatment is to send the patient to a medical aid facility.
- If transportation to medical aid is not possible, transport the patient to a place where proper re-warming can be applied and maintained (e.g. a farm house, chalet, or base camp).
- Leave the affected area frozen if there is no guarantee of preventing re-freezing after thawing has occurred.
- An individual can walk or ski a long way on frozen feet without further injury. If a frozen foot or toe is re-warmed on the trail, the patient immediately becomes a stretcher case. They cannot assist in their own rescue and may create a major crisis not only for themselves but for their companions. Do not permit anyone to walk on thawed feet or toes. Very serious loss of tissue is almost certain to result.

Re-warming deep frostbite

If, after careful consideration of the above, you attempt re-warming, use the following rapid re-warming method:

1. Re-warming should be achieved by immersing the affected part in water between 37C (body temperature) and 40C (98.6 F and 104F) for 20-30 minutes. For severe frost-bite, re-warming should be accomplished within 24 hours. Chemical warmers should not be placed directly on frostbitten tissue, because they can reach temperatures that can cause burn and exceed the targeted temperatures.
2. Continue re-warming until the blood has circulated completely to the end

of the extremity and the skin is pink throughout. This may take longer than 30 minutes, depending on the severity of the injury.

3. Protect the injury with dressings.
4. Immobilize and transport to a medical aid facility.
5. Be prepared for the injured to experience extreme pain.

Common hazards treating frostbite

Frostbite is serious. Much of its treatment involves avoiding certain actions as described below:

- Do not rub the affected part with snow. This will not get the skin above a freezing temperature, and may cause skin damage.
- Do not rub the affected part at all as the skin may be brittle and rubbing may cause further damage.
- Do not blow into a glove to warm cold fingers. Your breath will put moist air into the glove, which eventually condenses making the fingers colder.
- Do not allow the patient with severe frostbite to smoke. Smoking constricts the blood vessels, reducing circulation and, therefore, warming.

Heat exposure injuries

The body constantly produces heat. If this heat cannot be dissipated from the body or if external heat is added, the core temperature may rise above normal. A rise in body temperature results in severe damage to the central nervous system and the kidneys.

The body dissipates heat by conduction, convection, radiation and evaporation. When the atmospheric temperature is relatively high, most of the heat is given off by evaporation. The body perspires rapidly, losing water and chemicals such as potassium and sodium. These chemicals are necessary for conduction of nerve impulses, and if they are not replaced, the body cannot function properly.

If the surrounding air is also humid, little evaporation occurs, heat cannot be dissipated rapidly enough and there is danger of excessively high body temperature.

Heat exposure injuries, in order of increasing severity are:

- heat cramps (see "Heat exposure injuries" on page 17-14),
- heat syncope (see "Heat syncope (fainting)" on page 17-15),
- heat exhaustion (see "Heat exhaustion" on page 17-16), and
- heat stroke (see "Heat stroke" on page 17-16).

Prevention

Heat exposure injuries are the result of the inability of the body to cool itself or of a profound and rapid loss of water and chemicals.

Heat exposure injuries are relatively easy to prevent. Consider the following:

1. Gradually acclimatize to working in warm or hot environments.
2. Wear light-coloured garments made of materials that allow the easy passage of moisture to facilitate evaporation (fabrics that breathe).

3. Increase fluid intake.
4. Schedule peak physical work periods to cooler periods of the day.

Heat cramps

Heat cramps are painful involuntary muscle spasms that usually occur during heavy exercise in hot environments. The spasms may be more intense and more prolonged than are typical night time leg cramps. Inadequate fluid intake often contributes to heat cramps.

Muscles most often affected include those in the calves, arms, abdominal wall and back, although heat cramps may involve any muscle group involved in exercise.

Signs and symptoms

Onset is acute with:

- Pain as the muscle forcefully contracts
- A visible bulge in the muscle underneath the skin where the muscle is located
- Inability to flex and move the muscle normally
- Thirst

Treatment

Do the following:

1. Have patient stop any strenuous activity, and move into the shade.
2. Practice gentle, range of motion stretching and gentle massage of the affected muscle group.
3. Encourage fluid intake by mouth.
4. Apply moist towels to cramping muscles.
5. If symptoms are not relieved, transport to medical aid

To replace salts lost in sweating, the patient should drink at least a litre of fluid containing salt. This can be an electrolyte-carbohydrate mixture that can include juice, or a commercial electrolyte-carbohydrate drink such as Gatorade, or fruit juices / water with added salt. The rule of thumb is to use one teaspoon of salt per litre of water.

Heat syncope (fainting)

Heat syncope is a fainting episode caused by decreased blood volume reaching the brain.

The dissipation of heat is a priority during work in a hot environment. When not acclimatized, there is an increased movement of blood to the skin and to the working muscles. This may result in a temporary insufficiency of blood flow to the brain.

A temporary loss of consciousness may ensue.

Fainting is usually followed by a fall. The resulting horizontal position of the body improves the blood flow to the brain and allows spontaneous recovery.

Signs and symptoms

Dizziness followed by fainting.

Treatment

Do the following:

1. Lay the patient down if they feel dizzy.
2. Loosen tight clothing.
3. Move the patient to a cooler environment.
4. Keep the patient lying down with the legs elevated to a maximum of 30 cm.

The condition should be self-resolving and no further treatment should be necessary.

Heat exhaustion

The mechanism of heat exhaustion is the same as for heat syncope. The patient, however, may not experience a loss of consciousness. Because heat exhaustion is usually accompanied by fluid loss, there may be signs and symptoms of mild hypovolemic shock.

> Note: The greatest danger of heat exhaustion is that it may rapidly progress to heat stroke, which can be life-threatening.

Signs and symptoms

- Pale, cool, clammy skin,
- body temperature is usually normal but may be low,
- weak, rapid pulse,
- rapid, shallow respiration,
- headache,
- nausea,
- profuse sweating.

Treatment

Do the following:

1. Remove the patient to a cooler environment.
2. Remove any extra clothing.
3. If conscious, give cool water, preferably with one teaspoon of salt added per litre.
4. If available, administer oxygen.
5. If you do not notice signs of recovery after a short rest, transport the patient to a medical aid facility. Other medical conditions may be at play.

Heat stroke

This is the most life-threatening of the heat exposure injuries. Heat stroke is fatal if not treated immediately, and has a fairly high mortality rate even when treated.

Heat stroke is the result of the collapse of the body's cooling system. Without any effective mechanism for heat dissipation, the body's temperature rises. The delicate structures of the central nervous system are usually affected. Death may rapidly ensue if conditions are not corrected.

Signs and Symptoms

- rapid onset of the condition,
- hot, dry, flushed skin,
- full, rapid pulse initially. May become irregular or decrease progressively,
- deep respirations initially, becoming progressively more shallow,
- muscle twitching or convulsions,
- dilated pupils,
- very high body temperature (above 40 C),
- progressive decrease in the level of consciousness, leading to unresponsiveness and death.

Treatment

Do the following, depending on availability of water and materials:

1. Remove as much clothing as possible.
2. Cool the patient down rapidly. A cold shower, or immersion in cold water, is ideal.
3. Wrap the patient in a sheet and sprinkle with cool water.
4. Place cold packs under the arms, on the neck, groin and behind each knee.

5. Administer high flow oxygen.
6. Stabilize and monitor vital signs.
7. Transport the patient to a medical aid facility without delay. Watch for evidence of hypothermia from too much cooling!

Exposure to hazardous materials

Workplace Hazardous Materials Information System 2015 (WHMIS)

The Workplace Hazardous Materials Information System (WHMIS) is a comprehensive plan for providing information on the safe use of hazardous materials used in Canadian workplaces. It was originally created in 1988 with representatives from government, industry and labour unions to ensure that Canadian workers are aware of the safety and health hazards that may be associated with the materials or chemicals they use every day at work, a right to which they are entitled under law. (see Canada Lab our Code and the Canadian Occupational Safety and Health Regulations (Part X).

Exposure to certain hazardous materials can contribute to, and even cause, many serious health issues such as: organ (kidney, lung, or liver) damage, sterility, cancer, burns, central nervous system damage, and rashes. Some materials are safety hazards on their own and can cause fires or explosions. WHMIS was implemented to reduce and eliminate injuries, illnesses, deaths, medical costs, and fires caused by hazardous materials.

A modified WHMIS, referred to as WHMIS 2015, now incorporates the Globally Harmonized System of Classification and Labelling of Chemicals (GHS). This includes new criteria for hazard classifications and requirement for labels and safety data sheets (SDS). WHMIS 2015 will be implemented over a multi-year transition period to allow for adjustment to the new system.

Implementation and responsibilities

WHMIS 2015 is enforced by the Labour Branch of Human Resources Development Canada for federal workplaces, and by the provincial or territorial agencies responsible for occupational health and safety for most other workplaces. The following link provides a list of the appropriate provincial authorities by province as not all provinces have identical agencies.

Implementation and responsibilities

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http://www.ccohs.ca/oshanswers/legisl/

http://www.ccohs.ca/products/publications/WHMISafterGHS.pdf

WHMIS 2015 continues to be managed through the implementation of four specific processes:

1. Hazard identification and product classification:
2. Use of specific product labels;
3. Creation of safety data sheets (SDSs); and
4. Education programs for employees and employers.

Employers are required to establish education and training programs for workers exposed to hazardous products in the workplace. Employers must also make sure that the products are labelled appropriately including workplace labels as needed, SDSs are present and available to workers for each product, and ensure appropriate control measures are in place.

Workers are required to participate in the training programs available to them and are additionally responsible for the use of that information to help them work safely with hazardous materials. They should become familiar with any hazardous materials in their workplace, obey all of the prescribed precautions and warning labels. They are also responsible for informing their employers when labels on containers have been accidentally removed or if the label is no longer readable.

Safety data sheets (SDSs)

A safety data sheet (SDS) is prepared by the supplier or manufacturer of the hazardous material. It is a document that contains information on the potential hazards (health, fire, reactivity and environmental), use, storage, handling and all emergency procedures related to the material. In other words, this sheet provides all of the information required to work safely with the controlled products as regulated by WHMIS 2015 legislation. All controlled products fall into one or more of nine WHMIS 2015 classes as noted in the chart below.

WHMIS 2015	Types of Hazards
	**Gas cylinder** (for gases under pressure)
	**Flame** (for fire hazards)
	**Flame over circle** (for oxidizing hazards)
	**Skull and Crossbones** (can cause death or toxicity with short exposure to small amounts)
	**Health hazard** (may cause or suspected of causing serious health effects)
	**Exclamation mark** (may cause less serious health effects or damage to the ozone layer*)

	**Corrosion** (for corrosive damage to metals, as well as skin, eyes)
	**Exploding bomb** (for explosion or reactivity hazards)
	**Environment*** (may cause damage to the aquatic environment)
	**Biohazardous infectious materials** (for organisms or toxins that can cause diseases in people or animals)
* The GHS system also defines and Environmental hazards group. This group (and its classes) was not adopted in WHMIS 2015. However, you may see the environmental classes listed on labels and Safety Data Sheets (SDSs). Including information about environmental hazards is allowed by WHMIS 2015.	

Information on SDS

There are eleven sections that must be present on an SDS in Canada, and four (sections 12 to 15) that are optional for information to be provided. They are as follows:

	SDS Section	Information Requirements (partial list)
1	Identification	Product identifier, recommended use and restrictions on use, supplier contact information, emergency phone number.
2	Hazard identification	Classification (hazard class and category), label elements (including hazard pictogram, signal word, hazard statement and precautionary statements) and other hazards (e.g. thermal hazards).

3	Composition/information on ingredients	For a hazardous product that is a substance: the chemical name, synonyms, CAS No. and the chemical name of impurities, stabilizing solvents and stabilizing additives where classified and that contribute to the classification of the product. For a hazardous product that is a mixture: for ingredients that present a health hazard, the chemical name, synonyms, CAS No. and concentration. Note: Confidential Business Information Rules may apply.
4	First-aid measures	First-aid measures by route of exposure as well as most important symptoms/effects.
5	Fire-fighting measures	Suitable (and unsuitable) extinguishing media, specific hazards, special equipment and precautions for fire fighters.
6	Accidental release measures	Protective equipment, emergency procedures, methods and materials for containment and clean up.
7	Handling and storage	Precautions for safe handling, conditions for storage, including any incompatibilities.
8	Exposure controls/ personal protection	Exposure limits, engineering controls, personal protective equipment.
9	Physical and chemical properties	Appearance, odour, odour threshold, pH, melting/ freezing point, boiling point and range, flash point, upper and lower flammable or explosive limits.
10	Stability and reactivity	Reactivity, chemical stability, possible hazardous reactions, conditions to avoid, incompatible materials, hazardous decomposition products.
11	Toxicological information	Description of various toxic effects by route of entry, including effects of acute or chronic exposure, carcinogenicity, reproductive effects, respiratory sensitization.
12	Ecological information*	Aquatic and terrestrial toxicity (if available), persistence and degradability, bioaccumulative potential, mobility in soil.
13	Disposal considerations*	Safe handling and methods of disposal, including contaminated packaging.
14	Transport information*	UN number and proper shipping name, hazard classes, packing group.
15	Regulatory information	Safety, health and environmental regulations specific to the product.
16	Other information	Other information, including date of the latest revision of the SDS.

Copies of all relative SDSs documents should be available at all locations where that particular hazardous material is being used, as well as in a location where first aid personnel will have ready access in any emergency

Burns

A burn is an injury to the skin, or deeper tissues of the body, caused by contact with heat, radiation or chemicals. The contact causing the burn may be in the form of:

- hot solids,
- liquids,
- steam, air or other gases,
- sunlight or ultraviolet light,
- electricity,
- X-rays, radium, or
- chemicals such as strong acids or alkalis.

Burns damage the skin or tissues and result in loss of body fluids. This can cause shock. Burns can also lead to infection; so blisters should be kept from breaking and the burns protected with sterile dressings.

Classifications of burns

When first examined, classification of burns may be difficult or even impossible. However, they can generally be classified according to the depth of tissue damage.

First-degree burns

A first-degree burn is a superficial skin burn that merely reddens the skin. This burn will have minor pain associated with it, and can be compared to a mild sunburn. It usually heals in two to five days, and leaves no scarring.

Second-degree burns

Second-degree burns, or partial-thickness skin burns, involve both the epidermis and the dermis, and may blister the skin. These burns, which can resemble a sunburn with blistering, will probably be the most painful type of burn because the nerve endings are damaged. They will take five to 21 days to heal, unless infection occurs resulting in a longer period of recovery.

Third-degree burns

Third-degree, or full-thickness burns, destroy the skin completely and may extend into the deeper tissues, sometimes even charring the muscle and bone. This type of burn may not be very painful because the nerve endings may also have been destroyed.

Estimating the size of the burn area

It may be difficult to determine the depth of a burn until long after it occurs, but you can estimate the area burned.

Any second-degree burn involving more than 10 per cent of the body area, around the mouth or the one per cent perineal area is serious. Any third-degree burn regardless of size is serious. These must be referred to a medical aid facility.

For small areas, it is possible to estimate the size of the burn by comparing it with the size of the patient's outstretched palm and fingers, which represents an area of about one per cent. For larger burn areas the rule of nines is useful.

Figure 1: First-degree burn
Figure 2: Second-degree burn
Figure 3: Third-degree burn

An infant's head represents a larger portion of the body's surface area than an adult's.

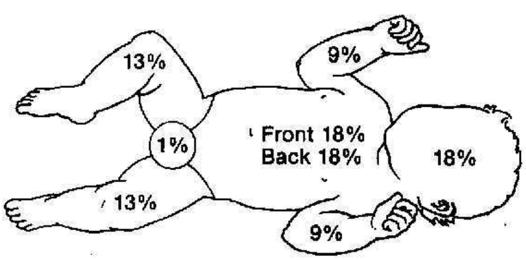

Figure 5: Rule of nines - infant

Shock in burn injuries

Shock in burn injuries is due to a fall in the effective circulating blood volume caused by drainage of fluids from the burn. Drainage of a fluid similar to plasma into the area of a burn causes swelling and

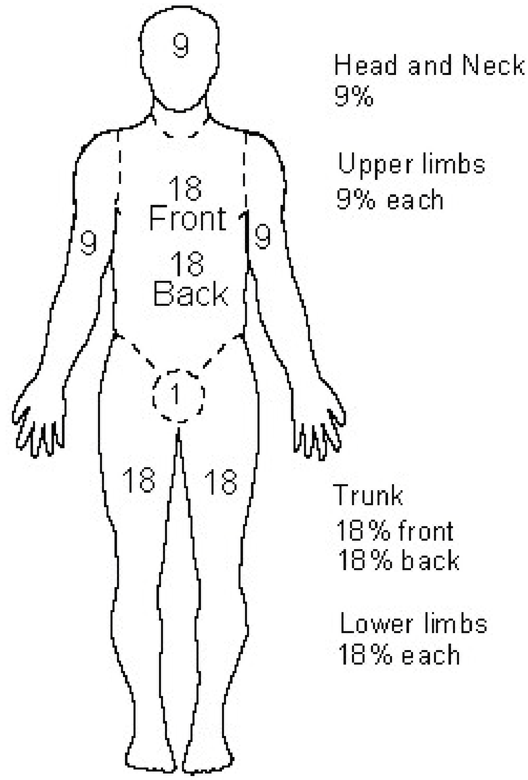

Figure 4: Rule of nines - adult

blistering. The greater the area of the burn, the greater the loss of fluid. The body can compensate for this loss up to a point, but as the volume of the loss increases, hypovolemic shock occurs.

General treatment for burns

Do the following:

1. Remove the cause. If the patient is on fire, douse the flames with non-flammable liquid (water or milk) or smother the flames with blankets, sheets, rugs, etc.
2. Initiate basic life support if necessary.
3. Cool the burn using sterile water, if available, or use cool clean water.
4. Apply dry, sterile dressings to the burned area. If sterile dressings are not available, use several layers of cotton cloth. Dressings relieve pain by

protecting the burn from the air. They also help in the prevention of infection.

5. Treat for shock.
6. If the burn area was large requiring much cooling water, watch for hypothermia.
7. Transport to a medical aid facility.

For extensive burns (more than 20 per cent of the body), do not use water, due to the danger of hypothermia. Wrap the patient in clean sheets and transport to a medical aid facility.

Immediate advanced medical aid is required if you encounter any of the following:

1. Burns to the face, inside the mouth, neck, hands, feet or genitals.
2. Any third-degree burns.
3. Second-degree burns that cover more than 10 per cent of the body.
4. Burns that occurred as a result of an explosion.
5. Second- or third-degree burns in children or the elderly.

Common hazards treating burns

Burns are serious. Much of its treatment involves avoiding certain actions as described below:

1. Do not remove any charred clothing, metallic flakes or charred tissue from a burn. These materials have become imbedded (baked) into the skin and cannot be removed without causing more damage.
2. Do not apply absorbent cotton, wool, or other fibrous material directly to a burn. Strands of fibrous material tend to stick to the fluid being lost from a burn and increase the chances of infection.
3. Do not apply ointments to burned areas. Ointments form a barrier between the surface of skin of the burn and tend to hold in the heat.
4. Do not break blisters. Breaking the skin creates an open wound that allows body fluid to escape and increases the potential for infection.

Specific treatment for minor burns (Small and first-degree burns)

1. Immerse in clean, cold water for two to five minutes.
2. If unable to immerse the burn, use cold wet applications to relieve pain and decrease the depth of burn by reducing heat.
3. Cover with a sterile dressing.

Early application of cold water is the best treatment.

Chemical burns

The severity of the damage depends on the properties of the chemical, its concentration, and the duration of the exposure. Most chemical injuries are caused by acids or alkalis.

Some of the more common acids are: sulfuric (battery acid), hydrochloric (also called muriatic), nitric acid and acetic acid.

Acids cause early visible damage, but penetrate less deeply than alkalis. They are fairly easily washed out. If washed out immediately, there may be less serious damage.

Some of the more common alkalis are:

- Household bleach,
- Caustic soda (sodium hydroxide),
- Lye,
- Drain cleaners,

- Cleaning agents,
- Ammonia,
- Cement, and
- Plaster.

Strong alkalis will penetrate rapidly into tissue. Liquid alkalis should be diluted immediately with water; solid alkalis should first be brushed off, then any remaining chemical immediately diluted with water. This is especially important with eye injuries due to alkalis, since the chemical will bind with and penetrate cells quickly and cause blindness.

Treatment

Identify the cause, and secure the scene. **Do not go if unsecured**.

Do the following:

1. Wash out strong acid or alkali burns immediately with large quantities of water (at least 20 minutes). If the corrosive agent is in a solid or powder form, brush off as much as possible before flushing the affected area.
2. Remove clothing soaked with the chemical and wash the skin with large amounts of water.
3. If the chemical is in the eye, flush thoroughly with large amounts of water. Make sure that the upper and lower lids are both washed out. Continue flushing for at least 20 minutes.
4. Give general first aid as for burns. (see "General treatment for burns" on page 17-22)
5. Transport to medical aid.

Respiratory complications

The respiratory tract is susceptible to damage from the following heat-related sources:

- Inhalation injuries
- Thermal injuries, and
- Chemical injuries.

Inhalation injuries

Inhalation injuries include thermal (burns) and chemical (smoke or gas) sources. The severity is determined by the chemical nature of the substance, temperature, volume and toxicity of the substance.

Typically, inhalation injuries include airway damage or obstruction or lack of oxygen. The rescuer must be vigilant and continually monitor the patient's condition. Inhalation injuries may compromise ABCs. If such is the case, treat as a load and go. Prompt extrication, first aid and medical intervention will quite often be lifesaving. This must be done while keeping in mind the need to prevent further injury.

Thermal injury

In thermal injury, the respiratory tract is injured by the introduction of superheated air or steam.

Such injuries usually occur in an enclosed space, and occasionally in association with forest fires. The superheated air or steam may injure the outside or inside of the mouth and nose, throat, vocal cords, trachea, bronchi, or even the lungs. The damage is essentially a burn wound, and may rapidly become life-threatening.

After the injury has occurred, there is no effective way to limit a deterioration in the patient's condition: thermal injury can cause swelling of the airways, and may lead to fluid developing in the lungs (pulmonary edema). You must recognize this as a priority injury and initiate a rapid load and go. Administer high -ate oxygen and perform artificial respiration if necessary.

Signs and symptoms

- burns about the face and mouth,
- singed nasal hairs,
- soot in the nose and mouth,
- shortness of breath,
- wheezing,
- coughing up soot tinged sputum,
- raspy, course breathing (stridor),
- muffled voice,
- drooling,
- difficulty in swallowing,
- a swollen tongue, and
- agitation.

Smoke injury

Smoke is composed of soot and various chemicals. The immediate treatment is removal of the patient from the hazardous environment. Then any burning clothing must be removed or extinguished. If available, oxygen should be administered at a high flow rate with a non-rebreather mask and the first aider should provide assisted ventilations, if required.

Difficulty in breathing may not be evident for several hours after the exposure. All patients should be transported for medical evaluation even if they initially appear stable.

Electrical burns

There are two types of electrical burns:

- flash burns, and
- contact burns.

Flash burns

Flash burns are the result of an electrical short circuit producing an arc of intense heat causing direct surface burns.

Contact burns

Contact burns are those in which the body completes the circuit between an electric wire and the ground. Contact burns occur between the points where the current enters the body (entry wound) and leaves it (exit wound).

Contact burns are associated with an electric shock which may be more dangerous to the patient than the burn.

(see "Electrical shock" on page 17-26.)

The extent of the damage is usually much greater than just the area of contact especially at the exit point. If the patient is still in contact with the current, do not touch them, or the source of electricity until the current has been shut off by the proper authorities.

If you attempt a rescue without having the current shut off, you are exposing yourself to a grave risk to your own life.

Do not approach the area of a downed transmission line, since the high-voltage current may be propagated along the ground. When high-voltage transmission lines are involved, the power company must be called.

After the patient has been rescued and the vital signs maintained, give general first aid for burns. Transportation to medical aid is mandatory, as there may be other concealed damage.

Electrical shock

Electrical shock can be caused by contact with, or proximity to, high-voltage power lines; but it can also be caused by the lower voltage used in industrial and house wiring. The current usually travels through the nervous system and through the heart. This may cause a range of effects - anywhere from a mild electrical shock to respiratory arrest, cardiac arrest or cardiac fibrillation. In fibrillation, the heart does not produce an effective or co-ordinated beat, and therefore it pumps inefficiently.

When either a cardiac arrest or atrial fibrillation occurs, you will find no pulse. You must maintain CPR until a defibrillator can be applied. Defibrillators are now available to many basic care providers.

In the case of electrical shock from a high voltage wire, the patient is usually thrown away from the wire. In some cases, however, muscle spasm can cause the patient to freeze to the source. In this case you must make sure that the power is shut off.

In addition to its effect on the heart and the nervous system, electrical shocks may cause serious burns or wounds at the entry and exit points. If the patient was forcibly thrown from the wire, suspect a potential spinal problem and fractures, and treat accordingly.

Signs and symptoms

The patient may:

- Be thrown to the ground and/or rendered unresponsive.
- Have fractured limbs, caused by the violence of muscle spasms or associated falls.
- Experience violent muscular spasm.
- Have paralysis of the limbs.
- Is unable to speak, followed by amnesia.
- Have an entrance and exit wound.

Treatment

Do the following:

1. Give oxygen, if available.
2. If unresponsive but breathing and spinal problems are not anticipated, place in recovery position.
3. Monitor vital signs closely.
4. Apply AR/CPR, if required.
5. Treat for burns if any (see "Electrical burns" on page 17-25)
6. Transport to a medical aid facility.

Lightning strike

Lightning is caused by violent vertical air currents associated with the development of thunderheads. These produce large differences of electrical potential between clouds or the cloud and the ground.
The average voltage may be of the order of 10- to 20- million volts, but the duration of the lightning bolt is much shorter (of the order of 0.1 to one milliseconds). The duration is so short that often little energy is delivered to the body, and therefore

tissue damage and burns tend to be minor. The major effects are cardiac and respiratory arrest. The fatality rate is about 30 per cent.

The patient may be injured by a direct lightning strike, by ground currents, or by side flashes from nearby strikes. The most serious consequence of a strike is that the electrical current found in the proximity to a lightning strike may easily disrupt the normal rhythms of the heart or even stop it. The lightning strike may also explode clothing from the patient's body by instantly converting moisture to steam; therefore steam burns may also occur.

Signs and symptoms

- Respiratory arrest.
- Cardiac arrest.
- Unresponsiveness.
- Nervous system changes, such as paralysis or seizures.
- Shock-like signs.
- Fern-leaf-like burn pattern.
- Burns from clothing.

Treatment

1. Watch for further lightning strikes.
2. Be prepared to give basic life support.
3. Consider the possibility of spinal injuries and other trauma from the fall.
4. Apply oxygen if available.
5. Monitor and record vital signs frequently.
6. Consider all lightning strikes as load and go and transport to a medical aid facility as soon as possible.

Sunburn or ultraviolet light exposure

A major sunburn (extreme exposure to ultraviolet light) can make a patient quite ill.

Treatment

1. Cool the burned area and protect it from further injury by applying a damp dressing.
2. If no other injury exists, encourage a sunburn patient to take fluids orally to replace lost fluid.
3. Transport to medical aid if:
   - the burn covers a considerable area,
   - there are blisters, or
   - the patient develops a fever.

Conclusion

Many cold exposure injuries are the result of a failure to take proper precautions, whether this involves winter activities, water immersion, or chronic hypothermia. Most cold exposure injuries can be prevented by using common sense with the understanding of the mechanism of heat loss which will greatly help in preventing such injuries.

In hypothermia, the treatment differs substantially between a mild and moderately hypothermic patient, and a patient who has severe or critical hypothermia. In the first case, re-warming is the treatment of choice. In the second case, re-warming is contraindicated; instead, the patient should be kept at a constant temperature. It is therefore most important to understand the difference in the signs and symptoms of the various stages of hypothermia.

Once again, in the case of heat injuries, prevention is key. The patroller can help prevent heat injuries by pointing out the risks of heat-related illnesses and the importance of adequate fluid replacement on hot and humid days.

Heat stroke is a life-threatening condition. The patroller must be familiar with the signs and symptoms of heat stroke, be aware of the progression from heat exhaustion to heat stroke, and be prepared to act quickly.

Proper first aid treatment of burns will prevent infection, relieve pain, and maintain blood volume. Consider burns as an emergency potentially leading to the onset of shock.

Notes...

Poisoning, Drug and Medication Abuse

Upon completion of this chapter the student will be able to:

1. Recognize the signs, symptoms and explain the treatment for poisoning, drug and medical abuse.
2. Demonstrate the treatment for the conditions found in this chapter.

Learning outcome

Recognize, understand, and explain the treatment of poisoning, drug and medical abuse.

Not all first aid injuries are obvious. Poisoning (below) and drug abuse (see "Drug abuse" on page 18-9) are less obvious and potentially life-threatening situations.

Poisoning

Poisoning can occur in any one of four different ways:

- ingestion

  (see "Ingested poisons" on page 18-3),
- inhalation
  (see "Inhaled poisons" on page 18-3),
- injection
  (see "Injected poisons" on page 18-4), or
- absorption through the skin
  (see "Absorption (surface contact) poisons" on page 18-5).

Poison may enter your body the same way it entered your patient's body.

Self-contamination is especially true in cases of absorption or inhalation poisoning.

Always attempt to establish the nature of the poisoning agent before taking action that could endanger yourself or others. Remember, you will not help the situation, if you, or others, are endangered or disabled. **In fact, you will have created more patients.**

Be especially careful in administering AR or CPR if there is any possibility of poisoning agent on the lips, vomiting of poison, or exhalation of poisonous gases.

There is an almost infinite number of compounds that can cause poisoning.

Common examples include:

- pesticides,
- herbicides,
- gaseous compounds,
- medicines,
- household cleaning products,
- plants,
- paints,
- burning plastics,
- specific poisons,
- perfumes, and
- some food.

General signs and symptoms

Typically, signs and symptoms include:

- nausea,
- vomiting,
- abdominal pain,
- constriction or dilation of pupils,
- excessive salivation,
- excessive sweating,
- abnormal respirations or pulse,
- loss of consciousness, or
- convulsions.

Caution: Several types of poisoning can lead to cardiac arrest.

General treatment for poisoning

Your greatest asset in treating a patient who has been poisoned is the ready access to the resources of a poison control centre.

Rescuers should have their local poison control centre's number readily available.

To effectively handle the situation, the centre will need to know the following:

1. What is the poisoning agent?
2. How much was taken?
3. The mechanism of poisoning?
4. The patient's vital signs?
5. Was the poison:
   - ingested,
   - inhaled,
   - injected, or
   - absorbed through the skin?
6. How long ago was the poison taken?
7. What is the present status of the patient?

Procedures for handling cases of poisoning

There are two procedures for handling poisoning, depending on whether the patient is conscious or unresponsive.

Unresponsive patient

- Do not give fluids or induce vomiting,
- Check vital signs, and do the following:

  If vitals signs are normal or stable:

  1. Determine the poisoning agent.
  2. Call the poison control centre.
  3. Monitor the vital signs frequently.
  4. Transport as a load and go.

If ABCs are compromised

1. Determine the poisoning agent.
2. Call the poison control centre.
3. Perform AR or CPR (with appropriate barrier device).
4. Continue resuscitation.
5. Transport as a load and go.

Conscious patient

Check their vital signs, and do the following:

1. Determine the poisoning agent.
2. Call the poison control centre.
3. If directed, induce vomiting.
4. Monitor the vital signs frequently.
5. Transport as a load and go.

Collect any vomitus for laboratory analysis. Transport any containers that may have held the suspected poisoning agent with the patient.

Without early identification of the poison, treatment may be delayed. Any delay will be detrimental to the patient.

Ingested poisons

Ingested poisons are poisons introduced into the body orally (swallowed).

Signs and symptoms

Please see "General signs and symptoms" on page 18-2.

Treatment

Do the following:

1. Monitor vital signs,
2. Ensure that the airway, breathing and circulation are maintained.
3. Identify the poison and the amount, if possible.
4. Call the poison control centre.
5. Follow the directions given by the poison control centre.
6. Transport to medical aid.

Induce vomiting only if directed by the poison control centre.

Do not induce vomiting if:

- The patient is unresponsive or convulsing.
- The poison is a known corrosive agent such as:
    - acid,
    - lye,
    - drain cleaner, or
    - a poison that contains petroleum distillates such as kerosene, gasoline, oil, lighter fluid, or liquid furniture polish, or
    - if it has caused burns to the lips, mouth or throat.

Inhaled poisons

Inhaled poisons are poisons introduced into the body through the respiratory system (breathed in). The most common cases are those of carbon monoxide poisoning.

Signs and symptoms

In addition to the general signs and symptoms of poisoning (see "General signs and symptoms" on page 18-2), other signs and symptoms include:

- respiratory distress,
- coughing,
- pain and burning in the throat;
- pain in the chest, and
- cyanosis.

Treatment

Do the following:

1. Remove the patient from the contaminated atmosphere as quickly as possible with the least amount of risk to yourself and others.
2. Check and monitor vital signs.
3. Ensure that the airway, breathing and circulation are maintained.
4. Initiate artificial respiration/ cardiopulmonary resuscitation as necessary.
5. Administer oxygen, if available.
6. Identify the poisoning agent, if possible.
7. Contact the poison control centre and follow their instructions.
8. Transport to medical aid.

If the environment is unsecured (unsafe), do not intervene, call emergency services, such as the fire department, and inform them of the situation.

Injected poisons

Injected poisons are poisons introduced into the body via a break in the skin. See also Insect stings (page 18 - 7) and Snake bites (page 18 - 8).

Signs and symptoms

- confusion,
- disorientation,
- delusions,
- pain,
- tenderness at the site of entry,
- swelling at the site of entry,
- unresponsive, or
- diminished function or failure of the respiratory or circulatory systems.

Treatment

Do the following:

1. If swelling is apparent, remove all rings, watches and jewelery from the affected limbs.
2. Apply a pressure immobilization bandage (see below).
3. Check, maintain and monitor vital signs.
4. Identify the poisoning agent, if possible.
5. Call the poison control centre.
6. Follow the directions given by the poison control centre.
7. Transport the patient to medical aid.

Pressure immobilization bandage

A pressure immobilization bandage is a tourniquet-like (venous tourniquet) device applied proximally (closer to the heart) to the injured or poisoned region of an extremity.

A pressure immobilization bandage must:

- completely encircle the extremity,
- be narrow enough to impede circulation, and
- be wide enough that the skin is not damaged.

A pressure immobilization bandage impedes circulation sufficiently to impede venous return to the heart, but not as tight as to completely eliminate arterial supply. A peripheral pulse should still be palpable.

Figure 1: Pressure immobilization bandage

Absorption (surface contact) poisons

Absorption poisons are introduced into the body through the skin, often with no visible sign of entry.

Some poisons can penetrate the unbroken skin.

Common absorption poisons include:

- pesticides,
- herbicides,
- corrosives,
- acids,
- alkalis, or
- some petroleum distillates.

Signs and symptoms

- nausea,
- sweating,
- skin irritation,
- burns,
- abdominal and substernal tightness,
- abdominal cramps,
- profuse salivation,
- respiratory distress,
- muscle twitching,
- seizures, and
- paralysis.

Treatment

Do the following:

1. Protect yourself from skin contamination by the same agent, wear gloves and other barrier devices as appropriate.
2. Remove the agent from continued skin contact by:
   - Removing any contaminated clothing from the patient, and
   - Washing the area with copious amounts of water including directing a stream of water under the contaminated clothing as it is being removed.

Caution: Always check if the substance could react to water. The poison control centre will provide you with instructions.

- If the poison is solid or in granular form, remove as much of it as possible by brushing before washing with water.

3. Identify the poison.
4. Call the poison control centre.
5. Follow the directions given by the poison control centre.
6. Transport the patient to medical aid.

Poisonous plants

Toxic plants such as poison ivy, poison oak and poison sumac grow throughout much of North America. The reaction caused by poison ivy, poison oak and poison sumac; **urushiol-induced contact dermatitis**, is an allergic reaction. Most people will become sensitized with repeated or more concentrated exposure.

It can take from 24 hours to 10 days for a rash to first appear. The rash persists typically one to two weeks and in some cases up to five weeks. Since this is an allergic skin reaction, people may develop progressively stronger reactions after repeated exposures. Reactions can progress to anaphylaxis.

Signs and Symptoms

- Itching.
- Inflammation (skin blisters).
- Oozing.
- Burning sensation.

Urushiol-induced contact dermatitis is contracted by contact with a plant or any other object containing urushiol oil.

A simple skin exposure is most common, however ingestion can lead to serious, more systemic reactions. Burning plant material can create urushiol-laden smoke that causes systemic reaction as well as a rash inside the throat and on the eyes.

Treatment

If contact with urushiol has been made, contact must be stopped as quickly as possible.

Do the following:

1. Cleanse exposed areas with rubbing alcohol.
2. Wash the exposed areas with water only (no soap yet, since soap can move the urushiol, which is the oil from the poison ivy that triggers the rash)
3. Wash the area with soap and warm water.
4. Wipe everything that may also have contacted the plant, including shoes, tools, and clothes, with rubbing alcohol and water.

If a rash develops:

- For milder symptoms, refer patient to a dermatologist. Cooling with an ice pack can reduce inflammation and soothe the itch.
- For more severe signs of anaphylaxis along with a rash, follow the protocol for treating anaphylaxis and transport to medical aid immediately - load and go.

Insect stings

Stings from insects such as bees, wasps, hornets, ticks and spiders are prevalent particularly during the warmer months and are more common among children.

The body reacts to insect stings on two different levels, local and systemic.

Local response

Most individuals stung by an insect have only a local reaction.

Signs and symptoms

- pain,
- redness,
- itching,
- swelling in the form of a raised, firm welt, and
- possible broken skin with bites.

Treatment

Do the following:

1. If the sting was induced by a bee, carefully scrape the injection site in order to remove the stinger and its attached venom sac, if it is present.
2. Apply an ice pack to reduce inflammation and pain. Usually no further treatment is necessary.

Systemic response

In approximately five per cent of the population, a generalized systemic reaction occurs with insect stings, particularly bee stings.

The patient in these cases displays an acute allergic reaction to the venom, known as anaphylaxis.

In anaphylaxis, death can occur within as little as five minutes from the time of the sting.

These people may have their medication with them and may require assistance. (see "Anaphylaxis" on page 16-3).

Be prepared to deal with breathing problems.

Signs and symptoms

- difficulty breathing,
- swelling (particularly about the throat, tongue, eyes and nasal passages),
- skin welts, or hives,
- generalized itching,
- weakness,
- headache,
- abdominal pain,
- anxiety, and
- restlessness.

Treatment

Do the following:

1. Provide life support as indicated by checking and monitoring vital signs and assist the patient with taking their own medication if necessary.
2. If the sting occurred on an extremity, place a constriction bandage above the site (see "Pressure immobilization bandage" on page 18-4.)
3. If the stinger with its venom sac is present and visible, carefully scrape it from the skin. If it is a tick bite, grasp the tick with tweezers as close to the skin as possible. The tweezers should be held at a right angle to the main axis of the tick's body. Gently pull the tick away from the host's skin. Avoid twisting or turning the tick during

removal. Examine the tick to ensure that it has been completely removed.

4. Apply an ice pack to the area to reduce pain and local blood flow.
5. If possible, collect and transport any insect that may be the source of the bite for identification purposes.
6. If possible, cleanse the area with saline solution or soap and water. Apply dressing if necessary.
7. Transport the patient without delay to a medical facility.

Jellyfish stings

To inactivate venom from a jellyfish sting and prevent further venom being injected, the site of the sting should be liberally washed with vinegar (4% to 6% acetic acid solution) as soon as possible and for at least 30 seconds. After the nematocysts are removed or deactivated, the pain from jellyfish stings should be treated with hot-water immersion when possible. The water should be as hot as can be tolerated for an immersion of approximately 20 minutes.

Snake bite

In North America there are four groups of poisonous snakes:

- copperheads,
- coral snakes,
- rattlesnakes, and
- water moccasins.

In Canada, the most serious threat is from rattlesnakes.

The venom of rattlesnakes, copperheads and water moccasins is primarily a hemotoxin. A hemotoxin is a poison that alters normal characteristics of blood, particularly its ability to clot.

A coral snake's venom affects the nervous system.

> Note that poisoning does not necessarily occur in all incidences of snake bite.

Signs and symptoms

- bleeding under the skin and purplish discoloration after several hours,
- blood blisters,
- sweating,
- vomiting,
- rapid pulse,
- limb numbness,
- weakness,
- faintness,
- low blood pressure, or
- severe burning pain and immediate swelling at the bite site, increasing over the next six to eight hours.

If no swelling has occurred after one hour, injection of venom is unlikely to have occurred.

Treatment

Do the following:

1. Calm and reassure the patient.
2. Have them lie down and keep them quiet throughout transportation to hospital.
3. Do not give them any alcohol.
4. Rings, watches and constricting clothing should be removed, if possible, to avoid a tourniquet effect as swelling progresses.
5. Clean the bite site with soap and water or an antiseptic solution, if available.
6. Locate the fang marks and place a pressure immobilization bandage. A pressure immobilization bandage can

be a broad elastic or a torn item of clothing bound from the distal portion of the bitten limb firmly up over the bite site) around the entire length of the bitten extremity (see "Pressure immobilization bandage" on page 18-4.)

7. Immobilize the extremity in a splint to reduce circulation in the limb.
8. Check and monitor vital signs. Ensure that the ABCs are maintained.
9. Under no circumstances should an ice pack or cold pack be applied to the area. Some types of snake venom are activated by cold.
10. Transport the patient to medical aid.
11. If possible, advise the medical facility prior to the patient's arrival in order to have the antivenom ready for them.

Drug abuse

A drug is defined as any chemical that modifies the function of living tissues resulting in physiological or behavioural changes. A vast array of chemicals, many of which are common in everyday living, can be thought of as drugs. Therefore, it is important to realize that any drug has the potential of being abused.

Drug use is defined as the usage of therapeutic or non-therapeutic substances to produce a desired effect with minimum hazard. Drug abuse, on the other hand, is defined as drugs taken or administered under circumstances and at doses that significantly increase their hazard potential.

Commonly abused drugs include:

- tranquilizers,
- antidepressants,
- analgesics,
- alcohol,
- prescription medication, and
- solvents.

The development of a tolerance to the effects of a particular drug results in the user requiring progressively larger doses to derive the perceived benefits of that particular drug.

In an attempt to reproduce the original effect of a drug for which they have an increased tolerance, it is not uncommon for some drug users to take dosages substantially larger than the accepted lethal dose of a drug.

Type of drug dependence

Psychological dependence is a craving for the repeated use or a compulsive use - not necessarily abuse - of a drug because its effects are deemed pleasurable or satisfying.

Gratification dependence occurs when there are no disturbing withdrawal symptoms after the use of a drug is discontinued, or when treatment following abstinence from the drug is not necessary or is minor.

Emotional dependence occurs in people who experience major emotional withdrawal symptoms and who require significant treatment following abstinence.

Physical dependence is a dependence of the body's tissues on the continued presence of a drug even in the absence of psychological dependence. This shows up as disturbing or life threatening withdrawal symptoms that develop when the drug is discontinued.

Signs and symptoms

Signs and symptoms vary with the type of drug the patient has been using or abusing.

Type	Signs and symptoms	Examples
Alcohol	• breath odour, • nausea, • vomiting, • lack of coordination, • slurred speech, • emotional instability, • loss of inhibitions, • aggressive, violent behaviour and abusive language, • deep respiration, • facial flushing, or • dilated pupils.	
Glue and solvents	• characteristic strong odour of glue or of other chemicals, • symptoms of intoxication similar to alcohol, • euphoria, • uncoordinated gait, or • slurred speech.	

Type	Signs and symptoms	Examples
Barbiturates	• decreased blood pressure, • decreased respiration rate, • slurred speech, • involuntary horizontal eye movement, • lack of physical coordination, or • absence of alcohol odour.	• Nembutal, • Seconal, • Amytal, • “yellow jackets", • "goofballs" • "reds", • "downers", and • "blue heavens."
Minor tranquilizers Minor tranquilizers are frequently prescribed medication. Although similar to those associated with barbiturates, Valium or Librium are not toxic enough to cause immediate death if taken in quantity. However, any abuse is to be treated.		
Narcotics Narcotics carry a high potential for psychological and physical dependence.	• nausea, • vomiting, • constricted pupils, • constipation, • decreased respiration rate, • unresponsiveness to pain, • lethargy, or • numerous injection sites along veins of the arms or legs.	• codeine, • morphine, • heroin, • Demerol, and • Percodan.

Type	Signs and symptoms	Examples
Stimulants	• dilated pupils, • loss of appetite, • over- or hyperactivity, • rapid speech, • belligerence, • suspiciousness, • confusion, • rapid and strong pulse, • shallow respiration, • dry mouth, or • profuse perspiration	• methedrine, • dexedrine, • Benzedrine, • Ritalin, • caffeine, and • cocaine.
Cannabis	• intoxication and euphoria without drastic change in judgment or gait, • reddening of the eyes, • increased pulse rate, • unusual hilarity, or • increased appetite.	• marijuana, and • hashish.
Hallucinogens	• markedly dilated pupils, • unusual hilarity, • emotional swings, • suspiciousness, • bizarre behaviour, • nausea and vomiting, • increased pulse rate and blood pressure, • sweating, or • anxiety.	• LSD 25, • psilocybin, • DMT, • DET, • mescaline, • DOM, • STP, and • ecstasy.

Treatment

If the patient is conscious, do the following:

1. Introduce yourself; attempt to carry on a conversation.
2. Attempt to establish their current state of mind.
3. If possible, attempt to "talk them down" and place them in a quiet, dimly lit room.
4. Try to establish the causative drug for the patient's current state.
5. Be aware of sudden changes in personality or behaviour.
6. Arrange transportation to medical aid. Never assume that any altered level of consciousness or personality changes are the result of drug ingestion, even in someone appears to be clearly intoxicated by alcohol.

Treat as per any other patient with an altered level of consciousness.

If the patient is unconscious, do the following:

1. Establish the presence of vital signs.
2. Maintain and monitor vital signs.
3. Question bystanders and/or search the surroundings to establish the patient's past medical and drug history.
4. Transport the patient to medical aid.
5. Transport any findings to hospital with the patient.

FYI: Opioid related life-threatening emergencies (aka: opioid overdose)

• There is an increased incidence of opioid-related deaths, and the prevalence of overdose education and naloxone distribution programs that equip laypeople to provide first aid in an opioid - related emergency.

• A responder who has naloxone available may administer naloxone.

• Basic life support (CPR /AED) should not be delayed to administer naloxone.

• Responders should always activate emergency medical services and stay with the person until help arrives.

• First aid and naloxone administration is not a substitute for definitive medical care. All people who receive naloxone should access professional care.

• Availability of naloxone and naloxone training vary by region and jurisdiction.

Conclusion

When dealing with poisons, the first consideration is that of your safety. That includes making sure that the air is free of poisonous gases, and that inhaled, ingested, or skin contact poisons cannot harm you. Of special concern are strong poisons that could be on the lips of the patient, in any vomitus, or exhaled from the lungs. In such cases your own protection is vital. You should use barrier devices such as pocket face masks or disposable filters.

While poisoning is not a commonly encountered problem in winter first aid, drug abuse problems are unfortunately surprisingly common. Anaphylactic reactions can occur in any setting and at any time of the year. Treat these conditions appropriately and aggressively, and do not fall into the trap of thinking that someone with an altered level of consciousness, and alcohol odour to the breath, just needs to sleep it off. Regrettably, many of these people will not reawaken.

Miscellaneous Treatments

Upon completion of this chapter the student will be able to:

1. Recognize the signs, symptoms and explain the treatment for miscellaneous injuries.
   - Demonstrate the treatment for the conditions found in this chapter

Learning outcome - recognize, understand, and explain the treatment of miscellaneous injures.

There are many injuries or first aid situations that do not fall easily into one of the standard categories, these include:

- eye injuries (below),
- ear and nose problems (see "Ear and nose problems" on page 19-5),
- tooth injuries (see "Tooth injuries" on page 19-6),
- abdominal problem (see "Abdominal problems" on page 19-7),
- childbirth (see "Childbirth" on page 19-7),
- miscarriage (see "Miscarriage" on page 19-9), and
- critical incident stress (see "Critical incident stress" on page 19-10).

Eye injuries

First aid eye injuries include:

- foreign body in the eye (see "Foreign body in the eye" on page 19-2),
- burns of the eye or eyelid (see "Burns of the eye or eyelid" on page 19-3),
- lacerated eyelid (see "Lacerated eyelid" on page 19-4),
- lacerated eyeball (see "Lacerated eyeball" on page 19-4), and
- solar keratitis (see "Solar keratitis" on page 19-4).

Foreign body in the eye

Check for contact lenses, especially with an unresponsive patient. If found, do not remove the lenses but record their presence to inform hospital personnel.

Only those foreign bodies lying on the surface of the eyeball can be removed safely by the first aider. An unskilled attempt at removing an embedded particle may result in severe damage to the eyeball or in extreme cases, blindness.

Signs and symptoms of an embedded object or a loose foreign body are the same but treatment differs substantially. An embedded object must be referred to medical aid.

Signs and symptoms

- redness of the eyes,
- irritation,
- tearing eyes,
- pain,
- visible presence of a foreign body embedded in, or on, the patient's eyeball.

Treatment for a loose foreign body

1. Tell the patient not to rub the eye.
2. Wash your hands thoroughly before examining the eye.
3. To dislodge the particle do the following:
   - Have the patient grasp the lashes of the upper lid gently.
   - While looking down, the patient should pull the upper lid forward and downward over the lower eyelid.

   This may dislodge a particle under the upper eyelid sufficiently to be washed away by the tears.

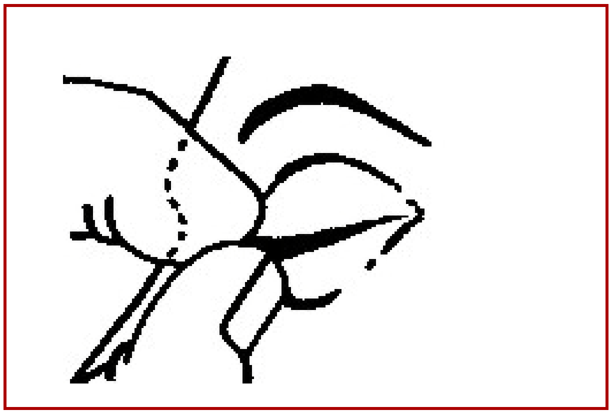

Figure 1: Grasp the lashes of the upper lid gently

4. If method one above fails, the foreign body must be located first by looking under the lower eyelid:
   - Look under the lower lid. With the patient facing a window or a light, place your thumb near the edge of the lower lid and pull downward, while the patient looks up.
   - If a foreign body is found, it may be removed with the corner of a clean handkerchief, cotton swab, sterile gauze or folded edge of a fresh tissue.
5. If method two above also fails, the foreign body must be located first by looking under the upper eyelid:
   - Prepare a cotton-tip applicator. If none is available, use a wooden match, its tip wrapped with cotton wool.
   - With the eye closed, grasp the lashes of the upper lid firmly between the thumb and first finger and pull down and away from the eyeball.
   - Instruct the patient to look down.
   - Place the applicator across the outer surface of the upper lid about halfway down, and press downward lightly.

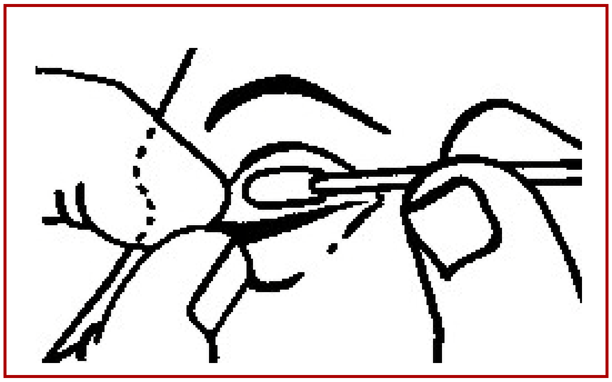

Figure 2: Placing the applicator on the upper eyelid

- Pull the lid out and up over the applicator. This folds the upper lid back over the applicator, and the inner surface may be clearly seen.

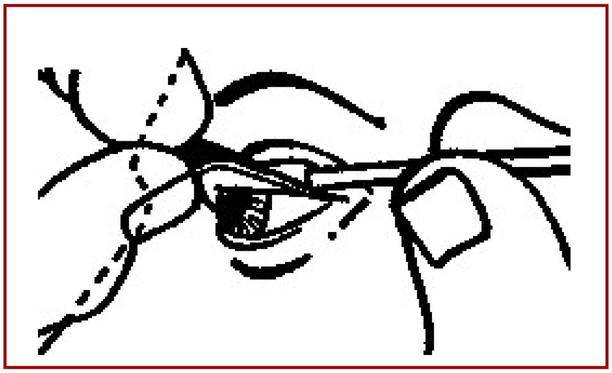

Figure 3: Pulling the upper eye lid out and over

- If a foreign body is present, it may be removed with the corner of a clean handkerchief, cotton swab, sterile gauze or folded edge of a fresh tissue.

6. If the above measures fail, treat as a lacerated eyeball and transport the patient to medical aid immediately. (see "Lacerated eyeball" on page 19-4).

Treatment for an embedded object

Do the following:

1. Tell the patient not to rub the eye. Rubbing scratches the eye membrane and may drive the particle (embedded object) deeper into the tissues, making its removal more difficult.
2. Wash your hands thoroughly before examining the eye.

   You may inadvertently transfer dirt from your hands into the eye.
3. Be gentle and cautious when examining the eye. Eyes are easily damaged.
4. Do not attempt to remove the embedded particle.
5. Cover the eye with a dressing.
6. Transport to medical aid.

Burns of the eye or eyelid

Burns to eyes or eyelids occur as a result of chemical reactions (e.g. contact with acid) or heat (e.g. flame).

Signs and symptoms

- redness,
- charred appearance of the skin,
- severe pain,
- reduced vision.

Treatment of chemical burns

1. Dilute the chemical immediately, by flushing the eye with water or an already prepared or manufactured sterile saline solution.
2. It may be necessary to hold the patient's eyelids open.

3. Flush the eye for at least 20 to 30 minutes. If possible, continue flushing en route, preferably using sterile saline solution.
4. Apply a moist dressing and transport the patient to medical aid immediately.

Treatment for thermal burns

When suffering burns of the face from a fire, a patient's eyes usually close rapidly because of the heat. This reaction is a natural reflex to protect the eyeballs. However, the eyelids remain exposed and are frequently burned.

The treatment of burned lids requires specialized care, therefore apply moistened sterile dressing and transport the patient to medical aid immediately.

Lacerated eyelid

Lacerations to the eyelid often occur in conjunction with serious injuries to the face or eyeball (see Lacerated eyeball, below).

Signs and symptoms

- profuse bleeding due to the rich blood supply.

Treatment

1. Apply pressure directed upwards against the forehead.
2. Do not apply direct pressure to the eyeball.
3. Transport the patient to medical aid immediately.

Lacerated eyeball

Lacerations to the eyeball may occur either as a single injury, or along with multiple injury sites such as broken bones.

This can be a very serious injury if fluid is lost from the inside of the eyeball. Ensure that the patient is transported comfortably and that nothing increases the pressure on the eyeball, for example, sudden movement, coughing, or tight dressings.

Signs and symptoms

Signs and symptoms include pain at and around the site of the wound, bleeding, or the presence of tearing in the eye.

Treatment

Do the following:

1. Do not exert pressure on a lacerated eyeball. This could force fluid out of the eyeball.
2. Do not remove a protruding foreign body from the eye.
3. Pad around the eye and cover with a dressing.
4. Transport the patient to medical aid immediately.

Solar keratitis

Overexposure to the sun’s ultraviolet (UV) rays can burn eye lids and the cells on the eye’s surface, which can lead to searing pain and the feeling of having sand in the eyes.

Prevention

Prevention is the best method of treatment. Wear dark glasses or sun goggles. Improvise goggles with a cardboard disk or leather. Slit the cardboard or leather in the form of a T (one for each eye) and place over the eyes.

Signs and symptoms

- blurred vision,
- irritation
- burning sensation increasing to intense pain,
- redness of the eyes,
- eyelid twitching,
- swelling,
- sensitivity to light,
- tearing eyes,
- temporary vision loss (called photokeratitis, or snow blindness).

Similar signs and symptoms can be experienced or exacerbated when an irritating substance like sunscreen and sweat get transferred into the eyes. These substances can temporarily irritate the delicate membrane over the eyeballs, making them sting or burn.

The treatment for sunburned eyes and foreign substances like sunscreen or sweat in the eyes is the same.

Treatment

Do the following:

1. Move patient to a shaded, cool location (seated).
2. Check if patient is wearing contacts and remove them. If unable to remove a contact, flush eye with the contact in.
3. Assist patient to hold the eye lid open and flush eye with saline or commercially available eyewash solutions. In lieu of saline, use cool water and continue with treatment as outlined. Flush the eye from the inner corner toward the outer corner. This prevents a substance in the eye from washing into the other eye.
4. Monitor patient. The treatment may have to be repeated several times.
5. Use a light, cool compress or ice towel to reduce the pain. If a small ice pack is used, place a wet cloth (single layer) between the ice and the skin. Do not use chemical cooling packs on the eyes.
6. After flushing the eye, encourage the patient to wear dark glasses or cover the eye with a sterile bandage or cloth. Keeping the eye closed may help reduce pain.
7. If the pain is still not controlled, send to medical care.

Ear and nose problems

There is little that first aid can do in practice for internal injuries to the ear or nose.

Earache

Refer the patient to medical aid.

Foreign body

Refer the patient to medical aid if they have a foreign body in their ear or nose.

If a foreign body is present, warn them not to blow their nose.

Tooth injuries

A blow to the mouth area may cause teeth to pop out of the gum or fracture. In some cases, broken permanent teeth can be saved if proper care is taken.

Due to the nature and location of tooth injuries, examine the patient for signs and symptoms of head, neck or spine injury and address these accordingly. If these injuries can be ruled out, follow the procedures below.

Types of tooth injuries

Tooth injuries, from a first aid standpoint, may be:

- general injuries, or
- specific tooth injuries.

General tooth Injuries

General tooth injuries can be treated as follows:

1. First protect yourself from body fluids and reassure the patient.
2. Recover the tooth, whole or broken.
3. Preserve the tooth, if broken or cracked off. If a sensitive dental nerve is exposed, and the patient is alert, have him cover it with gauze to protect it from cold air. If you find an avulsed tooth, handle it by the crown only, and replace it in the socket if possible. It may be cleaned by holding it under a stream of gently running water or saline solution. Never rub or vigorously clean the tooth.

   If unable to replace in the socket, place the tooth in a small container of milk. If the patient is alert, have him or her transport the tooth by holding it in his or her cheek and caution against swallowing.

   When possible, an avulsed tooth should be re-implanted by an oral surgeon within 30 minutes.
4. Transport the patient and tooth to dental aid. Call ahead and advise dentist of pending arrival of patient and include a note with pertinent information to the dentist.

   In the case of a chipped tooth, the broken piece can easily be transported wrapped in gauze.

Specific tooth injuries

A specific tooth injury is one in which the tooth is cracked off. If a tooth is cracked off, it should be sent with the patient to the dentist. It may assist the dentist in making a determination regarding the patient's treatment.

Sign and symptoms

- Severe pain in the mouth area.
- Bleeding from the mouth.
- Guarding of mouth by patient.
- Shock.
- Broken and/or loose tooth.
- Sensitivity to cold.

Abdominal problems

Children often swallow small objects such as coins, pins or tacks. In any of these cases, do not give anything by mouth and refer the patient to medical aid.

Abdominal pain

There are many causes of pain in the abdomen or "stomach," some of which are serious.

Refer the patient to medical aid. Make sure it's non trauma related. If the injury is trauma related, take necessary precautions and treat accordingly.

Childbirth

First aid for childbirth (or, more accurately, assistance with childbirth), requires common sense and professionalism on the part of the patroller.

Preparation

1. One of the first things to do is to ensure privacy for the mother and wash your hands to ensure they are clean.
2. Do not move the mother unnecessarily; lay her in the most comfortable position, preferably left lateral. If transportation is necessary, she should be carried.
3. When the mother is nearing delivery, look for the following:
   - breakage of the membrane which surrounds the fetus in the uterus, resulting in fluid flowing from the birth canal, and
   - uterine contractions.

   Contractions are the action of the uterine muscles dilating the birth canal and pushing the baby down and through it, to birth. They are involuntary and are intermittent.
4. Be aware that at the onset of labour (first stage) contractions occur at irregular intervals, and are:
   - Relatively mild, and short in duration (30 seconds) occurring at long intervals (often as much as 30 to 60 minutes apart).
   - Contractions progress as delivery nears. They become more intense, are longer in duration (50 to 60 seconds), and occur at short regular intervals (as close as two minutes apart), and

   These contractions continue until the cervix is completely dilated;
5. Transport the mother to medical aid unless the baby is crowning (the head of the baby is starting to show).

Delivery

Cleanliness, privacy, warmth, comfort and reassurance are all important during the birth process.

During the birthing process, all supplies should be kept as clean as possible, ideally sterile. If available, gloves, gown and mask should be worn.

The partner, family members or people who are accompanying the mother may also be a valuable asset.

There are three basic stages

First stage of labour

The first stage of labour begins with the regular contractions of the uterus and continues as the baby enters the birth canal.

During this stage, the cervix dilates (approximately 10 cm or 4 inches) to allow the baby to pass into the birth canal.

Second stage of labour

The delivery is the second stage of labour and is defined as the time from which the cervix is fully dilated until the baby is born. If it has been decided that there is no time to transport the mother to hospital, have someone try to summon a doctor or a person who has had some experience with childbirth.

Third stage of labour

The delivery of the placenta (or afterbirth) is the third stage of labour. It is usually delivered within minutes but may take as long as 30 minutes.

Procedure

Do the following:

1. Place the mother in the position she finds most comfortable - probably on her left side. Ask whether the mother has attended prenatal classes or whether she has a preferred position (such as squatting or kneeling).
2. Place absorbent clean material such as towels under her buttocks, and drape a blanket over her legs.
3. Have someone sit at the mother's head to reassure her and talk to her in a quiet, comforting way. Encourage the mother to relax and not to strain unless necessary.
4. If the mother complains that she has to move her bowels explain that this feeling is caused by the pressure that is exerted by the baby's head.

   During birth, the contractions change and are called expulsion contractions. The mother will feel the need to bear down and push at this point.
   This marks the end of the first stage of labour.

   Encourage the mother to push with each contraction, but not too hard as the top of the baby's head is being born. She should rest between contractions by panting or taking deep respirations.
5. Support the baby's head as it appears. Do not allow it to suddenly drop down from the vagina. Once the head is delivered, clear the baby's airway by stroking the nose to drain mucous and liquids.

   Look and feel to see whether the umbilical cord is wrapped around the baby's neck. If it is, gently slip the cord over the baby's head if possible.

   The baby's head will turn towards the thigh and allow the shoulders to be delivered next. As the baby's abdomen shows up, put your other hand under the baby so that it is always held by two hands from that point on.

   Be careful, the baby is very slippery.

   Do not compress the baby's neck and do not let the baby's head hang straight down.

   The baby should breathe on its own right away, and may cry.

Figure 4: Baby's head appearing

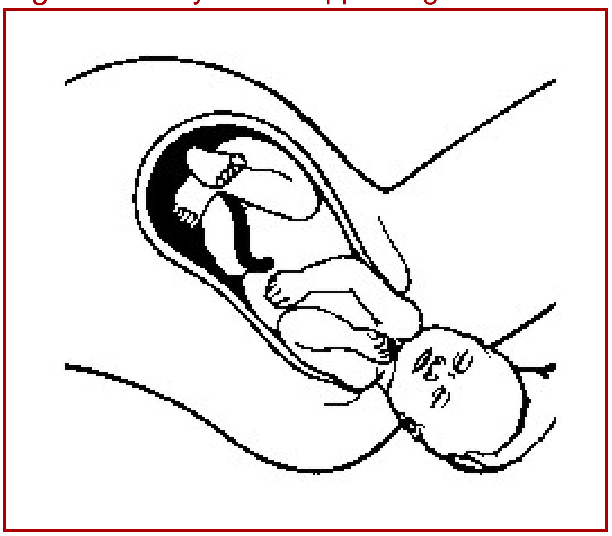

Figure 5: Baby's shoulders appearing

It should then be wrapped in a clean, dry blanket or cloth and placed on the mother's abdomen with the head lowered to help drain fluids. Do not cut the cord. Keep the baby warm. This ends the second stage of labour.

If the baby appears unresponsive, be prepared to administer infant AR or CPR.

6. After the birth of the baby, expect about 300 to 500 millilitres of vaginal bleeding.

The weight of the baby on the mother's abdomen helps the uterus contract and expel the placenta.

7. Place the placenta in a plastic bag or basin, and take it to the hospital to be examined for completeness; retained pieces of placenta will cause persistent bleeding.
8. Check the lower abdomen to see if the uterus is firm. If the uterus is not firm and the mother is hemorrhaging, gently massage the abdomen to help it contract. Check the uterus frequently and report its condition to medical aid.

Miscarriage

A miscarriage is the spontaneous termination of the pregnancy at any time before the fetus is capable of living outside of the womb. This time is defined in terms of:

- weight of the fetus of 400 grams (14 oz.), or less, and
- the length of pregnancy is 20 weeks, or less.

Signs and symptoms

Although the patient generally knows she is pregnant, signs and symptoms include:

- vaginal bleeding (first sign), which may be slight, moderate or heavy,
- cramps, after the bleeding has started, or
- a combination of both is an almost certain sign of abortion.

Treatment

Do the following:

1. Keep the patient at rest and reassure her.
2. Give nothing by mouth (she may require surgery).
3. Observe for signs of shock (pallor, rapid pulse, shallow breathing, coldness).
4. Keep her warm.
5. Preserve clots and tissue passed. This material may of use to doctors after the patient arrives at medical aid.
6. Transport the patient to medical aid immediately with preserved material.

Conclusion - miscellaneous injuries

The conditions described as miscellaneous injuries may be annoying, frightening and painful. But they do not immediately endanger the patient. They may, however, develop into a more serious condition, so it is important to reassure the patient and transport them to medical aid.

Critical incident stress

Patrollers possess many of the same characteristics as other fellow emergency workers.

These traits include:

- A need to be in control.
- A strong desire to do a perfect job.
- Compulsive, tend to repeat the same actions in very similar events.
- Highly-motivated by internal factors.
- Action-oriented.
- High need for immediate gratification.
- Easily bored.
- Risk takers.
- Strong need to be needed.
- Strong sense of dedication.

These traits allow patrollers to work effectively in the emergency setting.

During the process of assisting patients, it is natural to have emotional feelings. However, when the emotional reaction is so powerful as to overcome or severely impair your ability to think and act, you experience a personal "critical incident."

Cause of critical incident stress

Critical incident stress (CIS) is defined as a normal response, experienced by normal people to an abnormal event.

Patrollers are often the first people at abnormal events. Critical incident stress is most commonly associated with the following types of incidents:

- death or serious injury of a person,
- suicide or unexpected death,
- multiple-patient incident,
- death of a child (particularly if due to violence),
- serious injury or death of the patient or bystander during a rescue,
- situations when there is personal identification with the patient or the circumstances,
- any incident that attracts media attention, or
- when the signs, sounds and/or smell of the incident are so distressing as to produce a high level of immediate or delayed emotional reaction.

Signs and symptoms

The effects of critical incident stress may be felt at the scene or after the incident is over. CIS can manifest itself either physically, emotionally or in the individual's logical thinking process.

They include:

- physical conditions such as:
  - sudden fatigue,
  - nausea or vomiting,
  - shock-like symptoms,
  - twitching or tremors.
- thinking process conditions such as:
  - memory loss,
  - inability to clearly identify things by their proper terms,
  - confusion,
  - impaired thinking, or
  - reduced attention span.

After the incident, you may experience irritability, frustration, difficulty in concentrating, sleeplessness, or flashbacks associated with the incident itself or any personally appalling aspect of the incident, displays of anger and frustration, sadness, or distancing yourself from family and friends.

You may become extremely self-critical of personal skills and question the ability to provide help to someone else in the future.

All of these feelings are normal following a critical incident and will eventually pass with time.

Treatment

The effects of CIS can be greatly reduced by simply talking to another trusted patroller about the incident and the feelings it generated. Talking with the other patrollers who were a part of the incident is even more powerful. The sooner the incident is discussed, the better.

A good time to discuss the day's events is prior to leaving the hill, at the end of the day. A discussion of each incident managed during the day will allow all patrollers to tell their side of the incident and thus provide answers to some of the more gnawing questions. It provides a safe forum to describe feelings, release pent-up or suppressed emotions as well as being an excellent education opportunity.

It is an opportunity to put the incident in perspective. If a discussion is held at the end of each and every patrolling day, it will become a normal routine, rather than a special process to be used only for special incidents. This will help reduce the natural reluctance that rescuers feel in discussing the emotional sides of an incident.

Critical debriefing

When one or several patrollers are involved in a particularly distressing event, it may be possible to provide a critical incident stress debriefing to the rescuers.

A debriefing is an educational process designed to reduce the emotional aspects of the event.

Debriefings take place with the help of a specially trained professional. At times, a debriefing team may be required, made up of peer support people and individuals trained both in rescue and the debriefing process. The team can provide the guidance to bring the debriefing to a positive conclusion and provide the monitoring and additional counselling that may be required by members who may be experiencing a more heightened stress reaction.

Conclusion - critical incident stress

Emergency workers who talk about their emotions in a debriefing have found that they are better able to manage their feelings and maintain a normal balance in their lives with less impact on their loved ones. They are able to put the event into a more realistic perspective faster than those that have not participated in the debriefing process. Managing the emotional side of incidents will allow you to patrol for a longer time and enjoy it more.

Notes...

Pediatric First Aid

Upon completion of this chapter the student will be able to:

1. Identify the differences between adults and pediatric patients.
2. Understand how to effectively communicate and examine pediatric patients.
3. Differentiate between treatment protocols for adults and pediatric patients.

Learning outcome

Recognize, understand, and explain the treatment of pediatric patients.

Introduction

Pediatric patients are different from adult patients and as such, have different needs than those of the adult patients. Pediatric patients need to be treated with special care and attention.

Children of different ages are found at ski hills, lodges and their facilities. Younger children can be found at daycares that are provided at ski hills.

It is therefore important to be able to communicate and treat all ages of children, not just those you may find on the hill.

Pediatric age groups

The pediatric population is divided into the following age categories:

Infant	up to one year (some texts may refer to one to 18 months and is acceptable)
Toddler	one to four years
Child	five to 12 years

Anatomy and physiology of the pediatric patient

A child's body grows and develops into their adult form by approximately eight years of age. The tongue is proportionately larger than an adult in comparison to the size of the mouth. The tongue is the most common cause of airway obstruction, especially when the neonate is supine.

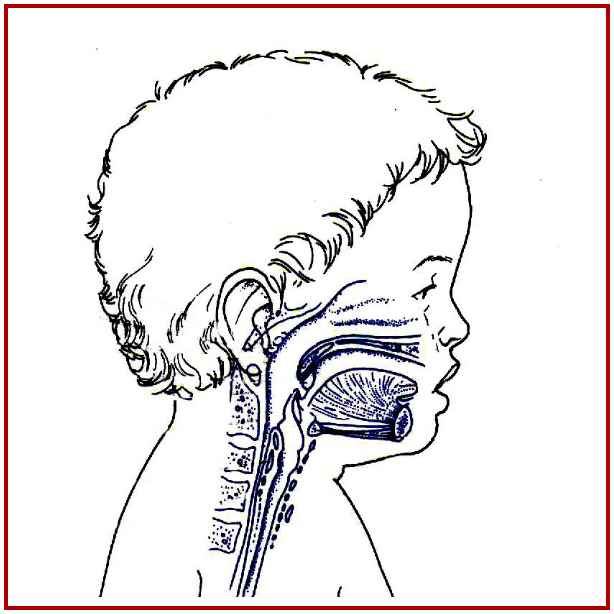

Figure 1: Infant

Trachea

The trachea is smaller and can become easily obstructed when there is swelling. The narrowest part of the adult airway is the vocal cords, whereas the narrowest part of the child's airway is the subglottic area at the cricoid cartilage. This gradually changes until the age of eight when the airway becomes similar to that of the adult. The airway size can be estimated by using the diameter of the child's little finger.

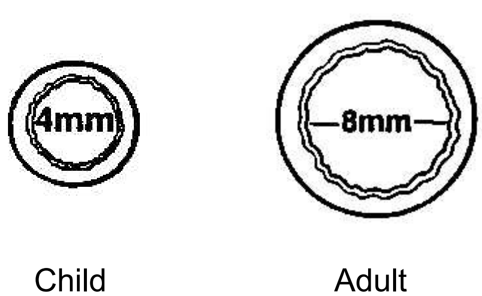

Figure 2: Airways

It will be roughly the same size as the narrowest part of the airway. For that reason, when managing the infant's airway, the neck is slightly extended, but should never be hyperextended because it will cause an airway obstruction.

Blood volume

The blood volume of a child is 80 to 90 ml/kg. When a child loses blood, the heart rate increases constricting the blood vessels and compensating for the blood loss.

Since a child cannot sustain the increase in heart rate, eventually the blood pressure falls. The fall in blood pressure indicates that the child has lost 30 per cent or more of their blood volume and that the child is in shock.

A loss of 200 ml of blood - which is less than a cup - will cause the following percentage of volume loss:

Age	Total blood volume for age	% of blood loss
One year	800 ml	25%
Five years	1,440 ml	14%
10 years	2,400 ml	8%
15 years	4,000 ml	5%
Adult	5,000 ml	4%

Ribs

The rib cage of a child under the age of six is comprised of more cartilage than bone. A child's rib cage is more flexible than an adult's; this allows forces exerted over the chest to be dissipated over a larger area. This is the reason why children have less significant rib fractures than adults, even when greater force is applied during an injury.

Abdomen

The abdominal muscles of a child are not fully developed and therefore do not provide adequate protection for the abdominal organs. The ribcage does not protect the child's liver and spleen as they are proportionately larger than an adults. They additionally protrude farther into the abdomen, making them more susceptible to injury.

Bones

A child's bones are softer and more flexible than that of an adult until the age of 10 to 12. This is why children tend to get greenstick fractures. Greenstick fractures refer to bones being bent rather than broken. Long bones such as the humerus and femur have growth plates that are located at the end of the bones. Damage to the growth plate can affect a child's development.

Head

The head of a child is the heaviest part (20 per cent of a child's body surface area) and is often the leading part in any fall. Helmet use must be encouraged in everyone, but is critical in children.

Heart rate

The heart rate of a child is faster than an adult. When stressed or injured, the child's heart rate will increase until it cannot compensate and then will fall. When the heart rate begins to fall, especially below normal, it is an ominous sign and the child may be in critical condition.

Communication with a child

It is very traumatic to a child to sustain an injury and go through the process of assessment, treatment and transport by the ski patrol, or any other emergency medical personnel. This experience will become a part of this child's life and will most likely be remembered for a long time. Your interaction with a child patient sets the tone for all other emergency workers who may have to take care of him or her. It is important to communicate with the child, and the parents, in a calm and professional manner. Both parents and children will have concerns over their situation; they should be given as much information as possible and each procedure should be explained to them briefly before proceeding.

Remember that you are a stranger and children are not supposed to talk to strangers. Introduce yourself as a good stranger, like a policeman or a doctor. Let them know that you are there to help them and that you will explain and let them know what you're doing before attempting any procedures or using any equipment on them. This is particularly important as some pieces of equipment can appear very intimidating to a child. For example, being in a toboggan pulled by a snowmobile can be terrifying for a child. If it is possible at all, have the parent ski beside the child and keep talking to them. If the child is not immobilized on a board and there is room, you may be able to put the parent in the toboggan with a small child. Parents and children have fears about pain and worry greatly anticipating it. The fear of loss goes both directions, depending on the age of the child, as both worry about losing each other.

It is sometimes impossible to keep a parent and child together. If this is the case, let them both know exactly what is going to happen and when they will be reunited. One of the hardest situations is when a child needs to be flown out by helicopter and there is only room for the child. The parents must then get in the car and drive to the hospital. Make sure they are given specific directions and have someone else drive, if at all possible. Give the conscious child something that will remind him or her of their parents, such as a T-shirt or sweater that has been worn by the parent. This will calm them. Let the child know that they will be reunited with their parents when they get to the hospital.

Children are often literal thinkers. If you "take their blood pressure," will you give it back? The following story shows how we need to think before we speak and ask before we do things:

A little girl named Liz who was suffering from a rare and serious disease. Her only chance of recovery appeared to be a blood transfusion from her five-year old brother, who had miraculously survived the same disease and had developed the antibodies needed to combat the illness. The doctor explained the situation to her little brother, and asked the little boy if he would be willing to give his blood to his sister. He hesitated for only a moment before taking a deep breath and saying, "Yes, I'll do it if it will save her." As the transfusion progressed, he lay in bed next to his sister and smiled. Then his face grew pale and his smile faded. He looked up at the doctor and asked with a trembling voice, "Will I start to die right away?" Being young, the little boy had misunderstood the doctor; he thought he was going to have to give his sister all of his blood in order to save her.

Each age group will require a slightly different approach to communicating with them.

Toddler

- Assess from head to toe and touch the sore spots last.
- Talk gently.
- Handle gently.
- Human restraints are better than mechanical ones unless spinal immobilization is required.
- Avoid separating the parent and the child if you can.
- If you use a toy or object to calm the child, such as a stuffed bear, set the ground rules right away. So for example, if you are going to take it back, let them know the bear needs to stay at the ski hill to help all the kids who get hurt. Do not just take it back as they go out the door or EMS will have to deal with a very upset child.

Preschoolers

- Watch what you say and how you say it. Preschoolers are literal listeners and thinkers.
- Cover up the blood. This age group will focus on the blood or the most graphic injury, not necessarily the most serious one.

- Use a gentle phrase and repeat it over and over. Make sure it is one that is the truth.
- Avoid the use of statements such as "you're okay," because in their world right now, they are not okay. To them that is a lie.
- Ask them what they like to be called and use that name. Do not call them buddy or sweetie.
- Let them know it is okay to be scared and that they can cry if they need to.

School age

- Explain what happened if you can. This group often feels the injury was punishment for something and that they will be in trouble for getting hurt. Reassure them.
- Include them in all conversations and explain what you are going to do. If you are going to perform a painful procedure such as moving a fracture to put on a splint, let them know and then do it immediately. Do not let them think about it for a minute or two.
- Assessments of this age group should be head to toe the same as is done with adults.
- Address their concerns and do not undermine them.
- Respect their modesty and avoid undressing them without covering them up with a blanket or sheet.
- Allow them to have some control over their situation as long as it does not impact the outcome. For example; "which ski boot do you want me to take off first?"

Teens

- Can give their own history most of the time.
- May not wish to be assessed or treated with family or friends present.
- Still need the reassurance of a six-year-old.
- Can become hysterical.
- Respect their modesty.
- Do not undermine their concerns.
- Be patient and gentle.

Principles for effective examination

- Be caring and gentle.
- Establish a rapport with the child and the parents.
- Avoid the use of medical terminology - talk to them and with them.
- Remain calm and confident.
- Make eye contact as appropriate.
- Get at a child's level.
- Try to give the child some control.
- Never lie to them.
- Instill positive thoughts.
- Describe in their words what they may feel.
- Do as much of your assessment as you can without touching. If you do touch, do so purposefully.

Parental reaction to an injury of their child

The parents of a child who is injured may react with shock, denial, grief, guilt, rage or hysteria. All of these reactions are normal for someone in this situation. Acknowledge their feelings and reassure them that they are okay to feel this way. Do not become angry at them even if they are mad at you. They are in a situation that is out of their control and this can make people very upset. Redirect a parent who is upset but consolable into an activity that will help the child such as holding their hand or telling a story to them. An extremely agitated parent may need to calm down before helping as they may upset the child even more.

Assessment of a child

Rapid cardiopulmonary assessment

Airway - Is it patent or not. If there is fluid in the airway (gurgling) turn them on their side to drain or suction it out.

Breathing - What is the rate? A very high rate may be caused by hypoxia or the body's need for more oxygen. This could be caused by an illness or by fluid/blood loss. A decreased respiratory rate most likely means the child is getting tired. This is a flag for you to be ready to support the child's breathing by artificial ventilation.

Is the child using abnormal respiratory mechanics such as grunting to keep the alveoli open between breaths, nasal flaring or any abnormal movements such as head bobbing to help move air in and out of their lungs? What is the skin colour? Are there abnormal sounds when they breathe such as wheezing or whistles?

Circulation - What is the heart rate? What are the pulses like and how do the distal (farthest from the heart - radial) pulses compare to the central (closer to the heart - carotid) ones? What is the skin temperature once you have them in a warm environment? Does it appear that the child is reacting normally for the age group? If a child just lays there and allows you to assess them with no fuss and only a blank stare, this may be an indication of the decreased blood flow to the brain.

Pediatric BTLS (basic trauma life support) primary assessment

Scene survey

- Safety, mechanism
- Number of patients
- Patient's reaction

General appearance

- Movement
- Skin colour
- Major bleeding
- Angulated fractures

Level of consciousness

- Recognizes parents
- Surroundings
- Presence of ski patrol

Airway and C-spine

- Airway open and clear
- Manual C-spine

Critical interventions

- Modified jaw thrust
- OPA
- Suction

Breathing

- Look
- Listen,
- Feel
- Rate and quality

Critical interventions

- Oxygen
- BVM

Neck

- Observe for trauma
- Observe work of breathing (retractions)
- Palpate for any trauma

Chest

- Observe for trauma
- Observe work of breathing (nasal flaring, retractions, grunting)
- Observe chest symmetry
- Auscultate if trained
- Palpate for trauma

Circulation

- Compare central and distal pulses
- Rate and quality
- Capillary refill
- Skin condition
- Stop critical bleeding

Critical transport decisions

- Unstable airway
- Obvious respiratory problems
- Shock
- Altered mental status

Packaging and rapid transport

- Critical interventions
- While preparing to transport, continue assessment

Abdomen

- Observe for trauma
- Palpate (tenderness, rigidity)

Pelvis

- Observe for trauma
- Palpate for trauma

Extremities

- Observe any trauma
- Palpate for any trauma
- Assess motor, power and sensation

Back

(Considered part of primary assessment, checked after logroll)

- Look for trauma
- Palpate for trauma

Normal vital signs

Age	Respiratory rate	Heart rate
Infant (less than one yr.)	30 to 50	80 to 160
Toddler (one to four yrs.)	20 to 30	80 to 120
Child (five to 12 yrs.)	12 to 20	60 to 110

Pediatric spinal care

The spinal immobilization devices that are designed for adults often do not fit a child. Many spider straps do not tighten small enough to secure a four-year-old. Check your equipment by using it on practice cases with children of different ages. There are many ways to immobilize a child on the adult backboard but the following method allows you to roll the child without movement if the child needs to vomit. Remove helmets prior to immobilizing the child.

- Place a properly sized rigid cervical collar. If a correct size is not available, move to the next step.
- Place a small pad such as a folded towel on the board that will pad from the child's shoulder to hips. This is done if the depth of the patient's head is greater than that of the torso. This will keep the spine aligned.
- Logroll the child onto the board and onto the padding if needed. Assess the back for trauma as you move them.
- Align the child along one side of the board.
- Pad the other side of the board with blanket rolls to take up the slack when you roll the patient.
- Cross the straps over the chest and pelvis, securing the body firmly.
- Secure the head with blanket rolls or blocks and tape in place.
- If you are using a child-sized board, you should place the child in the centre of the board with padding under the shoulder to hips if required. Many pediatric boards are molded to fit the child without any padding.

Notes...

Transporting Patients

Upon completion of this chapter
the student will be able to:

1. Identify the different methods of transporting a patient.
2. Demonstrate the identified methods of transportation.
3. Recognize the appropriate transportation method based on the patient, the injury and the situation.

Learning outcome

Understand and be able to effectively transport a patient

The purpose of transporting the injured is to remove the patient from any further danger and get them to a proper medical aid facility.

Transporting the patient

This section discusses the following:

a. actions taken prior to moving the patient ;
b. lifting techniques;
c. manually transporting the patient; and
d. transporting the patient by toboggan (see "Transporting a patient by toboggan" on page 21-5)

Each method of transportation has its own, unique set of actions that will ensure well-being and safety for both you and your patient.

Action prior to moving a patient

The most urgent priority in any emergency situation is control. You are a member of the Canadian Ski Patrol, tasked with first aid: Take command of the situation.

Before moving the patient, consider the following:

- the best method of transportation relative to the injuries;
- available material, either manufactured or improvised;
- assistance from bystanders;
- the weight of the patient;
- the route and the vehicle to be used, and
- reception arrangements at home or the hospital.

In certain circumstances, it may be necessary to move a seriously injured patient before injuries can be determined and treated. Such circumstances include drowning, electrical contact, cave-ins, fire, falling objects and gas.

As a general rule and of utmost importance is to avoid danger to yourself and others.

Lifting techniques

Before lifting a patient, explain what you will be doing and bear in mind the following:

- Always keep your back straight and lift with the legs when lifting anything heavy.
- When a change of direction must be made, turn your feet rather than rotating your back.
- Keep heavy loads as close to the vertical axis of the body as possible.

Manually transporting the patient

There are several methods of transporting a patient solely or with the help of others.

The basic techniques include:

- the human crutch (page 21-2),
- fore-and-aft carry (page 21-2),
- two-handed seat (page 21-2),
- three-handed seat (page 21-3), and
- four-handed seat (page 21-4),
- chair carry (page 21-4), and
- drag carry (page 21-5).

Human crutch

The human crutch is useful mainly in sports where there is a slight injury to one of the patient's lower extremities and the patient is conscious.

Do the following:

1. Stand on the injured side of the patient.
2. Place your arm around their waist, grasping clothing on their uninjured side.
3. Have the patient pass their arm around your neck. Grasp their wrist firmly with your free hand.
4. Instruct the patient to use your body as a crutch.
5. Step off together, with the inside feet.

This same method can be used with a patroller on each side of the patient.

Fore-and-aft carry

The fore-and-aft carry can be used to move a supine patient from the ground onto a bed or a stretcher when the patient is unable to assist you.

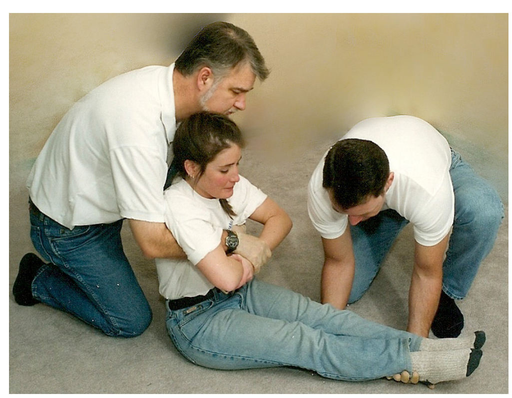

Figure 1: Fore-and-aft carry

Do the following:

1. Two patrollers assist the patient to a sitting position. Do not pull on the arms.
2. The patroller at the head reaches under the patient's armpits and grasps the patient's opposite wrists holding the patient's arms to their chest.
3. The patroller at the head then moves the patient's upper body tightly to their chest keeping the patient's back straight.
4. Facing the direction of the move, the second patroller squats at the side of the patient's legs and takes the patient's legs at the knees.
5. Simultaneously, the patrollers lift the patient to the appropriate surface.

Two-handed seat

Use the two-handed seat with patients light enough to be carried in this manner. For heavier patients, use the four-handed seat.(see "Four-handed seat" on page 21-4).

Figure 2: Two-handed seat

Do the following:

1. Two patrollers kneel, each on one knee on either side of the patient, each passing one arm around the patient's back, grasping each other's clothing.
2. They now pass their free arms under the patient's thighs and form either a hook grip or wrist lock with each other.
3. The patient places their arms around the patrollers' necks.
4. The patrollers rise together on a signal from the lead patroller.

Three-handed seat

Use the three-hand seat so one hand is free to support an injured leg or the patient's back.

Figure 3: Three-handed seat

Do the following:

1. The patrollers kneel, each on one knee on either side of the patient.
2. The patroller on the side of the injured leg keeps one hand free (left hand for left leg, right hand for right leg).
3. The other patroller grasps his own wrist as shown above.
4. Each patroller then grasps the other's free wrist.

5. The patient places their arms around the patrollers' necks and raises themselves slightly so they can place their three-hand seat in position.
6. While one patroller's hand supports the injured leg, both rise on a given signal.

Four-handed seat

Use the four-handed seat as a replacement for the two-handed seat for a heavy patient who is able to use his arms.

Figure 4: Four handed seat

Do the following:

1. The two patrollers kneel, each on one knee on either side of the patient and each grasps their own right wrist.
2. The patrollers now grasp each other's free wrist.
3. The patient places their arms around the patrollers' necks and raises themselves slightly so the patrollers can place their four-handed seat in position.
4. The patrollers rise together on a signal from the lead patroller.

Chair carry

The chair carry is used by two patrollers to carry a conscious patient down narrow stairs and passages.

Figure 5: Chair carry

The patient should be secured to the chair.

Do the following:

1. One patroller stands behind a chair and tilts it well back, resting the chair against their thighs. At the same time they extend their foot to the rear to brace themselves.
2. The second patroller stands between the patient's knees, facing the patient, then stoops and extends one leg behing him for support and balance.
3. Keeping the back and elbows straight, the patroller grasps the front legs of the chair around the patient's legs.
4. The patrollers rise together on a signal from the lead patroller.

Drag carry

The drag carry is used to move a patient along the ground by one patroller when that patient is unresponsive due to fire or gas. This keeps the rescuer and patient low where the air is freshest. It is also used in confined spaces such as tunnels where the rescuer cannot stand up.

Do the following:

1. With the patient supine, the patroller ties the wrists together in front of the body.
2. The patroller straddles the patient and places their head through the patient's arms.
3. The patroller then raises the patient's head and shoulders slightly with their neck.
4. The patroller crawls on the hands and knees, dragging the patient.

When descending stairs or, in case of a sudden drop, reverse the position and crawl backwards, supporting the patient's head.

Transporting a patient by toboggan

There are two steps to transporting a patient by toboggan:

a. loading the patient into the toboggan, and
b. transferring the patient from a toboggan to a bed or a car.

Loading the patient into the toboggan

Do the following:

1. Perform any necessary splinting and other first aid.
2. Position the patient across the hill or trail, ideally on a backboard for easier lifting.
3. Bring the toboggan to a position across the hill or trail, just above or below the patient. The position below the patient is preferred.

> Do not attempt to load a patient into a toboggan that is facing either uphill or downhill. This is especially important on steep terrain. Having the toboggan positioned below the patient makes it easier to load the patient into the toboggan.

4. Place a blanket in the toboggan for warmth before loading the patient.
5. If there is no spinal injury, pad under the head for comfort (e.g. sweaters,blankets). first aid kits should never be used as padding as it would make it unavailable to the patroller if needed.
6. Fold the flaps of the blanket over the patient.
7. Fold the flaps of the toboggan cover in place.
8. Strap the patient in.
9. Cover the patient's face if weather or snow conditions are such that it needs protection. The only exception to this is if there is a priority condition that necessitates maintaining the face uncovered.

   This action requires constant verbal monitoring of the patient's condition.

10. The position of the patient in the toboggan is important. In reaching a final decision about loading direction consider the type and location of injury as well as patient comfort. As an example; head injuries should be transported on a backboard with the head uphill, and if vomiting is a concern, tilt the patient and the board to either side to assist with the fluid drainage.

    Theoretically, the elevation of the head may reduce pressure from bleeding or swelling inside the closed space of the skull. However, it is not necessary to “switch ends” when transport requires temporarily travelling uphill (as the head will temporarily be downhill).

    Since vomiting may occur, be vigilant for the onset and be prepared to perform airway management.

    For nordic situations, the patient is generally transported with their head away from the handles when pulled by a snowmobile and towards the handles when pulled by a skier.

Transfer patient on a backboard from a toboggan to a bed

Do the following:

1. If the patient is on a backboard, ensure the patient is firmly tied down.
2. With one patroller at the head end and a second at the foot end of the backboard, lift the backboard, maintaining a straight back.
3. Move sideways to the bed and move the backboard onto the bed.
4. If the patient is heavy, use two more patrollers to help.

Transfer from toboggan to car

Do the following:

1. When loading a patient into a vehicle, place them in the back seat, if possible.

   If they have broken their lower leg and a short splint (wire mesh, board or cardboard) was applied, the injured leg should be toward the back of the rear seat to give added comfort when traveling.

   To accomplish this, load a patient with an injured right leg from the passenger side of the car, and the driver's side for the left leg.
2. Open the two back doors of the car. Bring the head of the patient toward the inside of the open door, approaching from the rear of the car. They will now be parallel to the car in a position beyond the swing of the door.
3. Swing the handle of the toboggan into a running position.
4. Two patrollers prepare to lift the patient at the shoulders.
5. The patient places their arms around the patrollers' necks and shoulders, each of whom places one arm behind the patient and the other hand under their thighs.
6. One patroller holds the injured leg, making sure that the splint is well-supported on each side of the fractured area.
7. The two patrollers at the patient's shoulders back toward the open car door. A third patroller enters the car and grasps the patient under both arms, taking over support from the two patrollers outside. They then ease the patient backwards onto the car seat.

If a third patroller is not available to help, one of the two patrollers enters the car while their partner continues supporting the patient.

The patroller inside then takes over the patient's support and eases them backwards onto the car seat.

Be sure the leading edge of the splint does not catch on upholstery, or the edge of the door.

Care should be taken when the doors are closed that the arm rest does not push against the patient's back or against the broken leg.

8. Once the patient is in position, slightly elevate the injured limb.
9. When using a ski pole splint, place the patient in the rear of the car with the injured leg pointing to the front seat.

   The splint must be supported at all times by the ski pole tips or baskets, usually by a patroller located in the front seat. Extra-long ski poles on a patient's leg may prevent transportation by standard passenger car and may require some other means of transportation.

   Send an assistant with the patient and driver.

   The assistant can assist the patient in case of an emergency en route, allowing the driver to concentrate on his driving.

Transporting a patient by stretcher

There are two steps to transporting a patient by stretcher:

- securing the stretcher, and
- loading it.

Securing the stretcher

1. Straighten the hinged transverse bars on the stretcher and lock them in position.
2. The leader should test the stretcher personally, making sure it will support body weight.

Loading the stretcher

At least four patrollers are required to load a patient onto a stretcher. One patroller will be in command.

The procedure is the same as for handling a spinal injury, but without axial immobilization at the head and feet.

1. After the patient is secured on the stretcher, lift the stretcher evenly, using two or more patrollers as the leader directs.
2. The patrollers should walk out of step with one another to prevent jarring the patient.

Summary

Avoid unnecessary movement of a patient. All movements should be slow and gentle. The patient should be transported in the position most appropriate to their injuries.

Unless this is a load and go situation (See “Load and Go’ on page 4-9), do not attempt transportation until all injuries are properly cared for and adequate personnel are available to help.

If a spinal injury is suspected, immobilize the patient on a backboard. Whenever the patient is being moved, apply axial immobilization at the head and feet without twisting or bending the spine. Transport them securely tied to a backboard.

Move the toboggan or stretcher to the patient, rather than the patient to toboggan or stretcher.

Never step into or over the toboggan when loading a patient.

Notes...

Persons with Disabilities

Upon completion of this chapter the student will be able to:

1. Assess injured persons with disabilities using a whole person approach
2. Define the following terms:
    - Disability
    - Impairment
    - Handicap
    - Adaptive and adaptive equipment
3. Understand how athletes are rated according to their adaptive abilities
4. Describe and name five intellectual disabilities:
    - Traumatic brain injury
    - Stroke
    - Autism spectrum disorders
    - Attention deficit disorder (ADD) and dyslexia
    - Down syndrome, fragile X syndrome, and fetal alcohol syndrome
5. Describe and name seven physical disabilities:
    - Spinal cord injury
    - Cerebral palsy
    - Spina bifida
    - Multiple sclerosis
    - Muscular dystrophy
    - Amputations
    - Visual and auditory
6. Primary and secondary surveys
7. Manage and treat the following conditions:
    - Autonomic dysreflexia
    - Thermoregulation
    - Osteopenia/osteoporosis
    - Spasticity
    - Pressure sores
    - Fractures and dislocations
8. Identify specialized equipment:
    - Prosthetics
    - Specialized equipment
    - Snow sport equipment
9. Understand how to extricate a patient from adaptive gear
10. Chair lift evacuation
11. Special considerations

With the increased popularity of adaptive sports, rescuers may face unique challenges when assessing, treating and transporting persons with physical or intellectual disabilities. Successful primary and secondary assessments will depend on the rescuer's ability to identify certain conditions and communicate effectively with the patient.

There is a high probability that a rescuer, while on or off duty, will encounter an injured person needing specialized care. A recent estimate in the U.S. indicates that up to 20 per cent of the population has some form of disability or impairment, with neurological deficits, amputations, and muscular diseases forming the majority. Estimates for amputations quote that one out of every 200 people live with some form of limb loss.

There are few age limits for persons with disabilities. Children, adults and seniors may participate in a variety of adaptive sports. Restrictions are generally more related to equipment cost and opportunity rather than to the disability itself. Surprisingly, the risk of further injury is no greater for a disabled person than for an able-bodied one. The physical consequences of inactivity for persons with disabilities include reduced cardiovascular fitness, osteoporosis, obesity, and impaired circulation.

Whole person approach

Injuries sustained by persons with disabilities need not be overly complex. When comparing identical injury sites, there is often little difference between disabled and able-bodied patients. It is important to consider how a particular injury may affect the whole person. For example, a sit-ski athlete with a spinal injury, who falls on his shoulder, may suffer additional problems related to mobility. After treatment, he may have difficulty using a wheelchair and coping with daily needs and routines. The injury may go beyond what an able-bodied person might expect in terms of healing, recovery and the return to activity.

Treating a person with an intellectual disability may involve more social and psychological skills, and draw heavily on nearby resources, such as a parent, friend coach, or service animal. Once communication with the patient has been established, assessment and care of basic injuries will be similar to other patients.

A patient's sensitivity to words needs to be taken into consideration. For example, when performing an assessment, rescuers should carefully weigh their word choices. Instead of saying “see you later” to a person who has a visual impairment, try “I will check on you later.” Other words like physically challenged have been replaced by more appropriate terms such as physical disability. The outdated words mental retardation is now called intellectual disability. Terminology, like medicine, has improved with the times. When in doubt, ask to be corrected.

Definitions

Accepted definitions for disability include any physical or intellectual condition that hinders normal functions or daily activities. Persons with disabilities, whether inherited though genetics or acquired through trauma, prefer the term disability to handicap, which essentially means the same thing but more positive.

The word impairment has a broader definition. This can be a loss of a physical, physiological, or psychological ability and/ or the inability to perform daily tasks. A person may have impairment but not a disability. For example, a person with an amputation above the knee (impairment) may not have any problems reading, preparing meals, or driving a vehicle (disability). The person is able to wear a prosthetic, fit into alpine gear, and load the chairlift without any assistance. His impairment is not restrictive; it is adaptive.

The difference in the terms, although subtle, seems to indicate the level of assistance the person may require to achieve certain tasks. This can reveal his level of independence. If a person requires an aide or a guide in order to participate in an activity, he may have both a disability and an impairment (example: cognitive disability and a physical deformity.)

An adaptive participant describes any person with an impairment or disability who is active in sports. The equipment that is used is called adaptive equipment. It is highly specialized, custom built, and very expensive.

Rating the disability

The rating system for persons with physical disabilities who compete in sports is complex. It is based on a mix of diagnosed injuries and functional assessments. This method attempts to promote ability rather than dwell on the disability, and help to ensure fair results for all.

Ratings for intellectual disabilities are more broadly based on gender, age, medical history, medications, and ability. In competition, knowing the rating for participants ahead of time for a particular event may be useful. If the person is injured and unable to speak for himself, this information, coupled with their choice of adaptive equipment (example: alpine sit-ski), can be as important as a medic alert bracelet.

Intellectual disabilities

Intellectual disabilities include many conditions ranging from traumatic brain injury and stroke, to learning disorders, autism spectrum disorders (ASD), and genetic or environmental factors. Understanding some of the key attributes of these categories may help rescuers to provide more individualized care for an injured person.

Traumatic brain injury (TBI), also called intracranial injury, happens when the head, and/or body suffers a direct blow or jolt, causing the brain to collide with the inside of the cranium. Symptoms may be mild or complex, and produce a host of physical, cognitive, social, emotional, and behavioral effects. One of the most common injuries is concussion (single or multiple), which may produce temporary impairments to more permanent ones. Subdural and epidural hematomas are also included in this group and are covered in the manual (see "Intracranial bleeding" on page 10-6).

Stroke is a serious brain injury caused by a blocked artery (ischemic stroke) or a leaking or burst blood vessel (hemorrhagic stroke), which causes a disruption of blood flow to the brain cells. In what is often called a mini-stroke, a transient ischemic attack can also occur, although the patient's symptoms tend to clear up rapidly and completely. Signs and symptoms of stroke can be a loss of balance, weakness, trouble speaking or understanding, partial paralysis of the face, arm or leg, distorted vision, and sudden headache. Some of these effects may produce permanent damage; however, through adaptive activities, a disabled person may continue to participate in sports. Management of stroke from a rescuer perspective is covered in the manual (see "Stroke" on page 16-15).

Learning disorders make up two streams: attention deficit disorder (ADD) and dyslexia. Those with ADD may present with a short attention span, impulsive behaviour, restlessness, hyperactivity and inability to focus on, or absorb, new information. In dyslexia, individuals have difficulty processing new information, which may hinder their success in learning a new skill. These conditions are generally not related to below-average intelligence, but may make communication with rescuers more difficult. These persons, if in distress, may not be able to help themselves in an injury situation, or follow directions given by rescuers.

The ASD group includes typically those with developmental disabilities. These include autism (severe or mild), atypical autism, and Asperger's. These persons often have learning, behavioral, and language difficulties, which can make communication difficult. Many people with ASD do not exhibit outward signs of their disability until they are a difficult situation. Reactions to stress may include repetitive movements, isolating behaviors, aggression or seizures (petit mal). People with ASD may refuse care, or if left by themselves for a few minutes, wander away from the very people who are trying to help them. They are particularly attracted to water (rivers, lakes and pools), a combination that points to drowning as the leading cause of death.

In the case of Asperger's, the person may be very intelligent in facts and figures, but lack in empathy or social skills. These individuals will readily follow instructions from a figure of authority, but may also behave in impulsive and unpredictable ways. They should not be left alone until the situation has been resolved, and the person 'handed off' to emergency services, or a responsible friend or family member.

Most persons with genetic and environmental disabilities have life-long challenges. This group may exhibit below-average intellectual and social skills. Prenatal factors include Down syndrome, fragile X syndrome (seizures), and fetal alcohol syndrome. Caring for these individuals requires a great deal of patience and kindness. The best approach is to treat them as you would any other patient. If the person has an aide or caregiver, be sure to include him in any communication. Symptoms may include anxiety, hyperactivity, and poor decision-making, and it may take more time than usual to gain their trust and cooperation. Because they can easily become distracted, rescuers should try to remain as calm and understanding as possible.

Down syndrome (DS) in particular, is caused by an extra chromosome at conception that results in a wide range of physical and intellectual disabilities. Although their physical appearance may look similar from one individual to another (facial features, short stature, pleasant disposition), intellectual attributes can differ. A person with Down syndrome can be very competitive and less likely to complain about injuries or illness that may hinder his participation in the event. Because of the body's tendency toward lax ligaments, specifically those that stabilize the vertebrae, they are at increased risk for musculoskeletal injuries. Rescuers should perform careful assessments to avoid missing an injury that may have serious repercussions.

Physical disabilities

Spinal cord injury

Spinal cord injury (SCI) has varied causes. The damage may be due to an acquired injury, such as a vertebral fracture/ dislocation and subsequent trauma to the spinal cord during a dynamic event (see "Spinal Injuries" on page 11-1). Other causes may be due to congenital conditions, as in spina bifida and cerebral palsy. In addition, tumors, infection or polio will give varied neurological results on assessment.

Persons who have lost the use of their legs are called paraplegic, and those who have lost the use of all extremities are called quadriplegic. The resulting nerve damage in SCI affects sensory perception and motor control at or below the level of the insult. Above the injury site, the person may have normal pulse, motor control, sensation (see "Evaluate the pulse, motor response and sensation (PMS):" on page 4-15) and muscular strength. Below the injury site, depending on the level of injury, there may a partial or total absence of PMS.

Most persons with SCI know if their lesion is partial or complete. If the injury is complete, their bodies' autonomic functions can be compromised. For example, a spinal lesion between T1 and T4 may affect heart rate by limiting the maximum beats between 110 and 130 beats per minute. This may lead to insufficient tissue perfusion, or hypoxia, and a lower heart rate if the person is in distress.

Ostomies

Many individuals with SCI will have diminished autonomic body functions. A variety of medical adjuncts have been designed to help alleviate these problems. These include bladder catheter tubes, which empty into exterior urine collection bags, or a surgically created urostomy port, located near the anterior abdomen or kidneys. For the collection of feces, there may be an ileostomy bag, connected to the small intestine, or a colostomy bag, which empties the large intestine. The bags are connected to the ports by pliable silicon seals. Rescuers should take great caution when assisting a person with an ostomy bag, port and seal, as pressure may cause them to kink, leak or burst.

Autonomic Dysreflexia

A patient with SCI may be at increased risk for autonomic dysreflexia. This condition may be chronic in some people, or be caused by a new injury in conjunction with an overfull bladder, kinked catheter, impacted bowel, hypothermia, and other physiological stressors such as skin lesions, blisters, frostbite, in-grown toenail, tight or constrictive boots or clothing. These factors may trigger an inappropriate release of noradrenaline, a hormone that raises blood pressure by constricting blood vessels.

Autonomic dysreflexia to a patient with SCI is a true medical emergency and is equivalent in severity to an able-bodied patient experiencing a cardiac arrest.

Signs and symptoms

- Initially, no symptoms may be detected even though present
- Increased feelings of panic or anxiety
- Rapid increase in blood pressure (200/100mmHg) causes headache and/or blurry vision
- Slower heart rate - less than 60 beats per minute
- Flushing of patient's skin and sweating above the level of injury
- Below the injury site, sweating or shivering may not occur, and lack of innervation, or the loss of neural or electrical stimulation, may affect bladder and bowel function

Management

- Recognize the symptoms
- Monitor vitals, particularly blood pressure and heart rate
- Loosen constrictive clothing
- Remove any painful stimulus
- Survey for the cause - check bladder and bowel problems first. If the patient is conscious, ask for his/her permission and assistance
- Treat the patient sitting up to avoid increasing cerebral pressure
- Treat patient in warm and quiet surroundings if possible
- Prepare for rapid transport to a higher level of medical care

Cerebral palsy

Cerebral palsy (CP) is caused by a lack of oxygen to the brain and can happen during any of the three stages of childbirth. CP is not considered an intellectual disability. (see "Childbirth" on page 19-7). The subsequent brain injury presents as impaired voluntary motor function and coordination. The patterns of CP include spastic, athetoid, and dystonic. Spastic, which is the most common, has intermittent, jerky, and/or repetitive involuntary muscle contractions in one of more extremities. A person with athetoid has slower involuntary contractions, and dystonic has rigidity in one or more limbs. All forms of CP include impaired balance.

These persons are at risk for extremity injury from falls as they may not be able to protect themselves or recover from a loss in balance by reaching out. Fractures or dislocations may increase spasticity, which makes splinting, traction or immobilizing an extremity on scene very difficult.

Because of the issues with balance, most people with spastic or athetoid CP are more likely to Nordic or alpine sit ski, even though they are capable of walking.

Spina bifida

Spina bifida (SB) is a congenital malformation that exposes the spinal cord to injury via gaps in the vertebrae. Individuals report sensory or motor deficits in the vicinity of the lumbar region, or at the site of the malformation. One key problem may be an abnormal circulation of cerebrospinal fluid (CSF), which may cause increased pressure in the brain and spinal cord. Some patients may have a surgically implanted shunt to drain excess CSF into the abdominal cavity. If this tube becomes kinked or blocked as a result of trauma, the patient may develop a severe headache and a change in his level of consciousness. In this case, rescuers should request urgent medical services. A note of precaution: in children with spina bifida the prevalence of latex allergies is 25 to 65 per cent.

Persons with SB tend to be involved in Nordic and alpine sit ski sports, and are often engaged in high level competitions.

Multiple sclerosis

Multiple sclerosis (MS) is a progressive disease that affects both the central and peripheral nervous systems, although some people may have remissions lasting several years. As the condition progresses, the patient will complain of motor and sensory deficits. Additional emerging symptoms may include paralysis of the extremities, imbalance, fatigue, visual deficits, mood changes, and slurred speech. Even though difficult to communicate with at times, their mental status is alert and oriented.

Persons with mild MS may be able to ski standing, however as the disease progresses, fatigue and weakness make it very difficult to switch to sit ski.

Muscular dystrophy

Muscular dystrophy (MD) is characterized by spinal curvature, loose joints, weak and atrophied muscles, and fatigue. As in MS, persons with MD are alert and oriented unless they have an altered level of consciousness due to trauma. Statistically, more males than females suffer from MD. Most persons with MD choose to Nordic or alpine sit ski.

Amputees

Amputees form the largest group of adaptive participants and use a wide variety of adaptive equipment and prosthetics. Amputations can be congenital, traumatic, or surgical (due to osteogenic sarcoma (cancer), diabetes, toxicity, frostbite, chronic infections, and flesh-eating disease). Some people have more than one amputation, and there are partial losses, which affect to what degree they are able to participate.

Many people with an upper extremity amputation do well in standing snow sports. Those with a lower limb amputation can be fitted with a prosthetic, which allows for standing activities. In double lower leg amputations above the knee, most people prefer to Nordic or alpine sit ski.

Visual and auditory deficits

Visual and auditory deficits affect a large percentage of persons with disabilities and impairments. These individuals are involved in many of the same snow activities as sighted persons; however, a guide may be necessary to point out hazards. Visually impaired skiers have higher rates of injury when compared to sighted skiers. Rescuers must take care to explain in detail beforehand how they plan to provide treatment.

In general, individuals who are unable to hear are able to participate in any sport they choose. Although they may have some difficulties with speech, many can read lips and communicate quite well. Hearing impaired patients may slur their words, and speak in monotones; this should not be mistaken for an intellectual disability. In treating those with hearing loss, rescuers should face the patient, speak clearly and wait for an answer before asking the next question.

Primary and Secondary Surveys

Primary assessments for all patients regardless of disability or impairment should focus on airway, breathing, circulation, deadly bleeding and environment, as learned in the manual (see "Priorities" on page 4-2). With every approach, make sure to ask what a person's normal is. This will help to establish a baseline for further care. The fascinating and complex thing about a disability is that everyone is different. A carefully performed set of all vital signs and thorough secondary survey will likely uncover some deficits. Rescuers should monitor adaptive participants frequently and carefully in order to anticipate changes in status and act accordingly.

Management and Treatment of Specific Conditions

Autonomic dysreflexia

Please see "Autonomic Dysreflexia" on page 22-5.

Thermoregulation

Thermoregulation may occur in a person with a spinal cord injury at T6 or above. He may have trouble with temperature regulation in extremities due to a lack of sensory input, a lack of shivering response, and the inability of vessels to vasoconstrict. This may happen even in milder temperatures.

Patients with paralysis in one extremity may have decreased circulation in that limb. For example, a paralyzed arm from the shoulder may be tied to the body with a sling for stability during skiing. Another example is legs that are tightly squeezed into a sit-ski for a period of time. These limbs can become very cold as the person cannot feel any sensation. The left and right pulses, along with skin colour, moisture and warmth may also differ.

Signs and symptoms

- Confusion
- Pale and cold skin
- Vital signs are not equal or bilateral
- Shivering is absent
- Increased spasticity
- Increased risk for autonomic dysreflexia

Management

- Recognize the condition as serious
- Help to re-adjust the affected limb
- Perform precise vital signs comparing left and right extremities
- Re-warm the patient gently (see "Frostbite and superficial frostbite" on page 17-12)

Osteopenia/osteoporosis

Osteopenia/osteoporosis refer to bone health and mineral density. This gradual loss of bone thickness can predispose a person to musculoskeletal injuries and overuse syndromes, and result in paralysis and consequent immobility. Rescuers should be suspicious of fractures with seemingly 'benign' mechanisms, and muscular pain associated with repetitive movements in the operation of adaptive equipment.

Signs and symptoms

- Pain and or swelling
- No apparent symptoms from SAMPLE history
- Mechanism may be hard to identify

Note: People in wheelchairs have increased rates of shoulder overuse injuries and carpal tunnel syndrome.

Management

- Perform a thorough primary and secondary survey
- Ask for more detailed medical history
- Splint fractures with extra padding
- Transport as gently as possible
- Advise x-ray
- Management is done through diet and medication by physician care

Spasticity

Spasticity can occur in any individual with a spinal cord injury or injury to the brain (congenital or acquired). The most common is spastic CP and one cause may be an irritant. In some individuals, spasticity can occur frequently and is velocity dependent. It can worsen if the person's limbs are moved rapidly. Slow and careful attention by rescuers caring for a person with this condition is very important.

Signs and symptoms

- Increased muscle tone
- Clonus (series of rapid muscle contractions)
- Scissoring of the legs
- Fixed or frozen joints
- Increased reflexes
- Velocity dependent

Management

- Recognize the condition
- Determine and treat the stimulus
- Slow and careful handling
- Consider padding instead of splinting
- Maintain position of comfort
- Stay calm and reassure the patient

Pressure sores

Pressure sores can develop when skin suffers from friction or shear, caused when bony parts of the body, such as joint, are pressed against a hard surface, or the sheath of a prosthetic for long periods of time. Skin damage may also be caused by abrasions from clothing such as buttons, bulky seams, boots, objects placed in pockets, catheter connections, clamps, tight stockings, and some adaptive equipment. Blisters are a common annoyance and should not be neglected. Rescuers need to take all skin conditions seriously in order to alleviate pain and discomfort, and avoid future loss of mobility and/or infection. Even trivial sores should command attention.

Signs and symptoms

- Redness and swelling
- Joint pain
- Bleeding
- Infection and abscess

Management

- Remove the offending object(s)
- Protect the skin against further abrasion or irritation
- Pad the affected area well with sterile non-stick dressings
- Do not break blisters if they are unlikely to do so on their own. It is more difficult to treat large blisters that have burst because of the layers of moving tissue that are subject to friction, i.e., the dressings may not adhere.
- Manage secondary complications such as infection and abscess

Fractures and dislocations

Fractures and dislocations should be treated according to the manual (see "Fractures" on page 14-1). Stabilizing of injuries with persons with disabilities involves splinting in a position of comfort, or padding to provide structure. Do not try to splint a limb that is undergoing spastic movements, or place a deformed limb (that is the 'normal' for that patient) in a straight 'anatomical' position. If possible, rescuers should be flexible with regard to patients' choices. For example, if a patient wishes to sit up rather than lay in the toboggan, or be transported head uphill rather than downhill, some additional stress or discomfort may be alleviated.

In the case of lower-leg fractures with an amputated extremity, i.e., a femur fracture with an above-the-knee amputation, traction will be ineffective because rescuers cannot apply or maintain the device properly due to the shortened limb and absent foot.

Specialized Equipment

A prosthesis is an artificial body part that replaces a lost body part. In this section, only musculoskeletal parts will be considered. A below-the-knee amputation is called a B/K trans-tibial amputation, while an above-the-knee is called an A/K trans-femoral amputation. An A/E amputation is usually the upper limb between the elbow and the shoulder: trans-humeral or trans-radial. There are many different types of artificial legs, ankles and joints. They range in cost and technical sophistication, and may have been designed exclusively for the chosen sport. Because of the nature of snow sports, most prostheses will be mechanical, and not computerized or electrical.

For people who have difficulty with balance and strength, helpful tools include canes and crutches, which vary widely in style and composition. The person may hold the aid on either the affected side or the non-affected side according to preference. Additional aids include a sling made out of a loop and tether, which helps the disabled person to bring his leg into a desired position.

Wheelchair design varies widely and often caters to the specific needs of the individual. These chairs may be motorized, hand-powered, or pushed by a caregiver. Some have removable parts to ease entry and exit, and may have extra padding or back extensions. Wheelchairs that are used for snow sports tend to be more rugged with thicker, knobby tires for traction.

Most people will have a way that they like to be assisted for transport and should be asked for their preference whenever possible.

Snow sports equipment

Because of the variety of adaptive equipment, rescuers should take every opportunity to ask questions and engage in scenarios involving disabled persons. Many adaptive participants are very open to discussion, and take pleasure in the interest shown by others.

Engaging with disabled skiers is rewarding. Aside from the pure enjoyment, if a rescuer accompanies a sit-skier on the lift and they do a run together, the rescuer gains a closer look at the equipment and the opportunity to ask questions. Then, if a situation should occur at a later date, the rescuer will know more about the sit-skier and his injury.

Adaptive alpine skiers can be divided into four major groups:

- Sitting - mono-ski, bi-ski, sit-ski, sit-board, snow bike (the person sits in a bucket with a harness)
- Three-track and four-track - tethers (straps held by a helper skier) and outriggers (a light-weight Lofstrand crutch with a small ski attached)
- Standing - two track skis

- Visually impaired guided skiers

Figure 1: Alpine sit ski

Figure 2: Nordic sit ski

Adaptive Nordic skiers are classified into similar categories, with sitting, standing and visually impaired being the most common. Nordic sit-skis have lighter frames, and woven seats and straps replace the heavy buckets of their alpine counterparts. Sit-skis are custom made and depending on the disability, will have unique tie-downs. In biathlon, the participant's skill is challenged by the addition of target shooting, and in visually impaired skiers, an audio component with laser sighting replaces the loaded rifle.

Note: most Nordic skiers do not wear helmets even though the terrain may be steep and forested.

Visually impaired skiers will usually have one of two systems to aid their progress down the hill. The first is a backpack worn by the guide with a speaker, which transmits verbal directions to the skier/ boarder, which they follow by tracking the sound. The second is a radio headset and transmitter worn by both the guide and the blind skier. This is an expensive set-up and the rescuer must be aware of the equipment when doing C-spine control or removing a helmet. Do not cut the wires if at all possible.

Extrication Techniques

The most successful extrications are the result of a team approach. This may require as many as four rescuers: two to stabilize the patient and two to safely remove the equipment. Sit-skis can vary greatly in design from the recreational individual to the alpine competitor, and by manufacturer, in which case the individual will usually be able to give any specific instructions. Familiarization with the safe removal of a sit-ski is of vital importance to prevent any injury to the rescuer.

Carefully remove the gear from the patient. Alpine sit skis can be very heavy, and patients can be found upside down and suspended by their straps. It is safer everyone involved if the patient is stabilized by holding C-spine before the straps and hooks are released. The adaptive gear can then be lifted from the patient rather than pulling the patient out of a bucket.

Figure 3: Attending to a patient in a sit-ski

Transporting of adaptive equipment and prosthetics must be done with extreme care and respect. These items often cost thousands of dollars, and may be irreplaceable if damaged in transit. Keeping a patient's adaptive equipment nearby may be useful, and will help reduce anxiety. Accept any instructions given by the patient with regards to the handling of gear.

Chair Lift Evacuation

Chair lift evacuation procedures for adaptive skiers and snowboarders are the responsibility of the resort management. (see "Lift Evacuation" on page 9-1 of On Snow Operations manual) Rescuers should familiarize themselves with the process designed for their area. For example, extra safety straps, attached to the back of sit-skis, may be needed in the event that the safety bar does not close. The height of the chair itself, with regards to the platform, is also important because some sit-skis may need to partially collapse or rise in order for the person to load.

Every sit-ski should carry three evacuation straps, which are placed between the skier's legs and on each side of the bucket, and hooked into special holders. During an evacuation, these straps form a triangle and are joined together by carabiners and rings. The lift evacuation belay is attached to the main carabiner, and the skier may then be lowered using the standard method with extra assistance on the ground. Before proceeding with an evacuation, inspect all straps, tethers and double check locking carabiners. Everyone involved needs to feel comfortable with the procedure and know their roles.

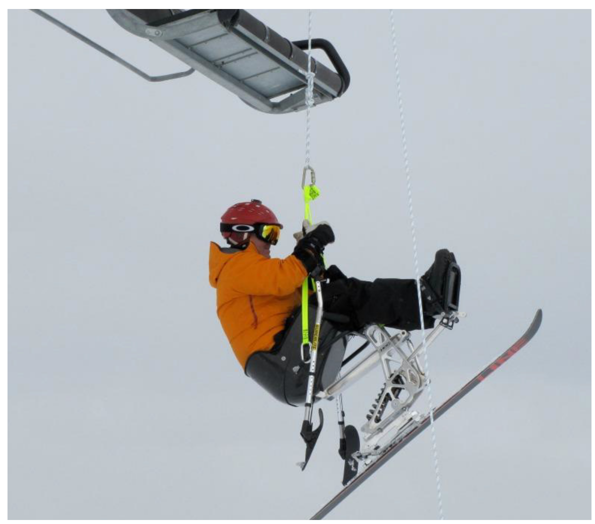

Figure 4: Chair evacuation of sit-skier

Note: 99 per cent of sit-skiers will have never been evacuated and many will have never looked at their straps. Therefore, they may not be familiar with their own system.

When evacuating a sit-skier, the rescuer needs to make sure the sit-skier is lifted off the seat, before it is swung out. This is for two reasons: first, if the sit skier wiggles off the seat he will drop a little and surprise everyone; second, because he has most likely never hung from the straps, he is not going to know how it feels. The weight distribution can be tricky. If a person ends up leaning backwards, with his weight on two points and almost no weight on the front point, this could cause him to flip backwards. Testing by first lifting the person off the seat will give him a chance to see where his centre of gravity lays.

At some resorts, sit-skiers are towed up-slope by snowmobile to avoid the problems and risks associated with chairlifts. This method may actually increase the risk for the general public.

Visually impaired skiers may require additional instructions and coaching during a lift evacuation. If a basket harness is available (see photo), this may lessen anxiety and expedite the process. A rescuer may also be hoisted into the chair using the harness and ropes (requires three ground assistants). Once in the chair, the patroller can remove the harness, slide over and safely place it around the patient for lowering.

Special considerations

Many disabled persons have a service animal at the base lodge. This animal is part of the patient's support system and should be brought as close as possible. Having the animal present will go a long way to reducing the patient's stress and anxiety.

Recognize that assisting a disabled person in distress may affect a rescuer personally, causing feelings of stress and self-doubt. Seek to debrief any disturbing incidents or complicated treatments in a timely manner, and contact your critical incident stress management (CISM) team for support. This will promote learning and understanding, and increase rescuer competency.

Notes...

Glossary

A.

ABC Method -

the sequence of operations required in cardiopulmonary resuscitation. A stands for airway, B stands for breathing, and C stands for circulation.

Abdomen -

the region of the body between the diaphragm and pelvis.

Abdominal cavity -

the anterior body cavity that is located between the diaphragm and the bones of the pelvic ring.

Abdominal thrusts -

manual thrusts that are delivered to the midline of the abdomen, between the xiphoid process and the navel, to create pressure to help expel an airway obstruction.

Abortion -

the spontaneous (miscarriage) or induced delivery of the fetus and placenta before the 28th week of pregnancy.

Abrasion -

a scrape. An open wound that damages the surface of the skin without breaking all the skin layers

Abscess -

a collection of pus in a sac, formed by dead tissue and accumulation of white blood cells.

Achilles tendon -

the common term for the tendon that connects the posterior leg muscle to the heel.

Acquired immune deficiency syndrome (AIDS)

- see "AIDS" below.

Actual consent -

agreement by a patient to accept emergency care. This has to be a rational adult patient. This must be informed consent - see "Informed Consent" below.

Acute -

to have a rapid onset. It sometimes means severe. Opposite of Chronic.

Acute myocardial infarction -

a heart attack. The sudden death of the heart muscle due to oxygen starvation. Usually caused by the narrowing or blockage of one of the blood vessels (coronary arteries) supplying oxygen to the heart muscle.

Adrenalin -

a hormone produced by the adrenal gland, which acts as a stimulant. Also known as epinephrine.

Aerobic -

requiring oxygen to function.

Afterbirth -

the placenta, part of the umbilical cord and some tissues of the womb's lining that are delivered after the birth of the baby.

Agonal breathing -

Agonal breathing may sound like gasping, grunting or noisy breathing with accessory muscle or abdominal movement. It is not normal, regular breathing and can happen when someone first goes into cardiac arrest.

AIDS -

Acquired Immune Deficiency Syndrome is a fatal disease first noted in 1978 that results from infection by HIV. It spreads through direct contact with body fluids of infected individuals.

Alert -

aware, oriented to space and time, full mental faculties. An assessment of the state of consciousness.

Airway -

the passage of air from the nose and mouth to the lungs.

Alveoli -

the air sacs of the lung where oxygen and carbon dioxide exchange with the blood stream takes place.

Alimentary canal -

the tubular passage which extends from the mouth to the anus and functions in digestion, absorption of food and elimination of residual waste.

Amnesia -

the short or long term loss of memory.

Amputation -

the surgical or traumatic removal of a body part. The most common usage applies to the traumatic removal of an extremity or one of its parts.

Anaphylactic shock -

the most severe type of allergic reaction with severe breathing spasms and collapse of the circulatory system, which may be fatal.

Anaphylaxis -

an unusual or exaggerated allergic reaction to foreign proteins or other substances.

Anatomy -

the study of the body structure.

Anatomical position -

the standard reference position for the body in the study of the anatomy. The body is standing erect, facing the observer. The arms are down at the sides and the palms of the hands are facing forward.

Angina pectoris -

the chest pains caused by an insufficient blood supply to the heart muscle.

Angulation -

the angle formed above and below a break in a bone. The fracture changes the straight line of a bone into an angle.

Anoxia -

a lack of oxygen in the tissues.

Anterior -

the front surface of an object.

Antiseptic -

any preparation that prevents the growth of and/ or multiplication of bacteria.

Antitoxin -

an antibody produced in the body which is capable of neutralising a given toxin, bacterial, plant, or animal.

Antivenom -

an antitoxin given to a person who has been poisoned by an animal or insect venom.

Aorta -

the largest artery in the body, which originates from the left ventricle and supplies blood to the body.

Arterial bleeding -

the loss of bright red blood from an artery. The flow may be rapid, spurting as the heart beats.

Arteriole -

a minute arterial branch.

Artery -

a muscular, thick-walled blood vessel which carries blood away from the heart.

Artificial respiration (AR) -

the maintenance of breathing by artificial ventilation in the absence of normal spontaneous breathing.

Artificial ventilation (AV) -

any method used to force air in and out of the lungs.

Asphyxia -

suffocation caused by decreased oxygen and increased carbon dioxide in the blood.

Aspiration -

to inhale materials into the lungs.

Assisted ventilation -

a method of providing additional air and/or oxygen to a patient whose breathing is inadequate.

Asthma -

the condition in which the bronchioles in the lungs constrict, causing a reduction of airflow and causing congestion. Air will usually enter easily, but cannot be exhaled easily.

Asymmetry -

not symmetrical; lack of correspondence of parts on opposite sides of the body.

Asystole -

when the heart stops beating.

Ataxia -

inability to coordinate the muscles properly; used to describe a staggering gait.

Atherosclerosis -

a form of hardening of the arteries.

Atrium -

either of two receiving chambers of the heart, from which blood moves to the ventricles.

Autonomic -

not subject to voluntary control.

Autonomic nervous system -

part of the nervous system which regulates cardiac, gland, and smooth muscle activity.

This includes digestion and sweating.

It cannot be controlled voluntarily.

Avulsion -

a piece of tissue or skin that is torn loose or pulled off by injury.

B.

Bag valve mask -

A portable unit device consisting of a bag, a valve, and a mask used to give artificial ventilation or assisted ventilations.

Bandage -

an item, such as gauze or tape, that can be used to hold a dressing in place.

Barbiturates -

class of drug that produces a calming, sedative effect.

Basic life support (BLS) -

the ABC's of emergency care. Those events related to the findings of the priority assessment.

Battle's sign -

a bluish discolouration of the area over the bone just behind the ear; may indicate a fracture to the base of the skull (basal skull fracture).

Bilateral -

pertaining to both sides of the body.

Bile -

a greenish-yellow fluid secreted by the liver to aid in fat digestion.

Biological death -

when lung and heart activity has stopped and brain cells die. Lethal changes usually begin to take place in the brain within 6 to 10 minutes after cardiac arrest. This process may be delayed by cold temperatures.

Bladder -

a hollow organ which serves as reservoir for urine.

Blood -

fluid circulating through the heart, arteries, capillaries and veins. It carries oxygen, nutrients, hormones etc. to the cell, and removes carbon dioxide and waste materials.

Blood pressure -

is the pressure that circulating blood exerts against the walls of the arteries.

Brachial pulse -

the pulse measured by feeling the major artery of the upper arm against the humerus. This is the most reliable location to detect the pulse in infants.

Brain stem -

most inferior portion of the brain.

It is directly attached to the spinal cord.

The brain stem controls breathing, heart function, and blood pressure

Bronchiole -

the small branches of the airway that carry air to and from the air sacs of the lungs.

Bronchospasm -

spasmodic contractions of the smooth muscle of the bronchi, as occurs in asthma.

Bronchi -

the portions of the airway connecting the trachea to the lungs.

Bruise -

a contusion, the simplest form of a closed wound. The blood flows into the tissues causing a discolouration.

Burn -

an injury caused by heat, flame, electricity or radiation; or a similar injury caused by some chemicals.

C.

Capillary -

a microscopic blood vessel through which exchange takes place between the bloodstream and the cells.

Capillary bleeding -

the slow oozing of blood from a capillary blood vessel.

Carbon dioxide -

an odourless, colourless, non-combustible gas. It is a normal by-product of body metabolism, eliminated through the lungs.

Carbon monoxide -

an odourless, colourless, and poisonous gas. If inhaled, it combines with the hemoglobin of the red blood cell and blocks the transport of oxygen, thus causing asphyxiation.

Cardiac arrest -

when the heart stops beating.

Cardiopulmonary resuscitation (CPR) -

heart -lung resuscitation where there is an effort to both artificially restore or maintain respiration and circulation.

Cardiogenic shock -

caused by the heart failing to pump enough blood to all parts of the body.

Cardio-vascular -

pertaining to the heart and blood vessels.

Carotid artery -

the large neck arteries. One is found on each side of the neck.

Carpal bones -

the eight small bones of the wrist.

Cartilage -

a form of connective tissue containing a tough, elastic substance, found in joints, at the developing ends of bones, and in specific areas such as the nose and ears.

Central nervous system -

the brain and spinal cord.

Cerebellum -

the smaller posterior portion of the brain.

It regulates body movement, posture, balance, and muscle tone.

Cerebral -

relating to the brain.

Cerebrospinal fluid -

the clear, watery fluid that helps to protect the brain and the spinal cord.

Cerebrovascular accident (CVA) -

the result of blockage or damage to a brain artery. Headache, confusion, paralysis (often to one side only), impaired vision, impaired speech, unequal pupil size, and many other signs and symptoms are possible (also known as stroke).

Cerebrum -

the portion of the brain which controls higher functions such as voluntary control of the body, sensation, thought, reasoning, memory.

Cervical -

relating to the neck. The same word is also used to refer to the cervix, the lower portion of the uterus (womb).

Chief complaint -

the problem for which a patient seeks help, in one word or a short phrase.

Chronic -

long or drawn out or recurring.
Opposite of "Acute".

Chronic obstructive pulmonary disease (COPD) -

a condition in which there is a progressive decline in the lung's ability to exchange oxygen and carbon dioxide. COPD includes chronic bronchitis, emphysema, and some types of chronic asthma.

Circulatory system -

consists of the heart, blood vessels, and lymph vessels.

Clammy -

moist and cold skin.

Clavicle -

the collar bone.

Clinical death -

the state reached when breathing and heart action cease but brain activity is still present.

Closed fracture -

a simple fracture where the skin is not broken by the fractured bone ends. The fracture site is not exposed to the outside world.

Closed wound -

an injury where the skin is not broken, as in the case of a bruise.

Clot -

the formation composed of fibrin and the entangled blood cells that act to help stop the bleeding from a wound.

Coagulation -

the change from a liquid to a thickened or solid state; formation of a clot.

Coccyx -

the lowest part of the backbone, formed by four fused vertebrae (tail bone).

Codeine -

A pain-dulling narcotic drug derived from opium.

Collateral -

Accessory or secondary; not direct or immediate.

Collateral circulation -

The circulation established to tissue whose original blood supply has been obstructed.

Colon -

the large intestine.

Coma -

the state of complete lack of response from which a patient cannot be aroused, even by powerful stimulation.

Comatose -

obsolete medical term referring to 'in a state of coma', meaning unresponsiveness from which a patient cannot be aroused.

Comminuted fracture -

a fracture where the bone is fragmented or crushed to pieces.

Concussion -

a mild state of stupor or temporary lack of response, often caused by a blow to the head.

Congenital -

any condition that exists or was acquired before or at birth.

Congestion -

an abnormal accumulation of fluid within an organ.

Congestive heart failure -

failure of the ventricles to pump blood effectively, causing backup of blood or fluid into the lungs or body tissues.

Conscious -

the patient is oriented, talks coherently, can answer correctly questions about name, address, location, day, and date.

Contusion -

a bruise; an injury that causes a hemorrhage into or beneath the skin but does not break the skin.

Convulsion -

uncontrolled skeletal muscle spasm or a series of spasms, often violent.

Commonly called "seizure" or "fit".

Coronary -

a term applied to the large arteries which supply blood to the heart muscle (myocardium).

Coronary artery disease -

the narrowing of one of more places in the coronary arteries brought about by atherosclerosis. Blockage may eventually occur.

Cortex -

outer part of the brain concerned with voluntary action.

Cranium -

the bones encasing the brain.

Cramp -

painful involuntary contraction of a muscle.

Cranial -

pertaining to the skull.

Cravat -

a piece of cloth material that can be used to secure a dressing or splint.

Crepitus -

a grating noise or the sensation felt caused by the movement of broken bone ends as they rub together.

Critical incident stress debriefing -

sessions that are held after a disaster or emergency incident to address the needs of rescuers who may have been influenced by the scene and the stress generated in providing emergency care.

Crowning -

when the presenting part of the baby first bulges out of the vaginal opening.

Cyanosis -

a bluish discolouration of the skin and mucous membranes due to insufficient oxygen in the blood.

D.

Defibrillation -

application of an electric shock to a patient's heart in an attempt to disrupt a lethal rhythm and allow the heart to spontaneously re-establish a normal rhythm.

Dehydration -

excessive loss of water from the body or a tissue.

Depressed fracture -

a fracture of the skull in which a segment is depressed. It is very important to avoid pressure on such a fracture.

Dermis -

the inner (second) layer of the skin. It is the layer that is rich in blood vessels and nerves found below the epidermis.

Diabetes -

a disease resulting from the inadequate production of insulin by the pancreas.

Diabetic coma -

the result of inadequate insulin supply or high blood glucose levels that leads to unconsciousness, coma, and eventually death unless treated. Also know as Hyperglycemia.

Diabetic shock -

the result of too high an insulin supply or low blood sugar, which if untreated will rapidly lead to a shock-like condition and death.

Diagnosis -

distinguishing one disease or injury from another; the determination of the nature of the disease or injury.

Diaphoresis -

profuse perspiration.

Diaphragm -

a dome shaped muscle that separates the chest cavity (thorax) from the abdominal cavity. It is the major muscle of respiration.

Diarrhea -

the passing of soft or liquid stools with abnormally high frequency. Can result in hypovolemic shock.

Diastole -

the part of the cardiac cycle during which the ventricles relax.

Diastolic pressure -

blood pressure measured when the heart is resting between beats.

Digestive system -

the group of body organs that carry out digestion, digestion is the process in which food is broken down mechanically and chemically and is changed into forms that can enter the blood stream and be used by the body.

Dilation -

to enlarge, having expanded in diameter.

Direct pressure -

the quickest, most effective way to control most external bleeding. Pressure is applied directly over the wound site.

Dislocation -

the displacement of the ends of two bones at their joint, so that the joint ends are no longer in proper contact.

Distal -

farther from a point of reference. In case of extremities, farther away from the body core.

Distension -

bulging or swelling.

Dressing -

a protective covering for a wound that will aid in the stoppage of bleeding and helps to prevent contamination.

Dura mater -

the outermost and toughest of the outer three membranes of the brain and spinal cord (meninges).

Duodenum -

the first portion of the small intestines, connected to the stomach.

Dyspnea -

shortness of breath, difficult or laboured breathing.

E.

Edema -

swelling due to the accumulation of fluids in the tissues.

Elation -

a feeling of well-being "happiness", commonly exaggerated.

Emergency care -

the prehospital assessment and basic care provided for the sick or injured patient. The care is started at the emergency scene and is continued through transport and transfer at the medical facility.

Emergency medical services (EMS) -

a chain of services linked together to provide care for the patient at the scene, during transport to the hospital, and upon entry at the hospital.

Emergency medical technician (EMT) -

a general term for the emergency personnel who provide pre-hospital care, typically from an ambulance.

Emphysema -

a chronic disease of the lungs, in which the alveoli suffer major enlargement and a progressive loss of elasticity. This reduces the capability of the lungs to exchange oxygen and carbon dioxide. The patient exhibits rapid, shallow breathing and the condition frequently results in a secondary impairment of heart activity.

Endocrine -

glands which secrete their hormones into the bloodstream, such as the pituitary, thyroid and adrenal glands; also called ductless glands.

Epidermis -

the outer layer of skin.

Epiglottis -

a flap of cartilage and other tissues that is at the top of the voice box (larynx). It closes the airway and diverts solids and liquids down the esophagus.

Epilepsy -

a chronic medical disorder characterised by attacks of unresponsiveness, with or without convulsions.

Esophagus -

the food tube leading from the throat (pharynx) to the stomach.

Evisceration -

usually applies to the intestine protruding through an incision or wound.

Expiration -

the action of breathing out.

Extradural -

outside the dura mater.

Extrication -

any actions that disentangle and free from entrapment.

F.

Fainting -

the simplest form of shock, occurring when the patient has a temporary, self-correcting loss of consciousness caused by a reduced supply of blood to the brain. Also called psychogenic shock.

Femoral artery -

the main artery of the upper leg (thigh).

Femur -

the thigh bone, the longest and largest bone of the body.

Fetus -

the developing unborn child. It is an embryo until the third month, when it becomes a fetus until birth.

Fever -

elevated body temperature.

Fibrillation -

uncoordinated contractions of the heart muscle. The pumping action of the heart is ineffective. See "Ventricular Fibrillation".

Fibrin -

fibrous protein material that is used to produced blood clots.

Fibula -

the lateral and smaller of the two bones of the lower leg.

First-degree burn -

a mild partial -thickness burn, involving only the outer layer of skin.

First responder -

an individual who has received training in emergency care in order to provide for the patient before EMTs arrive. The level of training allows this individual to assist EMTs at the scene.

Flaccid -

soft and flabby.

Flail chest -

a loose section of the chest caused by multiple adjacent rib fractures.

Flail segment -

the section of the chest wall which lies between the fractures and moves opposite to the normal chest movement.

The movement is called "paradoxical breathing".

Flexion -

to increase an angle of a joint. To bend, as in bending the knee or bending at the elbow.

The opposite of extension.

Fracture -

a break, crack, split or crumbling of a bone.

Freezing -

deep frostbite. An injury due to cold involving the skin and the layers below the skin. Deep structures such as bone and muscle may be involved.

Frontal lobe -

the frontal part of the cerebrum; site of emotional control.

Frostbite -

superficial freezing. The skin is frozen, but the layers below it are still soft and have their normal bounce.

G.

Gallbladder -

a pear-shaped sac on the lower surface of the liver, which collects and stores bile.

Gastrointestinal (GI) -

referring to the stomach and intestines.

Genitalia -

the reproductive organs.

Genitourinary system -

the system that includes reproductive organs and the organs that produce and void urine.

Germs -

any disease-causing organism.

Glucose -

a simple sugar which is the chief source of energy for most living organisms.

Glycemia -

glucose in the blood.

Glycogen -

a complex carbohydrate which is the chief storage form of carbohydrate. It is found in the muscles and liver, and is readily broken down into glucose.

Good samaritan laws -

a series of laws written to protect emergency care personnel. These laws require a standard of care to be provided in good faith, to the level of training, and to the best of ability.

Grand mal -

a severe epileptic seizure. This usually consists of a convulsion, followed by loss of consciousness. The convulsions may last from one to several minutes.

Greenstick fracture -

a split along the length of a bone, giving the bone the appearance of a green stick that is bent to its breaking point but without breaking into two or more pieces

H.

Heart attack -

usually the sudden blockage of a coronary vessel that can cause death to the heart muscle.

Heat cramps -

a condition brought about by the loss of body fluids and possibly salts. It usually occurs in people working in hot environments. Muscle cramps occur in the legs and abdomen.

Heat exhaustion -

a form of shock that is caused by the excessive loss of fluids and salts due to heavy sweating. It is characterised by cold, clammy skin and a weak, rapid pulse. It is also called heat prostration.

Heat stroke -

an emergency caused by prolonged exposure to heat, resulting in the failure of the body's heat-regulating mechanism. The signs and symptoms are extreme fever, hot and dry skin, delirium, or coma.

Hematoma -

localised collection of blood in the tissue as a result of injury or broken blood vessel.

Hemorrhage -

bleeding, particularly if excessive.

Hemoglobin -

the oxygen-carrying pigment of the red blood cells.

Hemorrhagic shock -

caused by the loss of blood and plasma.

Hepatitis -

inflammation of the liver, caused by a virus that is spread though blood-to-blood contact, mucous membranes or sexual contact. Signs and symptoms are nausea, vomiting, fatigue, abdominal pain, and jaundice.

Histamine -

a substance released by body cells which causes dilation of capillaries, stimulates visceral muscles and stimulates secretions.

Hives -

slightly elevated red or pale areas of the skin that may be produced as a reaction to certain foods, drugs, infections, or stress.

Hormones -

substances secreted by endocrine glands that act on other glands and organs of the body.

Human immunodeficiency virus -

is a virus that has the capability to affect every organ / system in the body by either direct damage by the virus or by making the host susceptible to opportunistic infections.

Humerus -

the upper arm bone.

Hyperglycemia -

an excess of glucose in the blood.

Hyperventilation -

abnormally prolonged rapid, deep breathing, usually associated with anxiety.

Hypoglycemia -

an abnormally low concentration of glucose in the blood.

Hypothermia -

a general cooling of the body.

Hypovolemic shock -

the state of shock that develops due to an excessive loss of blood or plasma.

Hypoxia -

an diminished supply of oxygen to the body tissues.

I.

Iliac crest -

the lateral upper long curving portion of the pelvis.

Immersion foot -

a form of hypothermia of the foot following prolonged immersion in water. When first removed from water, the foot is swollen, cold, waxy white with cyanotic areas. A short time later the parts become red and hot and swelling increases.

Implied consent -

a legal position dealing with a patient who is either unresponsive or so badly injured or ill that he cannot respond. It assumes that the patient would consent to receiving emergency care if capable. Implied consent may also apply to children, the developmentally disabled, or emotionally or mentally disturbed patients when parents or guardians are not at the scene.

Incision -

a cut or wound made by a sharp instrument.

Infarction -

localised tissue death due to the blockage of its blood supply.

Inferior -

situated below the top of the body.

Inflammation -

a tissue reaction to chemical or physical injury or infection. The signs are pain, heat, redness, and swelling.

Informed consent -

actual consent given after the patient knows your level of training and what you are going to do.

Ingest -

to take in by mouth.

Inguinal -

referring to the groin.

Inhalation -

drawing of air into the lungs.

Injection -

forcing a liquid through a needle or tube through the skin into the body.

Insomnia -

sleeplessness; usually referring to sleeplessness of unknown origin, not due to illness or disease.

Inspiration -

the act of drawing air into the lungs. Also called 'inhalation'.

Insulin -

a hormone produced in the pancreas that is needed to move glucose from the blood into the cells.

Insulin shock -

severe hypoglycemia produced by excessive insulin.

Intestine -

the part of the digestive system extending from the distal end of the stomach to the anus. Also called bowel.

Intracranial -

within the skull.

Iris -

the coloured portion of the anterior eye. It adjusts the size of the pupil.

J.

Jaundice -

the yellowing of the skin, usually associated with liver or gallbladder injury or disease.

Jaw thrust -

a method of opening the airway without moving the neck.

Joint -

a point at which two bones join.

K.

Ketones -

end products of the use of fat for the body's routine energy needs.

Kidneys -

two organs located high in the back of the abdominal region, which filter blood and produce urine. They also regulate the salt and water balance of the body.

L.

Labour -

the three stages of childbirth, including the beginning of contractions, delivery of the child, and delivery of the afterbirth.

Laceration -

an injury to the skin and under lying tissues resulting from the forces applied by a sharp or blunt object.

Laryngectomy -

surgical removal of the larynx.

A person who has had this operation is called a neck breather.

Larynx -

the airway between the throat and the windpipe. It contains the voice box.

Lateral -

to the side, away from the midline.

Lesion -

a change, structural or functional, due to disease or injury.

Lethargy -

a condition of drowsiness or indifference.

Ligament -

a band of fibrous tissue that connects bone to bone.

Liver -

a large organ in the right upper quadrant of the abdomen. It stores and filters blood, secretes bile, converts sugar into glycogen, and performs many other functions.

Lumbar spine -

the five lowest non-fused vertebrae of the lower back. Located between the thoracic vertebrae and the sacrum.

Lymph fluid -

a colourless fluid formed in tissue spaces.

It is returned to central circulation via lymph vessels.

M.

Major burn -

any third degree burn; any first or second degree burn involving more than 10% of the body surface; any significant burns involving the face, hands, feet, or genitals; any burns with associated smoke inhalation injury; electrical burns; and any burns encircling a limb.

Mandible -

the bone of the lower jaw.

Maxilla -

the bone of the upper jaw.

Mechanism of injury -

forces that cause the injury. Consideration is given to the mechanical forces involved in causing an injury, such as the type of force, its intensity and direction, and the body parts that it affects.

Medial -

towards the vertical midline of the body.

Membrane -

a thin layer of pliable tissue covering a surface or lining a cavity.

Meninges -

the three layers of membranes that cover the brain and spinal cord. They are the dura mater, arachnoid, and pia mater.

Meningitis -

inflammation of the meninges.

Particularly dangerous in children.

Metabolism -

the conversion of food into energy and waste products.

Metabolic Shock -

caused by the loss of body fluids, as in vomiting or diarrhea.

Metacarpals -

The five bones of the hand between the wrist and the fingers.

Metatarsals -

the five bones of the foot between the ankle and the toes.

Midline -

an imaginary vertical line drawn down the centre of the body.

Morphine -

a potent narcotic drug derived from opium, used to relieve pain.

Motor nerves -

nerves which cause contractions in skeletal muscles.

Mucous membranes -

the lining of some body cavities, such as the mouth.

Mucus -

a sticky fluid secreted by mucous membranes.

Muscle -

a tissue which produces movement by contraction of an organ or a body part.

If used as a prefix, is referred to as 'myo'.

Musculoskeletal system -

all the bones, joints, muscles, and tendons of the body.

Myocardial infarction -

damage or death of a portion of the heart muscle.

Myocardium -

the muscular tissue of the heart.

N.

Narcotic -

a class of drugs that affects the central nervous system for the relief of pain.

Nausea -

an unpleasant sensation in the upper stomach area, which often leads to vomiting.

Necrosis -

death of cells or tissue.

Nervous system -

brain, spinal cord, and sensory and motor nerves.

Neurogenic shock -

shock that results when the nervous system fails to control the diameter of blood vessels. The vessels remain widely dilated, providing too great a volume to be filled by the available amount of blood.

Nitroglycerin -

a vasodilator used in the treatment of angina.

Normal saline (NS) -

solution of salt in water in the same concentration as found in human blood.

It is normally supplied in sterile form.

O.

Occiput -

the back of the skull.

Occlusion -

blockage.

Open fracture -

the injury that results when the ends or fragments of a bone cut through the skin.

Also called a "compound fracture".

Organ -

a specialised body structure which performs a specific function.

Oropharyngeal airway (OPA) -

a curved breathing tube inserted into the patient's mouth. It keeps the tongue from falling back and obstructing the airway.

Oxygen -

a colourless and odourless gas which is essential to life. It supports combustion.

P.

Packaging -

part of the procedure for removal of the patient from an accident scene. It may involve applying splints and dressings, neck and spine immobilization, and stabilising impaled objects.

Palate -

roof of the mouth.

Pallor -

paleness; absence of skin colour.

Palpate -

to examine by feeling and pressing with the fingers and the palms of the hand.

Pancreas -

the large elongated gland in the back of the upper portion of the abdominal cavity, behind the stomach. It produces insulin and digestive juices.

Paradoxical movement -

when a loose segment of the injured chest wall moves in opposite direction to the rest of the chest wall during breathing movements.

Paralysis -

complete or partial loss of the ability to move a body part. Sensation in the area may also be lost.

Patella -

the kneecap.

Patent -

open, unobstructed, such as in "patent airway".

Pelvis -

the lower bony structure of the trunk.

Perfusion -

the flow of blood which carries oxygen and nutrients to the cells, and removes carbon dioxide, acids, and wastes.

Pericardial sac -

the fibrous membrane around the heart.

Pericardium -

a double-layer sac containing the heart.

Peripheral -

pertaining to an outside surface or furthest end.

Peripheral nervous system -

the portion of the nervous system consisting of nerves outside the brain and the spinal cord.

Peritoneum -

the membrane that lines the abdominal cavity.

Petit mal -

the minor epileptic attack that is noted by a momentary loss of awareness, with no major convulsive seizures.

Phalanges -

the bones of the toes and fingers.

Pharynx -

the portion of the airway between the nasal cavity and the larynx.

Physiology -

the science dealing with the study of organs or tissues.

Physiological -

pertaining to living tissues or organs.

Pia mater -

the innermost of the three meninges membranes of the brain.

Placenta -

an organ attached to the lining of the pregnant mother's uterus, which contains special tissues through which the blood of the mother and of the fetus are brought closely together. This allows exchange of oxygen, nutrients, waste products and other substances.

Plasma -

the liquid portion of blood.

Platelet -

a small cellular elements of the blood that assists in clotting.

Pleura -

a double membrane sac. The outer layer lines the chest wall and the inner layer covers the outside of the lungs.

Pneumonia -

an inflammation of the lung.

Pneumothorax -

the collection of air in the chest cavity to the outside of the lungs, caused by a puncture to the chest walls or the surface of the lung.

Point tenderness -

an area of tenderness or pain extending over no more than two or three centimetres.

It can be an important potential sign of bone fracture.

Posterior -

located toward the back. Opposite of Anterior.

Premature infant -

any new-born weighing less than 5.5 pounds (2.5 kg) or being born before the 37th week of pregnancy.

Pressure point -

location on the body where finger or hand pressure can be applied to an artery for the control of heavy bleeding.

Pressure regulator -

a device that is connected to an oxygen cylinder to reduce the cylinder pressure to a safe working level, thus providing a safe pressure for delivery to the patient.

Primary assessment -

the first examination of a patient to detect life-threatening problems, dealing with Airway, Breathing, Circulation and Disabilities.

Prone -

lying on stomach, face down.

Prosthesis -

an artificial body part made to replace a natural one.

Proximal -

closer to the centre of the body.

Psychogenic shock -

see "fainting".

Pulmonary -

relating to the lungs.

Pulmonary edema -

abnormal accumulation of fluid in the tissues and air spaces of the lung. It is often secondary to heart failure.

Pulmonary resuscitation -

providing rescue breathing to a patient in an attempt to artificially restore lung function.

Usually called Artificial Respiration.

Pulse -

the alternate expansion and contraction of artery walls as the heart pumps blood.

Puncture wound -

an open wound caused by a sharp object piercing through the skin and other underlying tissues.

Pus -

tissue fluid containing cell breakdown products of inflammation.

R.

Radial pulse -

pulse found on the thumb side of the wrist.

Racoon eyes -

bruising sometimes seen around the eyes after a head injury, and can be a sign of a basilar skull fracture.

Radius -

the bone on the thumb side of the forearm.

Realigning -

to reposition or adjust into a normal position.

Recumbent -

leaning back or reclining.

Red blood cells -

the circulating blood cells that carry oxygen to the tissues and return carbon dioxide to the lungs.

Renal -

referring to the kidneys.

Respiratory arrest -

the cessation of breathing.

Respiratory system -

a system of organs, which control the inhalation and exhalation of air and conduct the exchange of oxygen and carbon dioxide.

Resuscitation -

any effort to restore or provide normal heart/lung function artificially.

Resuscitator -

mechanical device or equipment used to restore respiration.

Retroperitoneal -

organs that lie behind the peritoneum and against the muscles in the back of the abdomen.

Rotation -

the turning movement of a body around it's axis.

Rule of nines -

a method used to estimate the amount of skin surface burned. The body is divided into multiples of nine, and these numbers used for the estimate.

S.

Sacrum -

the 5 fused vertebrae of the lower back which form a triangular shaped bone. It is inferior to the lumbar spine.

Saline -

a solution containing salt.

Scapula -

the shoulder blade.

Sciatic nerve -

a nerve emerging from the base of the spine and runs down to the lower thigh, where it divides into two.

Secondary survey -

the patient interview and the physical examination performed after the primary survey. This is done to detect any problems that may become life threatening.

Second-degree burn -

a partial thickness burn where the outer layer of skin (epidermis) is burned through and the second layer (dermis) is damaged.

Seizure -

generalised, uncoordinated muscular activity usually associated with loss of consciousness; a convulsion.

Semi-prone -

a position part way between lying on the side and lying on the stomach. The upper legs are bent and the head is turned to the side, supported by the lower arm.

Sensory nerves -

peripheral nerves which conduct the sensation of touch, pain, temperature, taste, and smell to the brain.

Septic shock -

is caused by infection producing poisons that are released into the blood. The blood vessels dilate, producing too great a volume to be filled by the body's blood supply.

Shock -

a depression of body functions which results from the progressive failure of the cardiovascular system.

Sign -

bodily evidence of disease or injury found on physical examination.

Sling -

a large triangular bandage or other cloth device that is applied as a soft splint to immobilize possible fractures and dislocations.

Spasm -

involuntary contraction of a muscle or several muscles.

Spinal Cord -

the part of the central nervous system which extends from the lowest part of the brain to the upper lumbar vertebrae.

Spleen -

an organ located in the left upper quadrant of the abdominal cavity behind the stomach. It stores blood and destroys old blood cells.

Splint -

any device that will immobilize a fracture.

Sprain -

an injury in which ligaments are partially torn or stretched.

Standard of Care -

the minimum accepted level of emergency care. It is set forth by law, administrative orders, guidelines published by medical and emergency care organisations, local protocols and practices, and precedent.

Sterile -

free of all life forms.

Sternum -

the breastbone.

Stoma -

the opening in the neck of a neck breather.

There may or may not be a tube in the neck opening.

Strain -

injuries to muscles caused by over stretching.

Stridor -

a harsh, high-pitched breathing sound.

Stroke -

the result of blockage in an artery supplying oxygenated blood to the brain.

Headache, confusion, paralysis (often to one side), impaired vision and speech, unequal pupil signs and many other signs and symptoms. This is also called a cerebrovascular accident or CVA.

Subcutaneous -

beneath the skin. It refers to the fats and connective tissues found just below the dermis.

Subcutaneous emphysema -

a condition in which trauma to the lung or airway results in the escape of air into the tissues of the body, especially along the chest walls, neck and face. It is characterised by a crackling sensation when palpating the skin.

Subdural -

between the dura mater and the arachnoid (see meninges).

Substernal -

under the sternum. Sub-sternal pain maybe the an indication of cardiac problems.

Sucking chest wound -

an open chest wound into which air is sucked through the wound and into the chest cavity each time a patient breathes.

Sudden infant death syndrome (SIDS) -

death from unknown cause occurring during sleep in an otherwise healthy infant; also called crib death.

Superficial -

on the surface.

Superior -

a part of the body located above another part.

Supine -

lying flat on the back, face upwards.

Symptom -

evidence of injury or illness as felt by and told to you by the patient.

Syncope -

fainting; a brief loss of consciousness caused by temporarily inadequate blood flow to the brain.

Syndrome -

a group of signs and symptoms which together characterise a condition or a disease.

Systemic -

pertaining to or referring to the entire body.

Systole -

the contraction phase of the cardiac cycle.

Systolic blood pressure -

the higher pressure exerted by the blood on artery walls when the heart is contracting.

T.

Tachycardia -

rapid heartbeat, usually more than 100 beats per minute.

Temporal -

referring to the temple.

Tendon -

fibrous tissue that connects muscle to bone.

Tension pneumothorax -

the condition in which air progressively enters the pleural space and cannot escape, causing progressive increase in inter-pleural pressure, impairment of respiration and pressure on the heart.

Third-degree burn -

a full thickness burn, where all layers of the skin are damaged. Deep structures may also be burned.

Thoracic cavity -

the anterior body cavity above the diaphragm.

Tourniquet -

a tourniquet is a constriction device intended to impede circulation distal to the point of application on an extremity. It can be expected to result in tissue loss or damage distal to application, and is to be used only in the case of exceptional and catastrophic injuries such as major amputations.

Trachea -

the trachea, or windpipe, is the upper section of the airway separated from the pharynx by the larynx.

Traction -

a part of the action taken to pull gently along the length of the limb to stabilise a broken bone to prevent further injury.

Transient ischemic attack (TIA) -

a minor stroke of short duration which occurs when the blood flow through a narrowed brain artery is temporarily inadequate to support the function of the brain area supplied by that artery. Dizziness, numbness, general weakness, vision problems, and unconsciousness may occur.

Trauma -

an injury caused by a mechanical or physical factor.

Trench foot -

a chronic cold injury caused by long periods of time in cold water, snow or mud.

Triage -

a method of categorising and sorting patients according to the severity of their injuries.

Tibia -

the shin bone.

Tissue -

a collection of similar cells that are specialised to perform a specific function.

Topical -

local, usually applied to a surface.

Toxic -

poisonous.

U.

Ulcer -

an open lesion of the skin or mucous membrane.

Ulna -

one of the two bones of the forearm, on the side opposite that of the thumb.

Umbilical cord -

the structure that connects the body of the fetus to the placenta.

Umbilicus -

the navel.

Universal precautions -

recommendations for emergency and medical personnel to wear protective gloves, eye protection, masks, and gowns to avoid contact with the patient's blood, body fluids, wastes, and mucous membranes.

Unresponsive -

incapable of responding to any stimuli.

Ureter -

tubes leading from the kidneys to the bladder.

Urethra -

tube leading from the bladder to the outside of the body.

Uterus -

the hollow muscular structure in which the fetus develops. The womb.

V.

Vagina -

genital canal in the female extending from the uterus to the vulva; the birth canal.

Varicose Veins -

dilated, enlarged veins whose valves are damaged. The most common site is the veins of the legs.

Vasoconstriction -

narrowing of the diameter of a blood vessel.

Vasodilation -

widening of the diameter of a blood vessel.

Vein -

any blood vessel that returns blood to the heart.

Venous bleeding -

the loss of blood from a vein. It is usually dark red to maroon in colour. Loss is usually a steady flow and can be very heavy.

Ventilation -

moving air into the lungs.

Ventral -

refers to the front of the body.

Ventricle -

the two lower, muscular chambers of the heart which receive blood from the atria and pump it into the lungs or general circulation.

Ventricular fibrillation -

disorganised rapid contractions of the ventricular muscles. They are ineffective in pumping blood.

Vertebra -

one of 33 bones of the spinal column.

Vessel -

Tube or canal for carrying blood or lymph fluid.

Vital signs -

indicators of body functions necessary to life.

They include pulse rate and character, breathing rate and character, skin condition, and level of consciousness.

W.

White blood cells -

help defend the body from infection.

Workplace Hazardous Materials Information System (WHMIS)

The Workplace Hazardous Materials Information System (WHMIS) is a comprehensive plan for providing information on the safe use of hazardous materials used in Canadian workplaces.

X.

Xiphoid process -

the xiphoid process is a small protrusion at the lower part of the sternum. Its importance lies in the fact that it is easily broken in improperly conducted CPR, and can then result in major internal bleeding.

Notes...