WILDERNESS MEDICAL CHAPTER

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SHOCK

Shock is a life threatening condition characterized by circulatory failure leading to inadequate tissue perfusion (adequate supply of oxygen and removal of waste products). Since the cells receive inadequate nutrients they begin to die. Toxins are released into the bloodstream causing further deterioration and additional cellular death.

Several different types and causes of shock exist. Fortunately, for field purposes the recognition and treatment protocols are all similar. Hypovolemic shock results from loss of blood or plasma, fluids, or electrolytes (body salts). Fluid loss may be external (diarrhea, vomiting, burns, sweating, gastrointestinal bleeding, or soft tissue bleeding) or internal (hemothroax, hematoma, bowel obstruction). Inadequate perfusion may result from the loss of more than one liter of whole blood in the adult.

In cardiogenic shock the heart is unable to adequately move fluid through the vascular system. In anaphylactic shock bronchioconstriction and a decrease in available fluid lead to poor perfusion. In anaphylaxsis the fluid is redistributed from the central vascular system to peripheral tissues. The same redistribution of fluid occurs in septic shock, neurogenic shock, and Psycogenic shock (vasovagal syncope or simple fainting). Septic shock results from prolonged bacterial infections and is rarely seen in the field. Neurogenic shock results when the brain is unable to keep the arteries constricted. If all the arteries dilate at one, not enough fluid exists to fill the capacity of the vascular system and inadequate perfusion results. However, neurogenic shock is rare and usually only occurs if traumatic quadriplegia or paraplegia is also present. Psychogenic shock is similar to neurogenic shock in that a dilation of the arteries occur. However, it is only temporary and can be corrected by the brain itself.

Signs and Symptoms

General

Shock may range from mild to severe. Therefore, not all of the signs and symptoms listed below may present at any one time. The best indication of severity of shock is the level of consciousness. If the patient is alert and oriented then the brain is being adequately perfused. A decrease in consciousness represents decreased perfusion and must be actively monitored for. A patient may rapidly be diagnosed in shock if an altered level of consciousness, cool clammy skin, and a weak thready pulse exists. These signs closely resemble hypothermia. However, in severe hypothermia the pulse is slow as opposed to shock where it is usually rapid. Additional signs and symptoms of shock include anxiety, restlessness, profuse sweating (diaphoresis), pale or blue skin (cyanotic skin), rapid shallow respirations, lusterless or dull eyes, the patient complains of thirst, nausea and vomiting, and the systolic blood pressure may be below 100 mmHg. Blood pressure is one of the last signs of shock to appear. If a sphygmomanometer (blood pressure cuff) is not available the patient's blood pressure may be estimated. If a radial pulse is present then the systolic pressure is at least 80 mm Hg. A femoral pulse presents a pressure of at least 70 mm Hg and the carotid pulse a pressure of 60 mm Hg.

Hypovolemic shock

In a patient suffering from hypovolemic shock a history of trauma is usually present. If no external bleeding is seen then internal bleeding may be present. This is especially true if rapid deceleration (impact) has ocurred. Fluid loss may occur through nontraumatic means such as perforated ulcer, diabetic ketoacidosis (causes excessive urination), vomiting, diarrhea, or excessive sweating.

Anaphylactic shock

Any recent history of insect stings, injection of medicine, ingestion of medicines, or ingestion of allergens indicates the possibility of anaphylactic shock. Additionally, the skin may be flushed, itching (pruritic), have hives, or be swollen (edema). The patient may be coughing, wheezing, or complaining of tightness in the chest. All of the above signs and symptoms may develop within five minutes or they may be delayed by several hours.

Cardiogenic shock

Any previous cardiac history or symptoms of cardiac problems (see cardiovascular section) allows one to suspect cardiogenic shock. Additionally rales or rhonci (abnormal breath sounds) indicating fluid in the lungs may be detected.

Treatment

Initially a patient potentially suffering from shock should have a clear airway established. Any obvious external bleeding should be controlled by direct pressure and elevation. If not otherwise contraindicated the feet should be elevated by about 12 inches. If the patient is in cardiogenic shock the legs should be kept flat. The body's temperature should be kept normal by the use of blankets or sleeping bags. In cold weather the patient should be packaged as if a hypothermic patient (see hypothermia treatment). However, the patient must not be allowed to over heat. Splinting of fractures if present will decrease blood loss and pain. Vital signs must be closely monitored and recorded throughout the evacuation, especially level of consciousness. The cause of the shock should be determined and any additional measures taken. Finally, the patient should be reassured and dealt with psychologically to help reduce any pain (see pain page).
Hypovolemic shock- see diarrhea, vomiting, bleeding, and musculoskeletal.
Cardiogenic shock- see cardiovascular section Anaphylactic shock- see anaphylaxsis

INFECTIONS

GIARDIA

Giardiasis is a parasitic infection of the small intestines caused by *Giardia lamblia*. Giardiasis is often asymptomatic, but flatulence (excess gas), malabsorption and severe diarrhea may result. Giardia has always been present in wilderness streams throughout the nation, however, more sensitive laboratory tests give the impression that it is spreading. Fecal contamination of water is the most common route of transmission.

Signs and Symptoms

Incubation requires 1-4 weeks. The patient may be asymptomatic or suffering from intermittent nausea, flatulence, epigastric pain (around the stomach), cramps, weight loss, fever and diarrhea.

Treatment

Purification of water with iodine is the best prevention against re- infection or

worsening the case. Otherwise, treat for the diarrhea.

RABIES

Rabies, also known as hydrophobia, is an infectious viral disease of mammals characterized by Central Nervous System irritation leading to paralysis and death. Rabies occurs typically in carnivous mammals. In addition rodents, bats, and domesticated animals may cause rabies. Virginia, Maryland, and Pennsylvania account for eighty-four percent of the rabies cases reported in raccoons. Transmission of the disease occurs through bites, contact of saliva with open sores, and breathing the air in caves infested with bats. Cavers are recommended to have a current vaccination. Since the virus travels along peripheral nerves to reach the brain, bites to the face will have a shorter incubation time.

Signs and Symptoms Incubation time ranges from 10 days to 1 year. Symptoms include fever, mental depression, restlessness, spasms, and an inability to drink. It is critical to obtain a history of the bite.

Treatment

Wash the wound thoroughly with soap and copious amounts of water. Use of Quaternary ammonium compounds or alcohol is not recommended. The animal that inflicted the bite should be captured if possible, and the patient should seek medical assistance immediately.

TETANUS

Tetanus, sometimes called lockjaw, is an infectious disease characterized by convulsions and spasm of voluntary muscles. Tetanus is caused by an exotoxin from the bacteria *Clostridum tetani*, commonly found in the intestines of domesticated animals, animal manure, soil, and country roads. The risk of tetanus is greater if wounds are contaminated with soil, puncture wounds, involve crushing injuries, or receive medical attention more than 24 hours after the injury.

Signs and Symptoms

Incubation time ranges from 2 to 50 days. Early symptoms include stiffness of the jaw, muscle aches and pains, fatigue, headache, fever, and convulsions. Difficulty in swallowing, stiff arms or legs, or a fixed smile may also be apparent.

Treatment

Since the prognosis for tetanus is poor once the disease is contracted there is no excuse for inadequate immunization. A wound should be cleaned and a sterile dressing applied. The advice of a physician should be sought concerning a tetanus booster shot in all cases of major wound; and for clean minor wounds if the last booster was given more than 10 years ago

LYME DISEASE

Lyme Disease is an inflammatory disorder characterized by neurologic and joint malfunction. The disease is a rare disorder transmitted by ticks from Massachusetts to Maryland. The disease is an immune-mediated inflammatory disorder that manifests itself mainily in joints, and is also known as Lyme Arthritis.

Signs and Symptoms

Discoloration of the skin is preceded 1-30 days by a number of other symptoms. These symptoms include fever, chills, headache, arthritis and cardiac arrhythymias.

Treatment

Removal of ticks is the best prophylactic measure (see Rocky Mountain Spotted Fever). Early medical attention will decrease the severity of the disease.

ROCKY MOUNTAIN SPOTTED FEVER

Rocky Mountain Spotted Fever (RMSF) is an acute febrile tick borne disease. RMSF occurs mainly between May and September and is most common in the Soulth Atlantic and South Central United States. RMSF can be prevened by a thorough daily inspection for ticks. Ticks may be removed by covering with petroleum jelly or nail polish, or by grasping them (preferably with a small forceps) close to the head and pulling steadily, in an upward direction. The area of the bite should be topically explored to insure that no mouth parts remain. Do not squeeze a blood engorged tick.

Signs and Symptoms

Incubation time ranges from 3 to 12 days with an average of 7 days. Onset is characterized by a severe fever of 39.5-40 C (103-104 F). The fever lasts several days and is accompanied by headache, chills, and muscle pain. On the second to fifth day of the fever a rash appears in 83% of the patients. The rash of 1-4mm diameter, characteristic RMSF, appears on the wrists, ankles, feet, palms, or forearms. During the next twenty-four hours the rash becomes petechial (purple spots), gangrerous, purpuric (itching), and continues to spread. In addition the patient will present with diffuse edema. Since 32% of the patients do not recall a tick bite, any searcher with a high fever following a search should seek medical attention immediately.

Treatment

Any patient with a high fever should be rapidly evacuated.. Ticks should be saved for examination by medical providers. Daily checks for ticks are the most important prophylactic measure. In addition, long pants with bloused cuffs, long sleeves, a wide brim hat, and application of insect repellant containing DEET prevent ticks from attaching.

TULAREMIA

Tularemia is an acute infectious disease characterized by skin ulcers and fever. Originally tularemia was thought to be contracted by contact with infected rabbits. However, recent evidence indicate 80-90% of human infections are due to tick bites. Therefore, the number of cases of tularemia due to tick bites is the same as the number of cases of RMSF.

Signs and Symptoms

In most cases incubation ranges from 1 to 14 days. In tularemia several different courses of the disease exist so signs and symptoms differ greatly. However, in most cases an acute fever of up to 104-106 F appears first. Since this sign alone could indicate RMSF, medical attention should be sought immediately. A severe headache, chills, malaise, and weakness are also present. Additional signs and symptoms include ulcers at the site of a tick bite, and enlarged lymph nodes.

Treatment Since no field treatment exists the patient should be brought to a medical facility. In addition prevention of tick bites should be a major concern for searchers.

TICK PARALYSIS

Tick paralysis is characterized by a paralytic syndrome caused by a release of a neurotoxin from the tick. The disease has occurred in both Western and Eastern states. The ticks causing paralysis must be attached for 4-5 days and are usually located on the scalp, in the axilla, or under the breast.

Signs and Symptoms

Onset is characterized by irritability, anorexia and lethargy. Later, weakness of the legs progresses to flaccid paralysis which spreads to the trunk, arms and cranial nerves.

Treatment

If the tick is located and removed, improvement begins in one hour and may be complete in 48 hours. Removal should be carried out as outlined under Rocky Mountain Spotted Fever.

IMMUNOLOGY

RHUS DERMATITIS

Rhus Dermatitis is a form of allergic contact dermatitis characterized by an acute inflammation of the skin. Rhus dermatitis is caused by Poison Ivy, Poison Oak and Poison Sumac. These plants when damaged or crushed release a sap called uroshial from their leaves, stems, and roots. Most cases of plant dermatitis occur during the spring when the young leaves are easily broken. However, active uroshial is found throughout the year in the roots, stems, and vines. Since plant dermatitis results from an allergic reaction, previous exposure to toxic plants is required. Initial sensitization requires 6-25 days with a second exposure resulting in symptoms 8 hours to 10 days later.

Casual exposure causes Rhus Dermatitis in half the population, and 35% of the population is affected by more prolonged exposure. Immunity gradually develops following sensitization and complete resistance may develop after repeated exposure.

Avoidance is the method of choice. However, during searches, recognition is of little value if an area needs to be covered. Since uroshial enters the skin 10 minutes after contact, the area should be washed immediately. Cold water and a mild soap should be used. Hot showers, brisk rubbing and harsh soaps only spread uroshail. Changing clothes and washing the hands are also useful since uroshial is easily transferred. The eyelids should not be rubbed since Rhus Dermatitis usually causes then to swell shut. Finally, long pants with bloused cuffs or gaiters, a long sleeve shirt and gloves may be the only

practical defense in the field.

Signs and Symptoms

Rhus Dermatitis usually appears on exposed parts of the body such as the extremities and face. The lesions are usually straight narrow lines, acute angles or sharp margins. Itching, vesiculation (swollen scratchlike marks), urticaria, redness, and swelling are also common. Rhus Dermatitis appears at the initial site of contact and then appears to spread when other areas having lesser concentrations of uroshial become active.

Treatment

Prophylactic washing and avoidance is the most effective treatment. However, cool water on a light cotton cloth will relieve immediate pain and itching. In severe cases of Rhus Dermatitis, a physician should be contacted.

ANAPHYLAXIS

Anaphylaxis is an acute (rapid), systemic, reaction to a foreign protein, characterized by respiratory distress that may result in death. There are 3-4 more deaths from insects than from poisonous snakes each year because of the anaphylactic reaction. The main reason for this is that anaphylaxis, like other allergic reactions, occurs after the person has been previously exposed to the antigen. When a second exposure occurs, a violent allergic reaction causes bronchial constriction and vascular dilation. Smooth muscle contraction around the bronchi causes wheezing by narrowing the air passages. This may lead to lethal respiratory track obstruction. Vasodilation causes the release of fluid into the tissues causing urticaria and fluid loss that may result in hypovolemic shock. Anaphylaxis can be induced by the venom of Hymenoptera (bees, wasps, hornets, yellow jackets and fire ants), allergen extracts, antibiotics, and exercise.

Signs and Symptoms In approximately 1-5 minutes, the patient complains of difficulty breathing, wheezes, hives, urticaria, nausea, vomiting, sneezing, apprehension, and palpitations. In addition, bronchospasm, cardiac arrhythmias, and shock may also be present. However, the onset of symptoms may be delayed by several hours in some cases.

Treatment

A conscious patient should be placed in a position that makes respiration easy. An unconscious patient should be placed supine with their head level or in a slightly head down position. If the anaphylactic reaction is due to a stinging insect, the stinger should be removed by scraping the stinger away. In all cases the patient should be evacuated to a hospital as quickly as possible. If available a helicopter evacuation should be carried out since anaphylactic shock is a true medical emergency.

ACUTE MYOCARDIAL INFARCTION
(Heart Attack)

An Acute Myocardial Infarction (AMI), or heart attack, is characterized by severe pain in the chest or arms. The patient may have a cardiac history or a volunteer searcher may develop a problem. Cigarette smoking, hypertension, diabetes, and previous cardiac history in the patient of his family predispose the patient to attacks. However, heart attacks may affect even athletic individuals. In the field a careful history is necessary so that true emergencies can be screened out from more simple problems (ie. heartburn) and properly treated.

Signs and Symptoms

Signs and Symptoms include severe substernal (below the breastbone) pain radiating to the shoulder, epigastrum (above the stomach), jaw, and arms. The pain is generally constant and severe and may appear while resting. In addition, severe sweating (diaphoresis), dyspnea, weakness, dizziness, palpitations, a sense of impending doom, and sudden death are also common.

Treatment

The patient should be placed in a semi-sitting position with restrictive clothing loosened or removed. Since stomach hyperacidity and heartburn produce symptoms similar to heart attack, relief of pain by antacids will prevent a complicated evacuation. However, in any case, medical command should be contacted to decide where and how the patient can best be treated. During the evacuation and during treatment the patient must not be allowed to do any work since even moving his bowels may prove fatal. Reassuring the patient is an essential aspect of field care.

ANGINA PECTORIS

Angina pectoris is caused by a narrowing of blood vessels in the heart resulting in mild to moderate pain. Angina is usually brought on by exertion or emotional intensity. In most cases the patient will have a previous history of Angina or other cardiac history.

Signs and Symptoms

The pain of Angina is often the same as that of a heart attack except that in Angina the pain only lasts 3-10 minutes. Furthermore, Angina usually occurs when the patient is active and is relieved when he rests.

Treatment

If a first attack of angina occurs it should be treated as an acute myocardial infarction. Furthermore, any attack that lasts more than ten minutes should also be treated as an AMI. Otherwise, the patient should be made to rest and be reassured. If he has a history of angina, he may have doctor's orders to follow.

CONGESTIVE HEART FAILURE

Congestive Heart Failure may be acute or chronic and may results in pulmonary edema. When the heart is unable to pump adequately the lungs, peripheral tissues, or both become filled with fluid from the capillaries. No one with a history of chronic

congestive heart failure should be allowed into the field since they have an increased chance of having an AMI.

Signs and Symptoms

In acute cases the patient coughs up bloodstained sputum, suffers from dyspnea, and rales may be heard in the chest.

Treatment

Treatment is identical to that of AMI.

RESPIRATORY

ASTHMA

Asthma is characterized by a sudden and widespread narrowing of the large and small airways with production of excessive mucous. Children usually suffer from extrinsic asthma due to allergies. Adults usually suffer from intrinsic asthma which is due to infections, exercise, changes in barometric pressure, inhalation of cold air, bronchial irritants or emotional stress. Individuals with mild asthma should not be limited in search and rescue operations unless told otherwise by a physician.

Signs and Symptoms

Patients with asthma are usually found with shortness of breath, sitting up or hunched over, and using accessory muscles to breathe. Wheezing, coughing and a hyperinflated chest may be seen.

Treatment

Give the patient fluids to prevent dehydration and to keep the mucous from drying out, potentially clogging the airway. Any oral administration of fluids must be carefully carried out in order to prevent aspiration. Without medication, nothing can be done to stop the labored breathing quickly. Administer oxygen if available. Reassurance is important to decrease the emotional stress which may be present especially in a first time "asthma attack". Determine if any bronchodilator has been taken previously. Many chronic asthma suffers will carry on their person a small inhaler which they use when an attack occurs. Do not try to administer the inhalant if the patient is not able to do so on their own.

HYPERVENTILATION

Hyperventilation is characterized by "overbreathing", causing excessive loss of carbon dioxide in expired air. The resulting metabolic imbalance can lead to serious consequences. Hyperventilation is usually triggered by an anxiety attack. However, other possible causes include CNS disorders, fever, coma and overventilation by rescuers.

Signs and Symptoms

Symptoms include rapid deep breathing, dizziness, blurred vision, tingling of the hands and mouth, the sensation of a pounding heart, weakness, shortness of breath, flexion of hands at the wrists, and fainting.

Treatment

Decreased carbon dioxide is corrected by rebreathing expired air from either cupped hands or a closed container such as a paper bag, nylon stuff sack, mitten, extra sock, or hat. The patient should be reassured and assisted to calm down.

GASTRO-INTESTINAL

ACUTE ABDOMEN

An acute abdomen is characterized by severe abdominal pain. The pain may be visceral (deep, poorly localized), somatic (well localized) or referred (from a distant source). An acute abdomen may be caused by an appendicitis, intestinal obstruction, perforated peptic ulcer, perforation of the bowel, intestinal strangulation, ruptured blood vessels or organs, or an ectopic pregnancy (implantation not in uterus). An acute abdomen is a medical emergency that requires immediate hospital treatment.

Signs and Symptoms

Each disorder has a separate list of signs and symptoms. However, any patient or searcher having diarrhea, severe cramps, rebound tenderness (should not be sought for in the field), nausea, vomiting, abdominal tenderness, abdominal swelling, rigidity of the abdomen, guarding, discoloration, a hernia, fever, severe pain, bloody urine, abnormal stool, or a history of ulcers should be removed from the field.

Treatment

Several of these symptoms may be treated, however proper treatment can only be administered after a doctor's diagnosis of the ailment. Transport the patient in the position most comfortable for them often the fetal position with the hips and knees flexed is the most comfortable. A reeves stretcher secured inside the stokes may allow this position. Nothing should be given by mouth. Full vital signs including temperature should be taken at regular, short intervals. The rescuer should be prepared to treat for shock. If possible a helicopter evacuation should be carried out.

GASTROENTERITIS

Gastroenteritis (stomach flu) is a term for generalized abdominal distress resulting in upper gastrointestinal tract symptoms, cramps, and diarrhea. It is caused by food poisoning, traveler's diarrhea, viral enteritis, food allergies, and infectious dysentery. Gastroenteritis may be mild or severe.

Signs and Symptoms

Each type of gastroenteritis has slightly different symptoms. Gastroenteritis may be differentiated from an acute abdomen by evidence of prominent diarrhea, food poisoning, diffuse pain, and acute onset. Other symptoms of gastroenteritis include spasms of pain, anorexia, nausea and vomiting, abdominal tenderness, excessive bowel sounds, and muscle aches.

Treatment

Treatment is directed towards the problems of diarrhea, subsequent dehydration, and vomiting (see diarrhea and vomiting). Treatment will consist of fluid replacement with electrolytes, supportive care, and evacuation.

MOTION SICKNESS

Motion sickness is caused by stimulation of the vestibular apparatus in the inner ear that conflicts with visual input. It is brought about by angular and linear acceleration and deceleration in the absence of sights that confirm this motion. A moving horizon, poor ventilation, fatigue, gastrointestinal problems and anxiety factors predispose a patient to motion sickness.

Signs and Symptoms

Nausea and vomiting are the most common characteristics. Yawning, hyperventilation, cold sweating, aerophobia, dizziness, headache, giddiness, and an inability to concentrate may result.

Treatment

Positional prophylactic measures such as facing forward, sitting over the wings in an aircraft, a supine or semirecumbent position with the head braced, and keeping the axis of vision straight forward at the horizon may help alleviate motion sickness. Adequate ventilation, small amounts of water and simple foods like crackers, or no food before short flights may prevent motion sickness. Prophylactic medications for nausea and vomiting need to be initiated 30 to 60 minutes before exposure to the flight or ride.

DIARRHEA

Diarrhea is not a disease, but instead a sign of several different diseases. It is characterized by an increased volume, fluidity or frequency of bowel movements. Diarrhea may be caused by osmotic changes (sugar found in diet food) and mucousal diseases (enteritis, colitis). Diarrhea leads to loss of electrolytes, dehydration, and eventually physical collapse.

Treatment Fluid loss and subsequent electrolyte imbalance is the major danger in diarrhea. Therefore, clear fluid intake should be increased. If nausea and vomiting are not severe, a solution of 5 ml table salt, 5 ml baking soda, 20 ml table sugar and flavoring can be added to 1 liter of water. Gatorade or salty Koolaid will also suffice. Patients with moderate diarrhea (5-10 watery stools/day) should drink 1-2 liters of the solution a day. In addition, determination and treatment of the underlying cause should be attempted. If the diarrhea persists for more than two days medical attention should be sought.

VOMITING

Vomiting is a sign of diseases related to the gastrointestinal tract or vestibular reflex. Vomitus should be examined and saved in some situations (eg poisoning) in order to make a differential diagnosis. Aspiration is a constant concern since it may rapidly lead to death. Major long term complications involve changes in acid-base concentrations and fluid loss.

Treatment

The underlying cause should be determined and dealt with accordingly. An attempt should be made to determine if the vomitus contains blood, especially in situations of trauma or history of gastrointestinal bleeds. In general, care should include a liquid diet and keeping the patient warm. During an evacuation the head should be kept lower by placing short litter attendants at the head or through the use of slings, unless otherwise contraindicated. If vomiting occurs the stokes basket should be turned to one side or upside down (the patient should be well secured) to prevent aspiration. Preventing aspiration is of paramount importance. Therefore, the head should not be secured (unless otherwise indicated) unless a quick release tie in is used. If aspiration does occur a large syringe or turkey baster can provide suction in the field.

ENDOCRINE

HYPOGLYCEMIA

Hypoglycemia (insulin shock) is defined as having a blood sugar level below 50 mg/dl (normal=70-110). It is most frequently associated with Diabetes mellitus. Hypoglycemia should be suspected in all patients with altered mental states since it can rapidly lead to brain injury or death within hours if not minutes. This damage results from a lack of sufficient fuel for the brain cells. In diabetics hypoglycemia may occur if too much insulin is given, too little food eaten, an unusual amount of exercise or work is done, or if environmental or psychological stress is present. In addition, alcohol use will predispose a patient to hypoglycemia. Hypoglycemic patients frequently become hypothermic due to a reduction of the body's temperature by the thermoregulatory center of the brain that contains blood sugar receptors. This process slows down metabolism, reducing the body's need for glucose.

Signs and Symptoms

In moderate hypoglycemia (blood glucose :30-50 mg/dl) the patient may be sweating, have clammy wet skin, reduced sensation around his hands or face, increased irritability, headaches, slurred speech, and be hungry. In severe hypoglycemia (blood glucose < 30 mg/dl) the patient may exhibit mental confusion and bizarre behavior, seizures, coma, and mild hypothermia (core temp 90-95 F, 32-35 C). Patients in coma are flacid, have normal quiet breathing and appear hydrated. If rescuers are properly trained and environmental conditions permit, a blood glucose determination using a drop of fresh blood and a glucose oxidase paper strip should be carried out (Visidex II or Chemstrips).

Treatment

If the patient is conscious, have him eat or drink a food containing sugar. The patient then must carefully be monitored. In unconscious patients, a proper airway must be secured first. Care must be taken to prevent aspiration of any foreign body or vomitus. Absorption of sugar through the intestinal mucosa can be carried out if oral secretions inhibit absorption through gums.

DIABETIC KETOACIDOSIS

Diabetic ketoacidosis ("diabetic coma"), also hyperglycemia, is a complication of diabetes mellitus that is seen in insulin dependent diabetics, mild diabetics who incur stressful situations and undiagnosed diabetics who suddenly fall into a "diabetic coma". Excessive food intake, too little insulin, trauma, burns, pain, anxiety or even decreased activity can trigger a hyperglycemic state. The higher level of glucose in the blood enters the urine causing large amounts of water to be pulled into the urine, resulting in decreased extracellular fluid, polyuria (large amounts of urine produced), and severe dehydration. Insufficient levels of insulin result in the cells burning fat and producing toxic keto- acids. The entire syndrome takes 2-4 days to completely develop.

Signs and Symptoms

The patient may present polyuria, polydipsia (excessive drinking), nausea, vomiting, Kussmal breathing (deep slow respirations), fruity breath odor, abnormal menstruation, hypotension, tachycardia, severe dehydration and shock. A complete history and exploration of possible predisposing factors is critical.

Treatment

If unable to differentiate between diabetic ketoacidosis and hypoglycemia, then rapid treatment should be for hypoglycemia. Immediately administer sugar (additional sugar will not harm a patient in keto-acidosis) and if improvement occurs continue with the sugar. Treatment for diabetic ketoacidosis entails protecting the airway, preventing aspiration and treating for shock secondary to dehydration.

MUSCULOSKELETAL

SPRAINS and STRAINS

Sprains and strains are characterized by pain and swelling due to the tearing, avulsing or severe stretching of ligaments, tendons or muscles around a joint. A sprain results from a ligament being torn, whereas a strain results from a muscle being overstretched. Ankle sprains usually result from severe internal rotation causing the lateral collateral ligament to be torn. Therefore, tenderness usually is located over this ligament.

Signs and Symptoms

In some cases it may be impossible to differentiate between a fracture and a sprain in the field. Therefore, the ankle or affected part should be treated as though it were fractured. The usual signs and symptoms of a sprain or strain include swelling, tenderness, guarding, pain, and possible discoloration due to bruising. All of these signs are also found with fractures. Differentiation is made by considering the mechanism of injury. The signs and symptoms will classify the sprain into one of three classifications. In a grade one sprain or minimal sprain no ligamentous tearing occurs. However, the patient presents with mild tenderness with swelling in some cases. A grade two sprain or moderate sprain results in an incomplete or partial rupture of ligaments. The patient presents with obvious swelling, ecchymosis, and difficulty walking. In a grade three or severe sprain, the ligament is completely torn. The patient may present with severe swelling, hemmorage, ankle instability, and an inability to walk.

Treatment

The severity of the injury will determine treatment. If the patient is able to walk forward, backwards, hop, run in a figure eight, and no swelling or ecchymosis is present, then the patient may be allowed to self extricate themselves. However, an elastic bandage should be applied. Furthermore, ambulation is only recommended for the most minor of the grade one sprains. If a sprain is undertreated chronic inversion instability and pain may result. Therefore, most sprains should be treated as fractures. If pain is elicited in the ankle region by pressing gently on the upper third of the fibula, then a fracture can be strongly suspected. Otherwise the affected part should be treated as a fracture by stabilizing and splinting accordingly. As in all cases of possible fractures, pulses and sensation should frequently be checked distal to the site of injury.

FRACTURES

Fractures in most wilderness settings are treated identically to those in an urban setting. However, some important differences apply.

Signs and Symptoms

The signs and symptoms of a fracture include an audible snap, crepitus, deformity, swelling, ecchymosis, localized pain, loss of function, loss of distal pulse, muscle spasm, or (obviously) an exposed bone. In addition, one should suspect a fracture in any unconscious patient or multi-trauma patient.

Treatment

Standard treatment dictates that any bleeding or symptoms of shock be treated first. Thereafter, check for distal pulses and sensation, then correct any deformity if properly trained. In all cases splints must be applied. Finally, reassess pulses and sensation distal to the fracture site and finally evacuate the patient. Cold compresses can be applied if available but should never be placed directly against the skin. NOTE: In some wilderness cases differences and additional measures apply to the treatment of the following kinds of fractures:

Phalangeal

These fractures are a common injury to the fingers. The fracture should be splinted in the position of function and not taped onto an uninjured finger or a tongue depressor. If possible, splint 2 or 3 other fingers in the position of function with the injured one for additional support. The entire hand should then be wrapped with an elastic or gauze bandage.

Patellar fracture

Differentiating between a patellar fracture and a contusion is difficult. Therefore,if the patient is able to walk and no deformity is present, then a contusion may be assumed and an evacuation avoided. However a cylindrical splint such as an Ensolite pad wrapped around the knee and secured may be helpful. If the patient is unable to walk or there is an obvious deformity or crushing, splint the leg as described above and request an evacuation.

Open Shaft Fracture

An open fracture is particularly difficult to deal with in the field.

The first step is to control any bleeding and assess shock. If distal pulses and sensation are present and the limb will fit into the stokes as positioned, then no manipulation is needed. Cover the wound with sterile dressings and splint the fracture. However, if the deformity of the limb disallows placement in the stokes or if distal pulses or sensation are absent, first rinse the open wound with either sterile water, a mild betadine solution or soap and water before applying sterile dressings. Do not scrub. Traction should be started and MAINTAINED as soon as possible in an attempt to keep muscle contractions from pulling the bone ends towards each other and from causing further soft tissue damage and extreme pain. Splint the injury with traction and evacuate the patient as soon as possible.

Ankle Fracture

Stabilization of an ankle fracture is carried out by holding the foot and applying gentle traction to the heel using the victim's leg as a counterweight if distal pulses are absent. This procedure will greatly alleviate pain and improve circulation. Furthermore, it may be carried out by anyone comfortable with the procedure. Afterwards a pillow type splint made with parkas, sweaters or other clothes; should be applied. If distal pulses are present the ankle should be splinted in its position of function and carefully monitored.

DISLOCATIONS

Treatment of dislocations in wilderness setting, should be different from that in the urban setting. Reduction of dislocations in the field provides immediate relief, makes immobilization and transport easier, reduces circulatory and neurological risk, and prevents severe swelling and muscle spasm. Furthermore, if an underlying fracture also exists, reduction will generally improve its position. However, if a long bone fracture exists, the fracture should be the primary concern. In all cases field reduction should only be carried out after proper instruction and practice in the techniques.

Shoulder

Signs and Symptoms

Anterior-inferior dislocations are the most common type of dislocation in adults. They are characterized by an inability to attain the standard sling position with the arm (where the forearm rests on the chest). Deformity located around the deltoid region is easily noted by comparing the injury with the normal shoulder.

Treatment

The quality of circulation and sensation should be noted before taking action. The shoulder may be reduced by having the patient lay down on a picnic table, rock, log, or other platform and allowing the affected arm to dangle down. A 10-15 pound weight is attached to the wrist and the patient is told to relax. Eventually

spontaneous reduction occurs.

Patella

Signs and Symptoms

Patellar dislocations are usually caused by pivoting the leg, with the knee flexed. The patella is usually obviously out of place.

Treatment

While gently extending the knee spontaneous reduction will usually occur. Otherwise, gently push the patella back into its normal position. Afterwards splint the entire leg from groin to ankle. A circular splint such as ensolite pad will provide the needed support. Avoid putting direct pressure on the patellar area. Swelling may be associated with pain or discomfort.

Knee

Signs and Symptoms

A knee dislocation is difficult to detect and usually presents as instability or subtle deformity. Changes in distal pulses or neurovascular signs are excellent clues.

Treatment

Reduction is carried out by applying gentle traction on the tibia. This is followed by splinting the entire leg.

Ankle

Follow the same procedures outlined under ankle fractures (see page xx). However, a reduction in pulses or neurological signs must be present to justify an attempted reduction.

NEUROLOGICAL

IMPAIRED CONSCIOUSNESS

Impaired consciousness is readily apparent or brought out by a thorough neurological exam. Since a fully alert state requires all the facilities of the Central Nervous System (CNS) almost any area of the CNS may be involved in patients with impaired consciousness. Factors that may lead to impaired consciousness include brain trauma, tumor, ischemia or anoxia (lack of oxygen), epilepsy, severe infections, drug abuse, hypoglycemia, diabetic coma, hypothermia, hysteria, and lightning strikes.

Signs and Symptoms

Changes in motor responses, verbal responses, abnormal sensations, and pupillary

reflexes should be sought. Obtain a complete history, vital signs including rectal temperature, and preform a primary and secondary surveys. examination.

Treatment

Immediately treat for hypoglycemia and assume cervical and cerebral damage are present. Vital signs should be complete and carefully monitored. At all times the airway must be carefully checked and no fluids given by mouth.

CEEBOVASCULAR ACCIDENTS

Cerebrovascular accidents (stroke) usually occur suddenly and leave neurological deficits. Cerebrovascular accidents are caused by a blood clot forming in a cerebral blood vessel (thrombosis), a rupture of a blood vessel (hemorrhage), obstruction of a blood vessel by material flowing in the vascular system (embolism), or by pressure on a blood vessel constricting it. Strokes occur in young adults with severe hypertension without warning. Therefore, health screening is suggested.

Signs and Symptoms

Signs and Symptoms usually develop rapidly and may include headache, nausea, vomiting, convulsions, unilateral relaxed paralysis, unilateral weakness, changes in visual field, difficulty speaking, sensory deficits, and rapid loss of consciousness.

Treatment

General supportive care including monitoring the airway, preventing aspiration, and reassuring the patient is required. In addition, the stokes should be positioned so that the airway is maintained.

CONVULSIONS

Convulsions reflect a disorder of the central nervous system (CNS) due to a sudden excessive disorderly discharge of brain neurons and may be a manifestation of underlying disorders. Causes may include heat stroke, high fevers, substance abuse, infection, toxic agents, cerebral hypoxia, brain trauma, brain defects, anaphylaxis, hemorrhage, or epilepsy. Convulsive seizures may be characterized as beginning with loss of consciousness and motor control, and tonic or clonic jerking movements of the extremities. Epilepsy involves periods of altered consciousness and motor activity, but may also include sensory phenomena or inappropriate behavior.

Signs and Symptoms

A broad spectrum of symptoms exist reflecting the many causes and types of seizures. Symptoms may include momentary or prolonged loss of consciousness, confusion, slight muscular twitching to generalized spasmodic convulsions of the entire body, emitting a peculiar cry, falling down, a rapid pulse, involuntary urination, or defecation. An epileptic seizure will often be preceded by an aura that warns of an impending attack. If an attack occurs, it results in loss of consciousness, a tonic-clonic phase that involves contraction of the muscles, and finally a post ictal state characterized by deep sleep, soreness, or a headache for several hours.

Treatment

During the convulsions the patient should not be restrained, although objects should

be removed that may cause injury. The sequence of stages or manifestations should be recorded along with the time they appeared. If the patient is secured in a stokes basket, set the basket down and secure the position and wait for the seizure to pass. Artificial respiration is not usually required since periods of apnea (lack of breathing) are very short. However, care should be taken to maintain an airway. After the attack no substantial treatment can be given, other than attempting to discover the cause, and inspecting for additional trauma.

PAIN

Pain reflects either physical or emotional discomfort, and is the most common medical complaint. Visceral pain spreads from one injured organ to visceral regions and thus is poorly localized. Somatic pain is easily localized. Psychogenic pain may result from chronic muscle tension, preoccupation with minor sensation, or imagination. In all cases a psychological aspect of pain exists. Neurological mechanisms exist that dampen both peripheral and central pain intensity.

Treatment

Apprehension greatly accentuates pain. Therefore, reassurance by clearly spelling out what is going on, what procedures are going to be carried out, and a clear description of the patient's injuries and implications should alleviate some pain. Distraction and imagination both diminish the perception of pain and calm the patient. Furthermore, physical distraction by rubbing or massaging nearby areas gently (if not otherwise contraindicated) have both a physiological and psychological basis for alleviating pain. Medications should only be given if proper training and medical command have been established. Attempt to evaluate whether the pain is strictly psychogenic or whether there is an underlying cause that should be treated.

HEAD TRAUMA

Head trauma is common in multi-trauma incidents and quite often is the pimarluy cause of death with a mortality ate of 50%. Its importance in climbing incidents and aircraft crashes is easily appreciated. While several catagories of head trauma exist the treatment protocols in the field are all fairly similar. Lacerations of the scalp, skull fractures, cerebrospinal fluid leaks, and brain injury represent the most common catagories. Although the initial impact event causes destruction or disruption of neural circuits proper field treatment can help prevent or reverse some more insidious complications. Neck injury occurs in about 5-10% of the patients receiving blunt head trauma. Improper care can easily result in permanent paralysis. Another important complication involves continual leakage of blood into the brain. If significant intracranial pressure develops (the skull prevents dissipation on any pressure) brain cells become crushed and then die. The buildup of extracellular fluids results in cerebral edema which also increases intracranial pressures. Since the build up of blood or fluid may occur rapidly or over several hours rapid or gradual deterioration of the brain may occur. The status of the central nervous system is accurately reflected in the patients level of consciousness and vital signs.

Signs and Symptoms

Fractures

Fractures of the skull may be closed, open, depressed or basilar. Closed fractures are difficult to diagnosis in the field. However, crepitation (a fine crackle like sound) on palpation of the skull or Battle's sign (bruising behind the ear) give a good clue of a fracture. Open fractures occur in the most extreme incidents or more typically through gunshot wounds. In the field depressed fractures may be detected by gently palpating the skull and noting a depressed area. Basilar fractures typically involve hair line fractures around the base of the skull. Clinical signs include blood in the ear (hematympanum) Battle's sign (after several hours), "raccoon eyes" (periorbital ecchymosis), impaired hearing, facial palsy, and blood or cerebrospinal fluid (CSF) in the nose or ears.

Cerebrospinal fluid leak

If cerebrospinal fluid is apparent then a basilar skull fracture has occurred. The fluid will appear clear or blood tinged emerging from the nose and/or ear. If blood is emerging from the ear it should be assumed to contain CSF. However, to get a more clear picture a drop of blood may be placed on a gauze pad. If two distinct rings appear then the blood most likely contains CSF. Unfortunately there is no method to differentiate between CSF and nasal mucus.

Brain injury

Several different types of lesions may exist, each presenting slightly different types of signs and symptoms. A concussion is characterized by loss of consciousness lasting less than 24 hours. However, in most cases loss of consciousness lasts only a few seconds or minutes. Since no structural damage results pupillary reactions and other brainstem reactions are intact. In more severe injures consciousness often returns then deterioration sets in. Progressive loss of neurologic function reflects rising intracranial pressures often from subdural hematomas, cerebral edema, and/or cerebral vascular laceration. Due to the widespread damage decorticate rigidity (arms flexed and drawn towards the body; legs extended) or decerebrate rigidity (all limbs extended and neck retracted) is often found. In addition fixation of the pupils to light, rising Blood Pressure, dropping pulse, and dropping respiratory rate express rising intracranial pressure. Finally hemiplegia, quadriplegia, or respiratory paralysis may result from damage to the spine.

Treatment

In all cases of head trauma a spinal cord injury should be assumed. Therefore, cervical and spinal immobilization must be carried out. If possible the first team on site should begin manual traction until the patient is more fully secured. In addition, the head should be secured to the litter and sandbags, coats or anything bulky should be placed on the sides of the head and neck. It is essential to secure a good airway without compromising cervical care. Even with a good airway respirations may be reduced due to head trauma. Furthermore, inadequate respirations cause hypoxemia (decreased oxygen levels) and hypercapnia (excessive carbon dioxide levels) which both cause cerebral edema and increased intracranial pressures. Therefore, the administration of oxygen is well worth the problems of carrying it into the field. If oxygen is not available then hyperventilation is called for since it causes cerebral vasoconstriction and a rapid decrease in intracranial pressure. While body temperature should be maintained and high temperatures reduced, hypothermia prevents cerebral edema and should not be treated aggressively in the field. A complete history of the accident, through primary and secondary exam, and a frequent neurological exam must by conducted. The neurological exam should describe the level of mentation in precise words and not solely numerical scales. Movement or lack of movement in all limbs must be recorded. In addition sensation or its absence must also be noted. Brain stem reflexes can be monitored by pupil reaction, eye movements, and the gag reflex.

The patient must be well secured in the litter in case of vomitus so that the patient may be turned on their side.

PSYCHIATRIC

THE FAMILY IN A SEARCH SITUATION

An important function during almost any search is providing both emotional support and information to the subject's family. In addition, close ties will be necessary to obtain accurate information concerning the subject. If an atmosphere of trust is not created vital information is often withheld. Ideally, someone from base with some counseling experience should be assigned to be the liaison with the family. However, any member with common sense, sound judgement, and some basic knowledge can handle the function.

Initially the family should be located in an area that is quiet and isolated from the activity of incident base. A quiet location allows family members to vent emotions without embarrassment. In addition a feeling of trust is more likely to occur in such a location. However, the family must not be isolated from information concerning the search. Therefore, detailed information concerning what is presently being done should be given. Furthermore, frequent updates are often necessary.

The liaison should both provide information and carry back any questions from the family to the incident staff. An important aspect of the two way communications is developing a more complete subject profile. Repetition from the same family member or from several family members should be tolerated. Moreover, such information helps substantiate the subject profile.

Since family members can provide valuable information concerning the subject or help substantiate clues they should remain at the incident base (or whatever quiet location was chosen). However, family members often desire to actively search for the subject. If the family is sent into the field the field team leader must be informed family members are on his team. In addition the field team leader should be exceptionally experienced. Finally, the task chosen should not be in an area of high probability. In this fashion, emotional complications if a find occurs are less likely.

While relationships with the family members are usually good, some key points need to be reinforced. Family members often feel responsible or guilty for the subject being lost. This will only add to the stress already present. In addition hostility may be directed at searchers. This is a natural reaction and should be dealt with in a sensitive fashion.

POSTTRAUMATIC STRESS DISORDER

When rescuers with a normal personality are exposed to severe physical or emotional stress Posttraumatic Stress Disorder (PTSD) may develop. Over twenty-three different names or diagnostically similar syndromes exist for PTSD. Some of the more familiar ones are combat fatigue, Post-Vietnam syndrome, Psychotraumatic reaction, Shell shock, stress response syndrome, survivor's syndrome, and traumatic neurosis. Rescuers tend to deny

any weakness especially psychological ones. However, any normal, stable, or strong person will develop PTSD if and when the individuals's threshold for stress is surpassed.

PTSD is characterized by recurrent recollections of the traumatic event, decreased interest in activities, hyperalertness, sleep disturbance, guilt, sadness, and memory impairments. However, not all of the above problems may be present.

After the San Diego airplane crash one third of the rescuers felt fine. Another third stated they had no adverse affects but in fact demonstrated the symptoms of PTSD. The final third felt the need to seek help but were too embarrassed to seek treatment. Even small incidents with no fatalities have caused 75% of the rescuers to present primary symptoms of PTSD.

Search and Rescue personnel can be expected to confront situations where PTSD is more than likely. Severely mutilated and burned bodies are often found during aircraft incidents. Furthermore, the rescuer usually reaches the incident site already fatigued and often in foul weather. Finally, a personnel threat to safety due to the possibility of hypothermia, terrain, sharp metal and glass, fires, or the possibility of explosions all increase the likelihood of PTSD.

When a traumatic event occurs the psychological elements may remain in active memory storage. Therefore, emotionally upsetting, intrusive, and uncontrolled images will frequently reappear since the information is difficult to process. If a personal threat to safety was involved, integrative processing will be even more difficult. As a protective mechanism to decrease the anxiety from such images a numbing cycle is enacted. During the numbing phase denial, memory losses, repression, and emotional numbing are often found. The rescuer will often alternate between the anxiety of replaying the event and the numbing stage. This allows gradual and controlled integration of an event that would otherwise be overwhelming. Most individuals are able to process the information eventually. However, if the event is suppressed or blocked the rescuer may require professional assistance in bringing the event to a conclusion.

Signs and Symptoms

A traumatic event that would upset any normal person is a necessary sign of PTSD. Recurrent thoughts concerning the event, recurrent dreams, or emotionally reexperiencing the event are common symptoms of PTSD. In addition , sadness, detachment from people, fatigue, headaches, loss of appetite, nausea, depression, guilt, nightmare, difficulty sleeping, memory impairment, muffled hearing, hyperalertness, exaggerated startle response, irritability, and anxiety may be present. Any number of signs and symptoms may be present. The wide variety represents the anxious and numbing stages. However, most rescuers have difficulty admitting any problem exists. In addition symptoms may appear immediately after an event or be delayed by weeks or even years.

Treatment

Although in some situations PTSD may be unavoidable some constructive steps towards prevention can be taken. Foremost, be prepared for the worst possible situation. If possible receive a vivid briefing of any mutilation. In addition realize that equipment is often inadequate, patients may be inaccessible, foul weather and communications hamper operations, and that patients often fail to respond to proper treatment. Finally a major frustration and factor in PTSD is the boredom and guilt that develops from waiting around while plans are being made.

After the incident do not expect recognition or praise. In addition strenuous aerobic exercise within 24 hours of the incident will relieve both mental tension and relax muscles. Within three days after the incident a guided critical incident debriefing is often useful. The leader of such a meeting should be trained in stress management. Debriefers trained to deal with rescue personnel exist at the University of Maryland and the University of Virginia. If problems with stress persist, professional assistance is often

necessary for a short period.

Alcohol has often played a role in stress management. While it does postpone or decrease symptoms of PTSD it holds several dangers. As a mental depressant it tends to increase the likely hood of depression. Furthermore, alcohol dependence may easily develop if PTSD is present. Therefore, following significant traumatic events alcohol should be avoided if possible.

SUICIDAL STATES

Suicidal subjects or subjects making suicidal gestures are not unusual at searches. Management of the suicidal patient involves recognition of the problem and basic treatment.

Signs and Symptoms

A history of depression indicates the possibility of a suicidal state. Furthermore once the subject is located direct inquiry is appropriate, the rescuer should not be afraid to ask "Have you been thinking about committing suicide?" or "Can you handle this situation?"

Treatment

Once the possibility of a suicidal state has been determined or suspected the subject must not be left alone. This should pose no problem during a typical rescue. Furthermore, a feeling of acceptance and empathy from the rescuer are the keys to treatment. Under no circumstances should contempt, rejection, or anger be vented towards the subject. Finally any possible means the subject may have of injuring themselves should be removed.

VIOLENT BEHAVIOR

Subjects displaying violent or unruly behavior on searches are usually rare. However, situations where subjects had a history or potential for violence have arisen. Therefore, any searcher must be prepared to deal with a potentially violent subject.

Signs and Symptoms

Several factors may predispose the subject towards violence. Schizophrenic disorders, influence of drugs or alcohol, highly charged (manic) states, or a previous history of violence should warn searchers of the potential for trouble. In addition head injuries, diabetes, and shock may also lead to violent behavior.

Treatment

Violent behavior may usually be prevented by using mature judgement and taking several precautions. Foremost, take time with the patient and never appear hurried. All actions and procedures must be clearly explained to the subject. Furthermore, the subject must then verbally state that they will cooperate. This is especially important when moving close or touching the subject. While rendering any aid the rescuer should clearly indicate their role as a helper. In addition, the rescuer must be accepting, non-judgmental, and supportive. Finally, the rescuer must be aware that uniforms, police officers, the sight of guns or radios, activity, and crowds tend to excite subjects. All of

the above commonly appear during evacuations and must be controlled.

EAR, NOSE, and THROAT

EPITAXIS
(Bloody Nose)

Bleeding from the nose usually has local causes such as blunt or digital (as in picking the nose) trauma. However, bleeding may be secondary to foreign bodies, infections, hypertension, bleeding disorders, or extremes of heat and cold.

Treatment

Bleeding should be controlled by pinching the entire nose together firmly, for 5 to 10 minutes. The patient should be in a sitting position with the head bent forward. This will effectively stop bleeding from the anteroinferior septum. Checking for shock, calming the patient, and determining the underlying cause must be an integral part of the treatment. If bleeding persists the patient should blow their nose and repeat direct pressure for another 10 minutes. If this fails the nose should be packed with half inch wide strips of petrololum gauze starting from the lower portion of the nose and then working the gauze upward. After packing, the ends of the gauze must be protruding from the nose. The pack should remain in place 24-48 hours during which time the patient should be removed from the field. Aspirin is contraindicated due to its anticoagulant (blood thinning) properties.

EXTERNAL EAR INFECTION
(Otitis externa)

External ear infection (otitis externa), otherwise known as swimmer's ear is a tissue infection of the ear canal. Water immersion or trauma to the ear canal will predispose a patient to otitis externa.

Signs and Symptoms

The ear canal looks red, swollen, and the tragus or auricle is tender to touch.

Treatment

Ear debris should be gently rinsed out or removed with the corner of a moistened gauze pad. A cotton wick soaked in povidine-iodine and gently placed into the ear will help fight the infection. A warm cloth or hot water bottle applied to the ear are also useful.

MIDDLE EAR INFECTION
(Otitis media)

A middle ear infection (otitis media) usually develops secondary to allergies, the common cold, and frequently involves the eustachian tube. Since ear pressure regulation is impaired the patient should refrain from air travel or helicopter operations. A middle ear infection may progress to involve the mastoid bone. Therefore, medical attention should be sought.

Signs and Symptoms

Signs and Symptoms frequently include earache, mild fever, slight hearing loss, and fluid behind the eardrum.

Treatment

Unfortunately the most effective treatment involves antibiotics, which are usually unavailable in the field.

RUPTURED EARDRUM

Ruptured or perforated eardrums generally occur from trauma to the ear, explosions or blasts (especially from lightening strikes), or from middle ear infections. Trauma to the ear often requires immediate surgery to prevent hearing loss.

Signs and Symptoms

Signs and symptoms include pain, hearing loss, discharge from the ear, and vertigo. Direct examination of the ear should be avoided unless you are especially trained and equipped to do so.

Treatment

If the eardrum has been perforated due to trauma, any discharge should not be stopped. Instead the fluid should be allowed to drain freely into a loose dressing placed over the ear. However, if no fluid is present, a small piece of cotton should be placed loosely in the ear canal to prevent further injury. Air travel or any activity placing stress on the ear should be avoided.

OPTHALMOLOGIC

CONJUNCTIVAL FOREIGN BODY

Conjuctival foreign bodies are the most frequent eye injury and must be sought out with a meticulous eye examination. Ocular penetration and secondary infection may have resulted and should be suspected.

Treatment

The eyelid should be everted and loose foreign bodies removed with a moist cotton applicator or the moistened corner of a gauze pad. Afterwards, rinsing the eye with water is often soothing.

CORNEAL FOREIGN BODY

Corneal foreign bodies more dangerous than conjuctival foreign bodies because corneal abrasions may result. It is important to check for intraocular foreign bodies and to rule out secondary infections. Metal foreign bodies should be treated immediately since they may leave rust rings in the eyes.

Treatment

The eye should be irrigated thoroughly with copious amounts of cool water to remove

the foreign body. A gentle stream from a syringe is often necessary. If this is unsuccessful, patch the eye lightly and seek prompt medical attention.

CORNEAL ABRASIONS

Corneal abrasions result from minor trauma to the eye. A thorough examination and follow up care are necessary to check for ocular penetration and prevent secondary infection.

Signs and Symptoms

The patient usually complains of a sensation that a foreign body is present, pain, photophobia (sensitivity to light), excessive tearing, and blurring of vision. In severe cases the eye is red.

Treatment

Irrigation of the eye should be gently carried out with sterile saline, ideally, but water will suffice. Apply a firm (but not tight) eye bandage.

INTRAOCULAR FOREIGN BODIES

Intraocular foreign bodies are a medical emergency that require removal by an ophthalmic surgeon. Excessive pressure or jarring may cause loss of the humor resulting in permanent blindness. The patient must be carried as gently as possible.

Treatment

The key to treatment is preventing jarring or excessive pressure to the orbit around the eye. Therefore, a light eye patch and shield constructed of stiff material should be placed over the eye. The patient should be gently evacuated.

RETINAL DETACHMENT

Retinal detachment is the separation of the neural retina from the underlying structural retinal pigment epithelium. Minimal trauma may cause detachment to patients who have predisposing factors such as myopia (near sighted). Severe trauma can cause detachment in any patient.

Signs and Symptoms

A sudden painless reduction in vision, flashes of lights or sparks, and the sensation of curtains in front ot the eye or cloudy regions indicate retinal detachments.

Treatment

The patient should be gently evacuated in a supine position with both eyes patched.

SNOWBLINDNESS

Snowblindness (actinic keratitis) which is caused by ultraviolet radiation from the sun is due to destruction of the corneal epithelium. Therefore, symptoms are quite similar to a scratched cornea. Sunglasses are important when working on flight operations, at higher elevations, on snow fields, near large bodies of water, or most importantly for looking

macho on searches.

In order for the sunglasses to be affective they must allow less than 10% of Ultraviolet B (wavelength of 290-320nm) to be transmitted to the eye. In addition they should be curved and for high altitudes have side guards. For every 1000 feet gain in elevation Ultraviolet B increases by 5%. Literature concerning the glasses should be consulted since darkness of the glass does not indicate UV-B filtering ability. Most reputable mail order establishments provide such literature. Sunglasses (or clip ons) that allow more than 10% UV- B through tend to encourage longer periods of time in the sun, decrease squinting, and may allow a greater amount of UV-B to the cornea than without sunglasses. Although the color does not affect UV-B transmitted it does alter vision. Clear, or grey-green glasses do not distort color vision.

Signs and Symptoms

Prevention is especially important since symptoms do not develop until 8-12 hours after exposure. Symptoms and signs include irritated eyes, feeling like they are full of sand, photophobia (pain caused by bright lights), swelling of the eyelid, redness of the eyes, and excessive tearing.

Treatment

Cold compresses and application of a firm bandage are the treatment of choice. Medical attention should be sought when possible.

SOFT TISSUE INJURIES

AMPUTATIONS

Amputations may either be complete or partial. Microsurgery allows reattachment within 24 hours of the accident if the amputated part is well preserved. Therefore, even after a delayed find, reattachment may still be a viable option.

Treatment

A. Complete amputation

Bleeding and other life-threatening injuries should be treated immediately. The amputated part should be washed with cold water or, ideally, with saline. However, prolonged washing should be avoided. The part should be wrapped with moistened (cold water or saline) sterile dressings and placed into a plastic bag. The bag should be kept cold with ice water, or wrapped with cold packs. The patient and amputated part should be evacuated as quickly as possible.

B. Incomplete amputation

Bleeding is often severe and must be treated immediately. The wound should be irrigated with saline or small amounts of cold water without scrubbing. The wound should then be dressed and the body part immobilized in a natural position if possible. Finally, a cold compress should be applied while elevating the injured part above the patient's head.

BLEEDING

Bleeding is the result of trauma and may be internal or external. In particular, internal bleeding may represent a medical emergency since it may easily be missed if an incomplete survey is conducted. When vessels are ruptured, the blood may fill internal spaces without being noticed. Tenderness or swelling in the abdominal area are particulary dire indications of internal bleeding. Internal bleeding should be suspected in all trauma cases. With both internal and external bleeding death may occur in minutes.

Signs and Symptoms

Signs and symptoms of internal bleeding include weakness, fainting, dizziness, paleness of skin or moist and clammy skin, nausea, vomiting, thirst, fast, weak, and irregular pulse, shortness of breath, dilated pupils, ringing in the ears, restlessness, and apprehension. A low blood pressure may indicate hypovolemic shock, especially when accompanied by some of the above signs. However, any of the above symptoms may indicate shock and a blood pressure is one of the last signs of shock to appear. While the signs of external bleeding are usually obvious, they must be nonetheless actively sought out during the primary and secondary surveys. This is especially true in the multi-trauma patient.

Treatment

Initially apply direct pressure with sterile sponges and dressings (if not available use anything), while elevating the bleeding site. If the wound is minor, apply a topical antiseptic (povidone-iodine) and a butterfly dressing to close if the wound is clean and presents little chance of infection. However, if the wound is major and severe bleeding persists despite direct pressure, place a BP cuff on the extremity proximal to the wound. Inflate the cuff to 10 mm/hg above the systolic pressure. Thereafter, an effort must be made to constantly maintain this pressure in the cuff. Severe wounds should be splinted before evacuation. In all cases distal pulses and vitals signs should be monitored closely. Always evaluate the patient for shock.

BURNS

Burn wounds occurring in the wilderness range from minor 1st degree to severe 3rd degree as judged by their depth. In the case of major burns, complications may take several hours to develop. The patient should be immediately removed from the source of the heat. Any non-adherent clothing should be removed. While checking the airway, burns of the face, lips, nose or singed nasal hairs should be checked for. If any of these are present suspect a respiratory burn has occurred. Hoarseness, stridor, and drooling also indicate respiratory problems. All constricting items (eg rings) should be removed from the patient while estimating the area and depth of the burn. Burned tissue should be covered with burn dressings, sterile sheets or bulky sterile dressings. Pain may be relieved with cold water; however, no more than 10 % of the body area should be treated with cold application at any one time. Oral fluids are contra-indicated since they are poorly absorbed and are usually vomited. Furthermore, creams and ointments and any narcotic are contra-indicated.

FRICTION BLISTERS

Friction blisters are characterized by the separation of a tough superficial skin layer from a bottom layer with subsequent fluid build up (infiltration). Friction blisters only occur where toughened or calloused skin is present, such as that on the hands or the feet. Blisters are caused by friction providing a shearing force on the two aforementioned skin layers. Perspiration will cause an increase in friction because of the moisture. The friction eventually causes the superficial skin (stratum corneum) to separate from a deeper layer of skin (stratum granulosum). This rupture occurs suddenly producing moderate pain, commonly referred to as a "hot spot". In addition, the heat from the friction will often turn the skin red. Within two hours the blister cavity will fill with fluid.

Treatment

Prevention is easy and the method of choice. The feet should be clean and kept as dry as possible. Footpowder and/or antiperspirant on the foot help to keep it dry. A light inner sock of silk, nylon, or polypropylene will reduce moisture and friction on the skin. A heavy cotton or wool sock outside, and properly fitted boots are essential. If blisters are a chronic problem, the skin may be toughened with tincture of benzoin and talcum powder. Insoles and teflon sprays have also been found useful. Finally, it may be beneficial to place moleskin on common trouble spots before starting to a field task. It may also be possible to get the boot "punched", that is, stretched at a trouble spot by a cobbler.

If hot spots begin to develop, the feet should be immediately dried off and moleskin should be applied to the affected area. [Editor's note: there are many different techniques for the application of moleskin. Experience is the best teacher. The author of this document does not claim to describe the best way, but simply to offer one in an attempt to fulfill the purpose of this document.] If a blister has already formed, then a small piece of gauze should be placed over the roof of the blister before applying moleskin. If further activity will most likely rupture the blister, it should be drained using sterile techniques and covered with a sterile dressing. A small hole at the foot of the blister can be made with a sterilized pin or needle. Ideally sterile syringe needles should be part of a field medical kit. The fluid is then gently removed. It is very important that blisters be well cared for and kept clean since they are very susceptible to infection, often leading to other complications.

DENTAL

AVULSED TOOTH

Avulsed teeth should be saved for reimplantation. A delay in treatment of a few minutes in replacement results in a poor prognosis.

Treatment

The tooth should be immediately reinserted into the socket without washing or excessive handling. Replacement must be carried out within 30 minutes of the accident. If you are unable to reimplant it, the tooth should be kept moist with a gauze dressing soaked in saline solution or placed in the patient's or rescuer's mouth.

FRACTURED TEETH

Fractured teeth cause great pain as air moves over the surface of the tooth and around the sharp enamel surfaces, irritating the dental pulp.

Treatment

If the teeth are loose they should be stabilized by gentle pushing, followed by placing gauze between the teeth to keep the jaws slightly separated. Placing gauze over the fractured teeth will help alleviate the pain secondary to air movement and sharp edges.

ENVIRONMENTAL

Heat

HEAT CRAMPS

Heat cramps are caused by painful contractions of the abdominal or leg muscles. They usually occur in individuals in excellent physical condition. Heat cramps are caused by depletion of sodium due to prolonged sweating, then followed by water replacement without adequate sodium replacement.

Signs and Symptoms

Heat cramps occur in the arms, legs, and abdomen. The skin may be cool or warm, and dry or moist.

Treatment

Place the patient in a cool place and massage the sore muscles. Replacement of sodium should be carried out by administering an electrolyte solution (Gatorade, ERG, or fruit juices) or increasing salt intake at meals. Salt tablets should not be used as they upset the stomach and are poorly absorbed.

HEAT EDEMA

Heat edema is characterized by swelling of the feet and ankles of elderly unacclimatized individuals. The normal vasodilation of the skin and muscular vessels leads to accumulation of interstitual fluid in the extremities. Patients with heat edema do not have heart, renal, or lymphatic complications. Unacclimatized individuals should be screened and not allowed to go into the field.

Signs and Symptoms

Edema of the hands, feet, legs, and ankles typically occur during the first days of exposure to a hot environment.

Treatment

Heat edema is self limiting and the only treatment is elevation of the legs when convenient.

HEAT SYNCOPE

Heat syncope or fainting may occur following exertion or prolonged standing in the heat. It usually occurs in elderly patients but may occur in well acclimatized individuals. Heat syncope is caused by the combination of volume depletion and development of decreased venous return, due to insufficient cerebral blood flow. Volume depletion occurs due to sweating and vasodilation. If tunnel vision, vertigo, nausea, diaphorisis or weakness develop the patient should assume a horizontal position or flex their arms and legs.

Signs and Symptoms

The primary symptom is fainting. In addition the skin is moist, pulse weak, and transient hypotension occurs.

Treatment

Treatment only requires that the patient assume a horizontal position, cool down, and replace his fluids. The patient should be checked for any trauma due to a fall. Finally, elderly patients should be evaluated for hypoglycemia, CVA, and cardiac arrhythmias.

HEAT EXHAUSTION

Heat exhaustion develops slowly (hours to days) and may rapidly develop into heat stroke. It occurs in young healthy individuals and is exacerbated by exercise in hot humid weather. Heat exhaustion is caused by sodium or water depletion, and accumulation of metabolites.

Signs and Symptoms

Generally the patient will complain of fatigue, weakness, and thirst. Signs and symptoms also include pale skin, diaphoresis, headache, vertigo, lethargy, decreased skin turger, anorexia, nausea, and muscle cramps. Finally hypotension, tachycardia, increased respirations, and temperatures between 38 to 40C (100 to 104F) may be present.

Treatment

Prevention of heat exhaustion is possible through adequate fluid intake. In addition fruit juiced or dried fruit will provide required electrolytes. The patient should be moved immediately to a cool shaded location. Constrictive clothing should be removed and gentle cooling with water and fanning initiated. Oral rehydration must be carried out with an electrolyte solution in severe cases. Replacement with only water may make the situation worse. Do not immerse in a cold bath.

HEAT STROKE

Heat stroke is characterized by collapse of thermoregulatory control, altered mental states, and body temperatures exceeding 41C (105.8F). Old age, alcoholism, exercise, psychotic drugs, diuretics, previous heatstroke, previous burns, sweat gland abnormalities, and cardiovascular disease predispose an individual to heat stroke. In addition, high relative humidity, low wind speeds, lack of acclimatization, obesity, dehydration, and warm clothing will interfere with heat dissipation. Heatstroke brings about denaturation and deactivation of enzymes, destruction of cell membranes, disruption of protein synthesis, interruption of cellular respiration and decreased oxygen transport. Thus the CNS, cardiovascular, hemtologic, renal, hepatic, and pulmonary systems are significantly

damaged. Heatstroke is considered an acute medical emergency since it rapidly leads to permanent disability or death.

Signs and Symptoms

Initial symptoms include headache, dizziness, nausea, visual disturbances, confusion, and convulsions. Onset is usually rapid and may result in temperatures as high as 46.5C (115.7F). Therefore, a thermometer that reads at least up to 105F should be carried. Blood pressure is usually low; pulse and respiratory rates are increased. While the skin is typically described as hot and dry, sweating is present in up to 50% of all patients. In addition in later stages the skin becomes cyanotic, pink, or ashen. Other symptoms include hallucinations, confusion, frank psychosis, combativeness, muscle rigidity, decerebrate posturing, hyperventilation, and abdominal pain.

Treatment

Immediately place the patient in a shaded, cool, environment and remove excess clothing. While monitoring the airway initiate external cooling. Ideally, cold water should be continuously applied with active fanning. Cold packs if available may be applied to high heat exchange areas (neck, axilla, groin). However, avoid direct skin contact. If the victim is near a stream, cold water immersion of the trunk may be carried out. Once again monitor carefully since hypothermia may result. In all cases cooling should be stopped when the core temperature reaches 101 F. Furthermore, the temperature should be continuously monitored since hyperthermic rebound may occur 3-6 hours later. In environmental cases of heat stroke aggressive fluid treatment is contraindicated since it may lead to pulmonary edema. If the patient is conscious a sugared electrolyte should be administrate since hypoglycemia is a predisposing factor. Additionally, aspirin, benedryl, and application of alcohol are also contraindicated.

Cold

CHILBLAINS

Chilblains are a nonfreezing skin injury brought about by vasocontriction and characterized by red pruritic (itchy) skin lesions. Temperatures between 33 and 60 F (1-16 C), high humidity, rain, wind, and vascular disorders predispose a patient to chilblains. Repeated or long term exposure to the environment is usually required, with young woman most commonly affected. Chilblains result from exaggerated vasoconstriction leading to ischemia and edema of the deep papillary dermis. Fingers, toes, ears, cheeks, and other such regions are most often affected.

Signs and Symptoms

Red swellings, papules, or plaques often pruritic and leading to ulcers, edema, or blisters characterize Chilblains. In addition, they may further degenerate to scarring, fibrosis and atrophy. History of cold exposure allows diagnosis.

Treatment

Since no definitive treatment exists prevention is imperative. Remaining well hydrated is the most important preventative step. However, elevating the injury while resting on pillows or sheep skin is palliative. Ice, rubbing, and massage are contraindicated.

IMMERSION SYNDROME
(Trench Foot)

Immersion syndrome (trench foot) is characterized by a cold, numb, and swollen limb resulting from prolonged exposure to mud or water, slightly above freezing. Within the literature at least eight different names can be found, demonstrating how common the disorder is. Prolonged standing, tight fitting boots, damp boots, and poor nutrition are predisposing factors. All conditions experienced during searches and constantly faced in caves. In addition, sweat in boots attracts water which exacerbates the condition. Staying well hydrated is the most important step in prevention, if the environment cannot be avoided. With 10-12 hours of cold exposure, vasocontriction leads to tissue hypoxia and ischemia (decreased cellular oxygen levels). The disorder is further characterized by progressive stages. In the Falklands war twenty percent of the British patients suffered from immersion syndrome.

Signs and Symptoms

Initially the affected limb is cold, pale, waxy, numb, tingling, or itchy due to tissue ischemia. While walking is possible it will be hindered by pain or decreased sensation. After 24-48 hours the limb becomes hot, red, swollen (edematous), painful, blistered, and the patient will notice bounding pulses. This hyperemia stage will then lead to recovery or become gangrenous. In normal recovery, the tissue will remain hypersensitive to cold for several years or permanent vascular change will occur.

Treatment

Since immersion syndrome can be confused with frostbite, a history concerning environmental temperatures are critical. If environmental temperatures were present below freezing the injury should be treated as frostbite. Care in the field consists of gently drying the foot and evacuating the patient. Rewarming in the field should be avoided. Application of heat packs, ice, and massaging are contraindicated.

FROSTBITE

Frostbite is characterized by frozen tissue resulting from ambient temperatures below -7C (20 F). Vasocontriction causes a marked decrease in blood flow to the skin, from a normal of 500 ml/minute to 50 ml/minute, allowing the skin temperature to fall to -10 C (14 F). At these temperatures ice crystals form in the extracellular space, resulting in cellular dehydration and allowing electrolytes to reach toxic levels. In addition blood flow stops and the capillaries breakdown. Both mechanisms lead to tissue death.

Temperatures below 7 C (20 F), significant wind chill, diabetes, decreased oxygen at higher altitudes, fatigue, dehydration, improper acclimatization to the cold, previous cases of frostbite, tobacco use, alcohol use, constricting garments, and a cramped position predispose the patient to frostbite. Tobacco causes vasoconstriction, further decreasing skin temperature, while alcohol makes the patient less aware of any warning symptoms. Areas that undergo marked vasocontriction such as the cheeks, nose, ears, toes, and hands are more susceptible. Increasing fluid intake to avoid dehydration takes active effort during cold weather but is critical in avoiding frostbite. While overwarming of hands and feet will prevent frostbite it may potentially lead to hypothermia due to decreasing the body's thermoregulatory system response.

Signs and Symptoms

Frostbite may be divided into four grades of severity (similar to burns). However, for field purposes the only differentiation that needs to be made is between frostnip and

the more severe classes. First degree is characterized as freezing without blistering. The patient presents with numbness, redness, swelling, and peeling. If capillary refill, peripheral pulses, and some sensation is present then the frostbite, can be considered frostnip. In second degree frostbite blisters will appear with skin vesiculations (large blisters). Third degree frostbite involves the full thickness of the skin with complete lack of sensation and hard skin. In addition skin blanching to pressure is absent. Finally, in fourth degree frostbite underlying muscle and bone are frozen, ensuring mummification and autoamputation of the affected part.

Treatment

If the patient is hypothermic then treatment for frostbite should be postponed until the core temperature has stabilized. Furthermore, only frostnip may be safely treated in the field. Frostnip may go unnoticed, therefore searchers need to constantly check their team member's noses, checks, and ears. Treatment consists of placing a warm hand or warm body part on the frostnip without rubbing. More serious frostbite must not be rewarmed in the field, since refreezing devastates the tissue. In one case a patient walked for 74 hours on frozen feet without sustaining further injury. Furthermore, proper treatment requires constantly regulating a whirlpool bath between 38C and 43C (100-110 F) to avoid further damage to the tissue. Severe frostbite is stable and the patient should be evacuated with the part loosely dressed with sterile bandages, mostly to avoid any trauma during the evacuation. Finally, rubbing and pressure on the affected part are contraindicated. Therefore, it would be better to leave a boot on so loose foot ties could be made in the stokes basket.

ACCIDENTAL HYPOTHERMIA

Accidental hypothermia challenges the rescuer with a wide array of treatment choices for multiple systemic dysfunctions. Unfortunately confusion and contradiction can be found throughout the medical literature. Furthermore, to adequately understand hypothermia some background in heat loss, thermoregulation, pathophysiology, and underlying causes are necessary. The information presented here is only a start and further reading is necessary to adequately understand the topic, especially since 35% of the Appalachian Search & Rescue conference's injured patients have had hypothermia. On a national level, 6460 deaths due to hypothermia ocurred between 1968 and 1980. However, many cases of hypothermia deaths are undetected or attributed to other causes. It has been estimated that over 50,000 causes of hypothermia may occur in america each year.

Hypothermia occurs whenever the body's core temperature falls below 35C (95 F). Hypothermia may be further classified as **Immersion** or Acute Hypothermia; Sub Acute, exposure, or **mountain hypothermia**; and urban or **Chronic hypothermia.** Immersion hypothermia occurs in water below 21C (70 F). Sub Acute Hypothermia usually occurs in healthy young individuals due to prolonged exposure exacerbated by fatigue. Chronic hypothermia usually affects the elderly in an urban setting, since usually several days are necessary for it to develop. Acute and Subacute hypothermia should be the primary concern in a wilderness setting. However, chronic hypothermia may develop over a prolonged search or cause a confused individual to wander off into the woods. Due to the prolonged onset, chronic hypothermia and to a lesser degree subacute hypothermia will have several complications due to changes in the body. As a general rule the longer the hypothermia takes to develop the more difficult treatment will be. In hypothermia cases

with an underlying medical condition mortality runs between 70 to 90%. However if no complication exist mortality may be as low as 10%. However the statistics must be viewed with caution since they largely reflect chronic hypothermia in an urban environment.

PHYSIOLOGY

Heat loss

Under normal circumstances 95% of the body's heat is lost through conduction, radiation, convection, and evaporation. Normally only 2% of total heat loss is through direct conduction from the body to another object. However, sitting on a cold rock or snow without adequate insulation will significantly increase this amount. Furthermore, conduction loss will increase 5 fold with wet clothes, and 25 fold in cold water immersion. At normal temperatures infrared radiation accounts for 60% of the body's heat loss. Unfortunately, at colder temperatures this increases and cannot be controlled by normal clothing. Air currents remove 15% of the body's heat by convection. However, this figure varies widely depending upon wind velocity and protective clothing. Finally evaporation, where water converts to water vapor, accounts for 22% of heat loss. Evaporation occurs continuously in the respiratory tract and through insensible perspiration. If sweating occurs heat loss will increase not only due to evaporation but also due to increased conduction.

Thermoregulation

Heat loss can be modified by the body through its thermoregulatory mechanism. The hypothalamus which is the thermoregulatory center in the body is able to both decrease heat loss and increase heat production. Heat loss is controlled through inhibition of sweating and vasoconstriction. Peripheral receptors in the skin and central receptors in the hypothalamus cause the blood vessels in the skin to constrict thus reducing blood flow and heat loss. An eighty fold decrease in blood flow may occur between 44 to 15 C. This vasoconstriction is most pronounced in the hands and feet. Periodically the vessels in the hands will dilate increasing skin temperature and preventing frostbite. Skin temperatures below 5 C will paralyze the nerves, allowing widespread vasodilation to occur. The increased blood flow will then warm the skin receptors. Even small temperature increases when the skin is 26C or below will be perceived as an uncomfortably warm sensation. This may account for paradoxical undressing, where hypothermic patients often wildly remove their clothing and are found nude since they feel hot.

The major method of increasing heat is through shivering. Preshivering may increase heat production 50-100%, while visible shivering causes an increase of 500%. Unfortunately, this can only be sustained for one or two hours and leads to glycogen depletion, buildup of lactic acid, and fatigue. Cellular heat is further increased by the release of thyroxine which increases the basal metabolic rate. In addition, the release of sympathetic exciters causes an immediate increase in cellular metabolism. Finally, a dilation of core vessels increases core volume and temperature. Unfortunately, when the core temperature reaches 30 C the hypothalamus is unable to control thermoregulation and the body becomes polkiothermic (functions like a cold-blooded animal) which leads to rapid degeneration.

The body normally maintains its core temperature between 36-38.5 C (97-101 F) and a nude individual can thermoregulate indefinitely between 60-130 F. However, through behavioral regulation humans can endure temperatures of 250 C (deep space) to 800 C (surface of Venus). Therefore, with the proper precautions hypothermia may be prevented in any circumstance. Adequate clothing that provides warmth while wet or more

importantly a system that repels water while preventing sweating are an absolute must. Adequate water intake is necessary to prevent dehydration, maintain pressure, avoid frostbite, and prevent fatigue. Finally food should be eaten constantly in small amounts to maintain energy stores.

Pathophysiology

As hypothermia overwhelms the body's thermoregulatory ability, every system is affected. The central nervous system, cardiovascular, respiratory, renal, and hemologic are significantly altered.

A decrease in blood flow to the central nervous system initially causes confusion, loss of coordination, and inappropriate behavior. Loss of behavioral thermoregulation (ability to take proper precautions) can quickly lead to further deterioration. Patients typically become semiconscious at 30 C and may be completely unresponsive with fixed and dilated pupils. However, patients with only minor nervous system deficits have been noted at 26 C. Furthermore, even of the patients with severe hypothermia (20-27C)/(68-80F) 33% will only be lethargic or confused. While in mild hypothermia cases 64% of the patients are lethargic or confused. At temperatures of 20C , the brain becomes a metabolic icebox, and may survive cardiac arrest for one to three hours. In one particular case a 42 year old male was buried by an avalanche. Five hours later he was uncovered with a core temperature of 19C and found to have no heart beat. However, 70 minutes later a physician decided to initiate CPR nevertheless. After 135 minutes of CPR a heart rate was regained. After a few days in the hospital the patient was discharged with no neural deficits. Therefore, no patient is considered dead until they are warm and dead.

Initially heart rate and blood pressure increase in hypothermia. However, eventually the collapse of thermoregulation leads to bradiacardia and hypotension. Ventricular fibrillation and asystole commonly occur below 29 C. In healthy individuals asystole usually results, suggesting ventricular fibrillation occurs due to rewarming treatments. The most common cause of ventricular fibrillation is jostling the patient. In addition, rewarming shock or afterdrop causes fibrillation. When cold peripheral blood returns to the core due to rewarming, the core temperature itself may decrease. In one hypothesis, whenever the temperature just outside the heart is less than the temperature inside the heart ventricular fibrillation results. However, the deleterious affects may not be so much due to the colder temperature as the high levels of potassium, lower pH, and toxins contained in peripheral blood. For these reasons rapid external rewarming techniques are dangerous and contraindicated for severe sub-acute hypothermia. Moreover, placement of central IVs, excessive use of sodium bicarbonate, hypovolemia, and initiating CPR when a pulse is present are also causes of ventricular fibrillation.

Respiratory rate also increases initially and then falls. At 30C it ranges between 7-12 per minute, while at 20C it falls to 4 per minute. The decreased exchange results in carbon dioxide retention leading to respiratory acidosis. Since the respiratory center may be triggered by oxygen levels at this point, not more than 50% oxygen should be administrated.

Peripheral vasoconstriction in early hypothermia results in increased blood flow to the core. The body responds by suppressing the release of antidiuretic hormones resulting in cold diuresis. Total blood volume may be reduced to 68% of normal values. In addition, damage to the kidneys may account for further diuresis. Therefore, even though the patient may present polyuria, severe hypotension may also be present.

Several significant changes occur in blood chemistry. Foremost among the changes is an increase in blood viscosity due to cold diuresis and a rise in hemacrit (red blood cell count). This further increases thrombus (clot) formation which can severally damage tissue because of hypoxia. In addition blood flow through the capillaries becomes sluggish or leaks out of the capillaries resulting in subcutaneous edema and hypotension. Lactic

acid produced by the muscles during shivering lowers the pH of the blood resulting in metabolic acidosis. Furthermore, large amounts of organic acids from injured cells make the peripheral blood even more acidic. The dangers of rapidly returning peripheral blood should be readily apparent. The peripheral blood also contains large amounts of potassium which alters cardiac function. Blood sugar may also be extremely high or low. Initially glucose levels are high due to breakdown of glycogen supplies in the liver. However, intense shivering can deplete these supplies and hypoglycemia may result. While many changes occur, some of these changes are considered protective.

While several different factors predispose a patient to hypothermia, they functionally are due to excessive heat loss or inadequate heat production. The urgency of a search will increase tremendously if any patient possesses any of the disorders listed in the following figure.

Predisposing Factors to Hypothermia

Excessive heat loss	**Inadequate heat production**
Exposure	Metabolic dysfunction
-low temperature	-Hypothyroidism
-high winds	-Hypoglycemia
-low humidity	-Diabetes mellitus
-rain	-Diabetic acidosis
-high altitudes	Central Nervous System
-immersion	-Brain trauma
Large area to mass ratio	-Spinal cord trauma
-elderly	-Wernicke's syndrome
-infants	-starvation
Drug intoxication	Unknown Mechanisms
-Barbiturates	-Sepsis
-Phenothiazines	-heart attack
-Tricyclic antidepressants	-Pneumonia
-narcotics	-Congestive Heart Failure
-alcohol	
Severe burns	
Immobility	

SIGNS AND SYMPTOMS

The only reliable sign for hypothermia is temperature. Therefore, a low reading thermometer is an absolute necessity for searchers. While only rectal, tympanic, esophogeal and urine temperature readings are reliable; oral readings serve a useful screening role. If the oral temperature is above 95 F and the patient has not drank any hot fluids within the past 15 minutes then a rectal temperature is not needed. However, the patient still needs to be treated to prevent any future hypothermia. The signs and symptoms vary and change depending upon the core temperature.

In one method hypothermia is broken into four stages, while in a second symptoms and signs dictate mild or severe hypothermia. **Stage I** or compensated hypothermia (34-37C) presents with painful hands, bluish white skin, increased heart rate, increased respiratory rate, and mild loss of coordination. **Stage II** or crisis hypothermia (30-34C) represents the bodies energy stores near depletion and presents with a numb face, muscular rigidity, bradycardia, irregular respirations, incoordination, and shivering. In **Stage III** hypothermia (27-30 C) thermoregulatory systems fail. Therefore, with a loss of shivering the core temperature begins to drop even more rapidly. Stage three is characterized by lack of pain reflexes, severe bradycardia, barely palpable pulses, and

pupils still reactive but the patient is usually unconscious. **Stage IV** or terminal hypothermia (Temp less than 27 C) looks similar to death with absent pulses, pupils fixed and dilated, deep coma, severe bradiacardia, and lack of all muscle reflexes.

Mild hypothermia represents Stage I and II. However, the temperature range is 32-35 C and is easily characterized by shivering and conscious but confused patient. Elderly patients are not always capable of active shivering and must be watched carefully. In severe hypothermia (Temperature below 32 C) shivering is no longer present and altered levels of consciousness are apparent. For purposes of field treatment remembering mild and severe hypothermia characteristics are critical.

HYPOTHERMIA

Mild

98-95 F / 37-35 C — Sensation of chilliness, skin numbness, minor incoordination, shivering begins, rapid heart rate and breathing.

95-93 F / 35-34 C — Increased incoordination, slow pace, mild confusion, agitated, pain in hands, bluish white skin, rapid heart rate and breathing, and marked shivering. Normal blood pressure.

93-90 F / C — Gross incoordination, frequent stumbling, mental sluggishness, retrograde amnesia, slower heart and breathing rate, numb face, shivering.

Severe

90-86 F / 32-30 C — Shivering stops, inability to walk, incoherent, irrational, hypotension, bradycardia, bradiapnea.

86-82 F / 30-28 C — Muscular rigidity, semi-conscious, pupils dilated, inapparent heart beat or respirations, no pain reflexes, cardiac dysrhythmias, paradoxical undressing. Ventricular fibrillation if heart irritated.

27 C — Frank coma, areflexia, victim appears dead.

26 C — Blood pressure reading unattainable. Lowest case of consciousness.

23 C — Corneal reflexes disappear.

22 C — Asytole very likely.

18 C — Lowest accidental hypothermia with recovery.

9 C — Lowest artificially cooled hypothermic case with recovery.

-7 C — Hamsters revived successfully.

TREATMENT

Mild Hypothermia

In mild hypothermia concern should be centered on other injuries, predisposing causes, and maintaining the body's temperature. The most essential aspect to treatment is early recognition. Team members must constantly be aware of each others mental status. The patient should be removed from a hostile environment and wet clothes replaced with dry ones. Additional insulation should be provided especially for the head. In mild hypothermia, the thermoregulatory mechanism is still intact and the patient will be able to heat themselves back up. However, placing a second person of the opposite sex in a sleeping bag will quicken the process and will improve morale. Sugared food should be administrated if the patient is able to chew it unassisted. Hot fluids should only be given in marginal hypothermia cases for morale purposes. Otherwise, it only warms the blood going to the brain thereby reducing the thermoregulatory response, increases the likelihood of aspiration, and provides insignificant heat. Any method of rewarming has been proven safe. Active external rewarming provides the most rapid relief. However, if a bathtub is being used the patient should be able to reach a hospital. If not, then the arms and legs should be kept out of the tub to prevent rewarming shock. In any case where rewarming shock is a concern every attempt to reach a hospital for rewarming must be made.

Severe Hypothermia

Treatment of severe hypothermia challenges any rescuer, takes precedence over other injuries, and involves an element of luck. While the literature is conflicting 50-80% of patients with severe hypothermia die. However, most fatal cases had additional medical disorders present. Treatment protocols vary from one article to another, however a clear method of treatment is beginning to emerge.

Foremost, treat the patient; some patients have completely recovered after two hours of cardiac arrest. Since ventricular fibrillation usually occurs during a rescue and not before, at all times treat the victim gently. If spontaneous respirations are present then under no circumstance are cardiac compression indicated. If no respirations are found gently expose the patient's chest, either by cutting buttons or zippers off, to gain access. If the clothes are dry, then only cut a slit to access the sternum region. The chest should be auscillated for at least a minute for a heart beat. If any beats are heard compressions are contraindicated. If no stethoscope is available monitor the carotid pulse, warming your fingers before palpating. A shelter from wind, rain, and providing insulation from the ground should be rapidly constructed. Remember, handling the victim gently is the foremost concern. If the clothes are damp cut them off. Gently dry the skin and redress in warm clothes. While redressing a rectal temperature should be taken. Furthermore, the stethoscope should be securely taped above the left ventricle of the heart. A similar technique should be used in placing a blood pressure cuff upside down on the arm so the tubes can run out the collar and a stethoscope placed over the brachial artery. Slits may also be cut to allow tubing to be accessible for continued monitoring. A QRS monitor if available will also assist with monitoring the patient. The patient should be well packaged with space blankets or plastic bags, blankets, sleeping bags, ensolite pads, further blankets, and plastic to keep everything dry. Any existing frostbite should not be treated but instead gently wrapped with bulky dressings. If unable to determine whether other coexisting disorders exist a cervical collar should be placed on the patient.

Oral fluids and food should not be given. Glucose may be administrated sublingually or rectally. Administration of 50% warmed humidified oxygen will help stabilize the core temperature. However, the patient should not be hyperventilated. Heat packs typically only burn the patient and may cause rewarming shock. Since central

pressure is difficult to determine in the field and MAST may increase the likely hood of rewarming shock they are also contraindicated. Remember active procedures are not generally indicated. Finally if possible evacuation should be carried out by helicopter. However, if only an ambulance is available it should be warmed to 65-70 F and the EMT-A's told not to begin any active external rewarming. Transporting the patient without inducing ventricular fibrillation can be regarded as completely successful treatment.

Bites and Stings

VENOMOUS INSECTS

Venomous insects include bees, wasps, yellow jackets, and fire ants. Stings are most common in late summer and early fall. The venom consists of enzymes, histamine, neurotransmitters, and 9-13 antigenic proteins. Although 100-200 stings are required to cause death in a normal individual, the antigenic proteins are capable producing anaphylactic shock in sensitized individuals. 50-100 people die a year from bee stings with 10 percent of the population presenting mild systemic allergic reactions.

Signs and Symptoms

Pain, mild edema, and a wheal and flare reaction occur immediately after a sting. Hives, nausea, and wheezing indicate a mild systemic allergic reaction. A local reaction may be painful and persist for up to four days. A severe systemic reaction indicates anaphylaxis characterized by itching, fever, dyspnea, cyanosis, vomiting, hypotension, bronchospasm, and respiratory arrest. Systemic reactions usually occur in the first 15 minutes but may be delayed up to 6 hours.

Treatment

The stinger of a honeybee should be removed with tweezers, or scraped away from the side by a fingernail. A cold compress will help lessen the pain. The patient should be closely watched for anaphylaxis (see anaphylaxis).

VENOMOUS SNAKE BITES

Eight thousand venomous snake bites occur each year resulting in 12-15 deaths. Those deaths usually occur in young children receiving multiple bites and in untreated cases. Therefore, a snakebite should be of little concern to someone in the field.

In the Eastern Mid-Atlantic region venomous snakes are all pit vipers which include cottonmouth, copperhead, and rattlesnakes. Fatalities are usually only due to rattlesnakes. Pit vipers can be easily recognized by their triangular head and fang marks on the victims. They receive their name from a heat sensory pit located between the eye and nostril.

Snake venom is a complex mixture of 5-15 enzymes, 3-12 non-enzymatic proteins, peptides, and at least 6 unidentified substances. While pit viper venom has been classified as cytolytic, in fact it affects almost every system in the body. The cytolytic aspect lyses cells, enhances local spread of venom, causes hemolysis (breaks down blood), leads to increased capillary permeability, and terminates with tissue necrosis. Therefore, making cuts in the skin almost guarantees tissue necrosis.

Signs and Symptoms

Envenomations are characterized by fangmarks; swelling and edema; pain; ecchymosis;

weakness; diaphoresis; numbness or tingling of the tongue and mouth; faintness or dizziness; nausea; vomiting; changes in vital signs; increased blood clotting time; tingling or numbness of the affected part; necrosis; and thirst. Swelling and pain usually appear 5 minutes after the bite.

Treatment

The most important aspect of treatment will be reassuring the patient, avoiding panic, and keeping the patient still and calm. It has been hypothesized that venom travels in the lymphatic system which is spread primarily by activity. Furthermore, excitement will only exacerbate such symptoms as nausea, dizziness, and other stress reactions. Since several pathogens reside in a snake's mouth and some venom may still be present on the skin the wound should be rinsed with water.

If less than three hours away from a hospital, cutting and sucking are not required. Place an elastic wrap (Ace bandage, gauze roll) firmly around the bitten extremity wrapping proximal to distal. If not available a piece of cloth at least two inches in width can be used. The wrap should be loose enough so distal pulses and sensation are not altered. Splint and immobilize the limb at or below the level of the heart. The patient should then be evacuated while monitoring vitals.

If the patient is more than three hours away from a hospital then cutting may be considered. In order to cut, a sterile blade and suction device must be present since complications of infection are high. Furthermore, the bite should be to a young child or elderly patient from a rattlesnake. Further contraindications include bites to the hands, feet, face, and genital area. Finally cutting must be initiated 5 minutes after the bite to be worthwhile.

If cutting is to be carried out the washing and placement of the constricting band come first. The constricting band should be at least two inches in width and should be placed proximal to the bite. Distal pulses and sensation should be checked to insure the band is not on too tight. The fang marks should be washed with povidine-iodine and not with alcohol. A single cut through the fang mark parallel to the long axis of the limb, 1/4" (6mm) and 1/8" (3mm) deep can be made. Suction should be continued for one hour. Afterwards the wound should be dressed and wrapped, splinted, immobilized, and kept at the level of the heart. A helicopter evacuation should be considered.

Cold therapy is mentioned here simply because it is contraindicated. The possibility of frostbite in compromised limbs leads to needless amputations. Furthermore, the snake's enzymes are not inactivated as readily by cold and may only be driven deeper into warmer tissue by vasocontriction.

BLACK WIDOW SPIDER BITES

The female black widow spider is shiny, black, with a red hourglass marking on her abdomen, and are 12-18 mm in body length. Most bites occur in rural and suburban areas of Southern states. The spider releases a neurotoxin that acts on the myoneural junction accounting for the severe muscular spasms. Fatalities are rare, and occur usually only in small infants and older patients with preexisting cardiovascular disease.

Signs and Symptoms

The initial bite is minor and is unnoticed or described as a "pin prick". Symptoms of envenomnation usually appear after 10-60 minutes. Symptoms include, severe pain in the extremity, muscle spasms of the abdomen, diffuse paresthesias, abdominal rigidity, headache, dizziness, dysphagia, nausea, vomiting, diaphoresis, facial edema, and the pain is usually described as burning or agonizing. Symptoms usually peak at 2-3 hours after the bite and may last up to 24 hours.

Treatment

Attempt to save the spider for positive identification. Local application of ice will alleviate pain. The patient must be closely monitored especially if a young child.

BROWN RECLUSE SPIDER

The brown recluse spider is brown in color, has a violin-like mark on the cephalothorax, and is about 2 cm in length. Most bites occur in the South Central states, but the spiders are found all over the United States. The venom is a cytotoxin causing local tissue damage. Fatalities are rare and occur only in small children.

Signs and Symptoms

The initial bite typically goes unnoticed and pain at the site does not occur for another 1-4 hours later. Initially an red (erythematous) spot with a central pustule is seen that gradually grows over the next 3-4 days. A systemic reaction occurring 24-48 hours after the bite presents with fever, malaise, painful joints (arthralgias), rash, and hemolysis.

Treatment

No field treatment other than capture of the spider and evacuation exist.

MITES

Several species of mites exist that cause different skin disorders in humans. While one species of mites cause scabies, mites are more commonly known as lice or chiggers. The harvest mite or chigger is a common problem. Chigger mites are tiny (0.5mm) arthropods that inhibit green vegetation on warm or hot areas.

Signs and Symptoms

The actual mite is seldom seen. However, when they attach they burrow under the skin in order to deposit their eggs. This process causes local redness and a 0.5-1cm pruritic papule. In addition, the papules are usually located at the edges of tight clothing such as the top of a sock, belts, underwear, and bras.

Treatment

The best treatment is prevention. Blousing the bottom of pants legs and application of repellents are the most effective measures. Once the papulla is present application of a campjhor-phenol ointment or nail polish to the skin will asphyxiate the mite.

TICK DISEASES

Ticks carry a variety of pathogenic organisms. Tick paralysis, Rocky Mountain spotted Fever, Relapsing Tick Fever, Lyme Disease, and Tularemia are covered under infectious diseases. Ticks also cause Babesiosis, Q fever, and Colorado Tick Fever which occurs in Western states.

Other Agents

POISONOUS MUSHROOMS

Poisonous mushrooms are consumed by hikers and foragers who make mistakes, and by pleasure seekers after the hallucinogenic properties of some mushrooms. The cyclopeptides found in the species *Amanita* and *Galerina* are responsible for 90-95% of all mushroom deaths. Amatoxin, one of the cyclopeptides, causes damage to two major systems. In the liver they interfere with the synthesis of messenger RNA resulting in cell lysis and liver necrosis (death). In the kidney they cause tubular necrosis allowing the poison to return to the blood. Other types of mushroom poisoning occur, but if unable to positively identify the mushroom without doubt, then amatoxin poisoning should be assumed.

Signs and Symptoms

In amatoxin poisoning symptoms do not appear until 6-24 hours after ingestion. Whereupon, the gastrointestinal symptoms of abdominal pain, vomiting, diarrhea (often bloody), and hematuria occur (blood in the urine). In addition, hypotension, severe dehydration and electrolyte loss, fever, tachycardia, and hypoglycemia are common. These initial symptoms persist for approximately 24 hours and are followed by a remission that lasts one or two days. The remission then progresses to a terminal phase that is characterized by increased abdominal pain, coma, seizures, confusion, renal failure, impaired myocardial function, and finally death.

Treatment

Induce vomiting in all cases of mushroom poisoning and save a sample of the emesis. Activated charcoal should also be given. Treatment for dehydration and hypoglycemia may need to be carried out.

SUNBURN

Sunburn is a radiation burn caused by ultraviolet light from the sun. The typical redness seen is due to vasodilation of surface vessels and release of prostaglandins. Working around a reflective surface (water, snow, sand), moist skin, high relative humidity, heat, and a brisk wind increase the severity of the burn. Prevention through the use of sunscreen is the best treatment.

Signs and Symptoms

Signs and symptoms include chills, fever, malaise, nausea, and vomiting. Erythema redness), blistering, and edema are the most typical signs.

Treatment

Treatment is the same as all burns. The patient should be evaluated for possible dehydration and electrolyte imbalance.

LIGHTNING

Lightning strikes 600-900 people a year in the United States, killing 200- 300. Therefore, lightning is the natural disaster with the highest death toll. In Virginia, Maryland, and Pennsylvania 30-50 thunderstrorm days occur per year; usually in the summer and fall and often located in mountainous areas. A large proportion of the victims are hikers, campers, and golfers.

A typical bolt of lightning will last 10-3 to 10-4 seconds, attains voltages over 100 million volts and temperatures over 3000 degrees C. Due to the brief duration most of the current (500,000 amps) travels over the skin following areas of concentrated sweat or moisture. This flashover phenomenon tends to turn skin moisture to steam causing clothes to explode off. Injuries are produced by four mechanisms. A direct strike results when the victim is physically hit by the lightning bolt. In a side flash or splash strike the lightning hits a tree, person or nearby object and jumps to a person with less resistance. This mechanism is responsible for large groups of people huddled together all being hit. In step voltage or ground current, lightning strikes a nearby object and then current spreads out like a wave in a pond. Finally blunt trauma may result from an explosion due to superheated air, or the victim being thrown by muscle contractions produced by lightning's direct current. This current will sometimes cause asystole and cause the respiratory center in the brain to stop functioning. The heart will usually spontaneously restart but respirations will not always restart without assistance.

Signs and Symptoms

Victims usually are disoriented, combative, comatose, or have amnesia that lasts for a few days. The clothes may be found exploded off but second and third degree thermal burns are not usually found. Instead first degree linear burns that typically start at the head or neck and follow the path of heavy sweat to the feet are typical. In addition, punctate burns which are clusters of circular burns that form starburst patterns are found. Feathering burns are produced by imprints from electron showers that track through the skin and are characterized by fernlike patterns with delicate branching. Other sign and symptoms include, perforated eardrums; transient blindness; dysrhthymias; respiratory arrest; and mottle, blue, cold, pulseless lower extremities with paralysis due to vasospasm and sympathetic instability.

Treatment

In a triage situation those not breathing should be treated first. Artificial respiration must be continued for an hour in many cases before spontaneous respirations resume. The rescuer should suspect and treat for cervical spine injury and other blunt trauma. Treatment of burns follow standard care. Although distal pulses may not be present in the lower extremities aggressive fluid replacement or MAST trousers is contraindicated due to possible cerebral edema. The patient must be evacuated and carefully monitored since neurological changes occur during the first 72 hours after a lightning strike.

TRIAGE

In most search and rescue incidents triage will not be needed. However, when responding to an aircraft accident or mass casualty incidents the searcher may be confronted by a large number of patients. In this type of situation the normal patient assessment survey is altered. Triage is the system of sorting out patients for treatment so that the greatest good is done for the greatest number of people. This is carried out by rapidly placing patients into one of four catagories that determine the order patients are treated.

The only equipment necessary for triage are triage cards and a pen. Triage cards can be obtained from any local rescue squad or improvised from any piece of paper. Ideally the most experienced medical personnel available should carry out triage. However. the following system allows any rescue personal to rapidly carry out an initial triage.

Upon arriving on the scene any patient able to walk is told to move to a designated area. These patients typically do not have serious injuries and are placed into the delayed (green tag) category. It should be stressed that if only a small number of patients are present this technique should not be used. Instead the patients should be asked to raise their hand or other appropriate technique. Thereby reducing the risk of any cervical or spinal damage. However, in the case of a true mass disaster normal precautions cannot always be followed.

The patients remaining stationary are then categorized into dead or near dead, immediate, or serious catagories. Assessments of respiration, perfusion, and mental capability are made on each patient. The entire process of making the assessments should only take 30-60 seconds per patient. This technique also provides a method a rapidly assessing a patient when a find is made. Furthermore, stabilization of life-threatening disorders can be carried out. However, this is not too critical where search and rescue personnel are being used, due to the time required to arrive on scene. More importantly, the assessments do not require any diagnosis to be made so rescue personal weak on medical skills can still function usefully.

Respiration is the first assessment. If respirations are above 30 per minute the patient is placed in the immediate category (red tag). If no respirations are present the neck should be repositioned. If respirations resume they are placed into the immediate category. Otherwise, they are placed into the dead or near dead category (black tag). The only exception to this, is lightning strikes. Upon witnessing or arriving within 10 minutes of a lightning strike upon a group of people, those in respiratory arrest should be treated first. If a patient is breathing they will most likely survive irregardless of other injuries. Finally if respirations are below 30 per minute the patient is not categorized yet. Instead perfusion is then assessed.

Perfusion is assessed by the capillary refill test. The fingernails or lips are pressed firmly and then released. If it takes more than two seconds for the color to return to normal the patient is placed into the immediate category. Additionally, any obvious bleeding should be controlled and the legs elevated by about 12 inches if not otherwise contraindicated. If the light produced by a headlamp makes color determination difficult the radial artery may be used for assessment. If the radial pulse is not present (pressure below 80 mmHg) then the patient is placed into the immediate category. If the pulse is present or capillary refill occurs is less than two seconds then mental status is assessed.

Mental status is assessed by asking the patient to open and close their eyes. If unable to comply they are placed into the immediate category. Otherwise they are placed in the critical category (Yellow tag). The rescuer should then place the appropriate tag

on the patient and quickly move onto the next.

ON THE SCENE MANAGEMENT

Mass causality incident or large number of rescuers

If a large number of patients exist or a large number of rescuers are needed to carry out the evacuation, the on scene management will differ. The entire ICS command structure will need to be repeated in the field. One person responsible for overall management (field commander, branch leader) will need to be chosen by the regular Incident commander. This person should be appointed from the original team on scene or from a nearby team. In addition the role of the safety officer should be filled by one person. If that is not possible it should be clearly delegated to a rescuer who is not otherwise overworked.

Operations should be responsible for medical control, transportation of the injured, and security of the site. In addition, any hazards present should be handled by operations. It should be obvious that in a large incident these jobs must be handled by several people. Operations back at base must meet all of the above roles in addition to directing any additional teams.

Logistics should obtain, stockpile, and control incoming medical and rescue supplies. If a large number of rescuers will be present at the disaster site for a length of time than food and water will need to be supplied. Most importantly communications at the actual scene may require a separate communication system in most cases. Incident base logistics may potentially be the most important job under disaster situations.

Unfortunately, most disasters function under the react method as opposed to planning ahead. Therefore, if only one shift is seen a separate plans function in the field should not be required. However, if several shifts are forseen then a separate person to handle plans in the field is necessary. Since Incident base plans originally generated an evacuation plan and medical plan its role in a disaster should be quite apparent.

In such a situation it is paramount that the incident bases personnel are kept intact and do not all leave to enter the field. Otherwise, changing shifts cause confusion and the collapse of most previous plans.

Normal evacuation

From a medical standpoint, a medic whose sole responsibility will be the welfare and treatment of the patient must be appointed. In accordance with Department of Health regulations this person must hold current certification as an Emergency Medical Technician or greater certification. Whenever possible a direct radio contact with a medical command facility should be established. In addition the importance of documentation of any medical decision must be made. In addition the medic should make sure any medical decisions or treatments rendered before his arrival are also documented. In situations where no formal medical treatment is required or no evacuation is required documentation should be made demonstrating the factors involved in those decisions.

MEDICAL KITS

Medical equipment available to treat the patient or an injured searcher can be divided into three levels. Initially the contents of a personnel first aid kit are present. As members increase their medical knowledge and skills the size of this kit increases. However, in all cases it can be kept fairly compact and light. If a field team is being sent into a high probability area then a field team medical kit will often be carried. This kit is contained in a fanny pack so that a field team member's equipment does not have to be left behind. Finally, when the patient is located then a full evacuation kit may be carried by the evacuation team.

Personal First-Aid kit

The contents of a personnel medical kit are varied and open to debate. Furthermore, weight and size are major considerations. However, certain fundamental items should be carried by any member of a SAR organization. While, most medical treatment in the field is done on oneself or other team members, one must be prepared to find a badly injured patient in need of prompt medical assistance. The following table includes items in **bold print** that must be carried. Other items are optional and should reflect the training of the individual. Furthermore, medications are not covered in this chapter for several reasons. However, they serve an important role when treating oneself (they should never be given to a patient). Therefore, the reader should consult the references given and consult their physician to determine what medications are appropriate.

DRESSING AND BANDAGES
- **Band-aids** (assorted sizes)
- **Sterile gauze pads** (2"x2", 4"x4")
- **Self adhering roller gauze**
- **Triangular bandage**
- **Tape** (2", 1", 1/2")
- **moleskin**
- Molefoam
- Spenco second skin
- Ace bandages
- Butterfly closures
- Surgipads
- Eye patch
- Vaseline impregnated gauze

SPLINTS
- Wire splint (6"x30")
- Tongue depressors

DISINFECTION
- Povidone-iodine
- Bacitracin
- Triple antibiotic ointment
- Hand soap (small bar)
- Alcohol prep pad- not for wounds
- **at least one type**

DIAGNOSTIC TOOLS

- **Hypothermia thermometer**
- Penlight
- Stethoscope
- Syphgnomometer (BP cuff)

MEDICAL TOOLS

- **Scissors**
- bandage shears
- Para-med shears
- **Tweezers**
- **Sewing needle**
- sterile syringe needle
- Scalpel
- Suction device
- Safety pins
- Cotton swabs

PATIENT STABILIZATION

- **Sugar source**
  - hard candy
  - sugar packet
  - glutose
- **Electrolyte mix**
  - Gatorade
  - ERG
  - Infantlyte
- **Cup**
- **Plastic bag (large)**
- **Pen/ notebook**
- **Parachute chord**
- Tube tent
- Space blanket
- Ensolite pad
- Small stove or fuel source
- Pocket mask
- Oropharnygeal airways

SURVIVAL/SIGNALLING

- **Waterproof matches**
- Magnesium block
- Fuel pellets
- Candle
- **Canteen**
- **compass**
- **Knife**
- **Flashlight**
- **Whistle**
- Signal mirror
- Flaregun/flare launcher
- Handheld flares
- Smoke signals
- Insect repellent
- Sunblock

Lip balm
Coins/calling card for phone
Extra prescription glasses
Sunglasses
Water purification tablets/filter

Field team leader kit

A well prepared searcher may carry all of the equipment found in the field team medical kit. However, due to weight considerations many items are not usually carried by individual members. The kit represents increased diagnostic capability and some basic medical equipment. The entire kit fits into a fanny pack so no individual gear needs to be sacrificed.

Sphygmomanometer
Stethoscope
Bag assorted gauze pads
Bag assorted roller gauze
Cravats
Penlight
Hypothermia thermometer
Bite-Rite stix
Foam Bite Stick
NH3 Smelling Salts
Oropharyngeal airway
Safety pins
Tape
Ace bandage
Tongue depressors
Wire ladder splints
35cc syringe
Clamp
Scissors
Sterile gloves
Pen and paper
callsheet

Evacuation kit

While, the evacuation medical pack is set up so the needed supplies can easily be pulled out and divided among the team members, this usually is not the case. Therefore, a evacuation medical pack should also contain a simple survival kit in the unlikely event the searcher becomes separated from the evacuation team. The evacuation pack represents the Basic Life Support Ambulance of the wilderness. Since weight is a major consideration only supplies that have a direct bearing on patient care are carried.

DIAGNOSTIC KIT (blue bag)
Penlight
Sphygmomanometer
Hypothermia thermometer
Stethoscope

Clamp
Scissors
Pen and Paper
Call sheet

DRESSINGS, BANDAGES POUCH
Tape
Cravats
Steripads
Roller gauze, large
Roller gauze, small
Elastic roller gauze
Multi-Trauma dressing
Alco-Wipes w/ Aluminum
Bandage sheers
Burn pouch with:
Burn and trauma dressings
Betadine

AIRWAY BAG
Smelling salts
Pocket mask with oxygen inlet valve
Oropharyngeal airways
Adaptors for airways
Bite-Rite stix
35cc syringe
Suction catheters

ORTHOPEDIC POUCH
Kwik cold instant cold packs
Kwik heat instant packs
Ace bandage rolls
Cravats
Cervical collars
Air splints
full arm
full leg
half arm
half leg

PATIENT SUPPORT BAG
Hand towel
Extra socks
Mittens
Change of clothes (jumpsuit)
Wool hat
Glucose
Electrolyte mix
Cup
Space blanket
Plastic bags (large)
Tube tent
Parachute chord
Fuel pellets

pencil/medical notebook

SURVIVAL BAG
- Waterproof matches
- Sterile water
- Compass
- Flashlight
- Whistle
- Knife
- Smoke signal
- Signal mirror
- Handheld flare

EVACUATION BAG
- Flagging tape
- Goggles
- Gloves

WATERPROOF BAG
- Sleeping bag
- Ground cloth

STOKES LITTER
- 11 mm Bluewater yoke
- Large steel locking D carabineer
- Tubular webbing straps
- Short backboard
- Joe Brown climbing helmet
- Clear face protector
- Ensolite pad
- Wool blanket

PATIENT MONITORING

Monitoring a patient's vital signs is more important and much more difficult during wilderness evacuations than typical ambulance transports. Due to the long time periods required to evacuate often unstable patients it is not unusual to take 20-80 sets of vital signs. However, in most cases the patient will be packaged in warm clothing, a blanket, a sleeping bag, a second blanket, and a tarp. In addition, gloves, a hat, a helmet, and a face mask also protect the patient. In otherwords, being able to access the patient's skin may take twenty minutes for vital signs required every five minutes. In addition removing protective layers will not benefit the patient. Clearly special techniques and equipment are required. Unfortunately, most wilderness rescue teams are unable to acquire specialized equipment. In addition such equipment has to be carried long distances in the field. Therefore, an emphasis must be placed on special techniques adapting normal medical equipment.

Initial Patient Assessment

Patients may be assessed into immediate care, serious care, and delayed care catagories quite rapidly. While these catagories exist for triage purposes they provide a common meaning that can be transmitted over the radio easily. The procedures for these

assessments are outlined under the triage section (see page xx). The assessments can be made with no medical equipment and little experience. However, a full secondary survey with vital signs will be required later.

Temperature

Temperature can only be assessed with a thermometer. A hypothermia thermometer that ranges from 70-105 F exists on the market and can also be used for heat stroke. Oral temperatures if the patient is conscious provide an easy screening procedure. If the temperature is above 95 F and no hot fluids have been consumed in the previous ten minutes then aggressive monitoring is not required. However, if the temperature is below 95 F then a rectal temperature or a temperature reading of urine should be made. Since the patient will be packaged further readings will be impossible or difficult. However, once an initial temperature is taken then treatment will be for severe hypothermia most likely and changes in temperature should not alter treatment. Therefore, further readings are not critical in the field. Furthermore, in most cases recorded in the medical literature, field temperatures are seldom taken and continued temperature readings are even more rare. However, continual readings may be taken with a rectal thermoprobe connected to a thermoresister with lithium batteries. In cases of heat stroke continual temperature readings are critical. Readings must be taken until the patient is cooled down to 101 F. At that time active cooling should be stopped. However, the body's thermoregulation is unstable for the next several hours and high temperatures may spontaneously return. Therefore, even after the patient is stable, continual temperature readings are required. However, since the patient is sparsely dressed access for rectal temperatures are simplified.

Blood pressures

When a sphygnomanometer (BP cuff) is not available the systolic blood pressure may be crudely estimated. If a radial pulse can not be detected the systolic pressure is below 80 mmHg. If the femoral pulse can not be palpated the systolic pressure is below 70mmHg. Finally if the carotid pulse can not be detected (after 1-2 minutes in hypothermia patients) the systolic pressure is below 60 mmHg.

Once a patients is packaged it is nearly impossible to place a BP cuff on the arm. Therefore, while packaging is occurring special techniques should be used. If long hoses exist on the BP cuff then it may be placed normally and the hoses allowed to run out the bottom of the sleeve. However, if only a normal cuff is present then the cuff should be placed on the arm and the hoses allowed to run out the collar.

If a radial pulse is present the pressure may be taken by palpation. The BP cuff is inflated while the radial pulse is palpated. As the cuff is then deflated the radial pulse site is carefully monitored. When the pulse returns this indicates the systolic pressure. Readings with both the systolic and diastolic may be attempted by taping a stethoscope head over the brachial pressure point. If successful, the patient's hand does not have to be removed from packaging.

The best solution is to utilize automatic blood pressure units. The units are able to filter out muscle movement and outside movement by special sensors. In addition the systolic pressure, diasyloic pressure, and pulse readings are given. A model that gives an error sign if too much movement is occurring is a minimum requirement for accuracy. The accuracy of such units in a moving ambulance is within 8mmHg of the readings EMTs were obtaining. In addition, lithium batteries should be used to provide constant voltage at low temperatures.

Pulses

Once the patient is packaged the radial pulse is often difficult to obtain. Therefore, the location of the sub-maxillary pressure point (under the jaw) and the temporal pressure point (posterior to the ear) should be familiar to rescuers. These points may be easily palpated under any packaging scheme.

The pulse may also be determined by listening directly to the heart. In this case a flat stethoscope head (nurse's or anthesiologist's stethoscope) can be taped directly over the location of the third ventricle. This is located slightly to the left of mid-sternum (breastbone). The hose should then run out of either a small hole cut in the patient clothing or out the center of a shirt.

The pulse may be determined mechanically through a blood pressure unit so equipped or through an EKG machine. Since the EKG units are large, heavy, and bulky they are seldom seen in the field. However, small QRS monitors (QRS describes an electrical wave produced by the heart) which operate like an EKG unit are inexpensive and available. These machines are equipped with high and low alarms, and digital readouts of the pulse so active monitoring is not required. Lithium batteries should be used in cold weather situations.

Respirations and breath sounds

Respirations are made more difficult since the chest cannot be watched. However, while taking a temporal or submaxillary pulse the hand may be positioned over the patient's mouth and nose. In this fashion respirations may be taken without the patient's awareness.

Continual monitoring of breath sounds will require taping of the stethoscope. However, placement of even a flat stethoscope on the back will be uncomfortable to the patient during long evacuations. Therefore, the heads should only be placed on the frontal and lateral aspects of the chest. Long tubing will allow the patient to stay completely packaged.

Perfusion

The capillary blanch test for refill provides a good indication of perfusion. In the packaged patient the lips should be used instead of the fingernails. However, in a severely hypothermic patient or cold adapted normal patient the test may be inaccurate. Therefore perfusion may have to be surmised form the general mental state of the patient. If the patient is alert then the brain is receiving adequate perfusion.

Mental State

The mental state of a patient must be continuously monitored during an evacuation. Fortunately this is the most important vital sign and requires no special techniques or equipment. However, the normal baseline of the patient must be known since many lost victims have mental differences before hand.