91W10
Advanced Individual Training Course

Combat Trauma Treatment and Management Handbook

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Appendix A – Treat a Casualty with a Spine Injury, Competency Skill Sheets

Appendix B – Treat a Casualty with a Chest Injury, Competency Skill Sheets

TERMINAL LEARNING OBJECTIVE

Determine the type, nature and extent of injuries and initiate appropriate treatments to stabilize the casualty and prepare them for evacuation.

Introduction to ballistic, blasts, and burns injuries

Medical personnel

(1) Historically ignored weaponry believing that this knowledge had little relevance to being able to perform their job
(2) Believed in some way conflicted with the status accorded medical personnel under the Geneva Hague treaties

Medical personnel should know how weapons are used and understand their effects on the human body

(1) Medical personnel are required to protect and defend the lives of their patients
(2) Medical personnel will be better able to treat the casualties that they encounter
(3) Enables medical personnel to more accurately predict the number and type of casualties that may result from a combat action so that adequate medical support can be arranged
(4) Can lead to development of countermeasures and protective equipment

Three types of wounding agents common to all weapons systems employed in conventional warfare

(1) Projectiles (bullets) that are fired from small arms
(2) Primary and secondary missiles created by explosive munitions
(3) Flame and incendiary chemicals used in incendiary munitions

Identify small arms, wounding agents and their effects

Small arms:

Individual or crew served weapons (pistols, rifles, and machine guns) that fire solid projectiles, which have a diameter of 20mm or less

The trend in small arms development weapons capable of generating multiple casualties either by firing more rounds or improved munitions, which will generate multiple casualties per round, fired.

The rationale:

(1) If a casualty receives multiple random wounds from a weapon, the likelihood that a critical organ will be injured is greater than if the victim were hit with only one projectile
(2) Weapons that cause multiple wounds require an opponent to use more resources and personnel to treat and evacuate their casualties

Small arms designs commonly found in use today

(1) Pistols: weapons that may be employed using one or both hands. The ammunition used in pistols is of relatively low velocity and modest lethality.
(2) Submachine guns: shoulder fired weapons designed to be fired in either a semi or fully automatic fire mode. They use pistol caliber ammunition and are usually issued to specialized personnel.
(3) Shotguns: shoulder fired, pump action or semiautomatic weapons which discharge multiple spherical shot or flechette projectiles with each round fired
(4) Assault rifles: shoulder fired weapons that are capable of semi or fully automatic fire (e.g. M-16A2, AK-47). Principle weapon of infantry forces and snipers.
(5) Machine guns: fully automatic, individual or crew served weapons used to suppress enemy fire rather than hit specific targets. Three categories of machine guns:
    (a) Light (e.g. M-249 Squad Automatic Weapon, SAW)
    (b) General purpose (e.g. M-60 General Purpose Machine Gun, GPMG)
    (c) Heavy (e.g. M-2 Heavy barrel .50 cal Machine Gun, HMG)

Wound causing agent from small arms fire is the projectile or bullet, which is discharged when the weapon is fired.

Severity of wounds is dependent on several factors:

(1) Caliber (size)
(2) Shape
(3) Design and construction
(4) Weight
(5) Velocity
(6) Type of tissue struck or impacted
(7) Fragmentation of the projectile

As a bullet passes through body tissue it produces two mechanisms of wounding.

(1) A permanent cavity that is created as a bullet penetrates through and crushes the tissue in its path
(2) A temporary cavity which is a stretching of the surrounding tissues that is created as the energy of the bullet is released into the surrounding tissues ahead of the bullet via a sonic shock wave and hydrostatic energy that is created

Wounds and complications of wounds resulting from small arms may be manifest in a variety of ways, for example:

(1) Simple penetrating wounds
(2) Through penetrating wounds with disproportionately large exit wounds
(3) Fractures, amputations and massive soft tissue injuries when extremities are involved
(4) Eviscerations and evacuation of body cavities

(5) Massive soft tissue and internal organ injuries
(6) Severe blood loss, shock and death

Emergency medical care for small arms wounds is essentially the same as for any other form of trauma and revolves around the soldier medic Core Skills

(1) Airway
(2) Breathing
(3) Circulation (Bleeding is controlled)
(4) Shock is prevented or treated appropriately (I.V. therapy is initiated if appropriate)
(5) Evacuation is accomplished in a timely manner (Ongoing care is provided en-route)

Identify explosive munitions, wounding agents and their effects

Explosive munitions:
Consist of explosive projectiles and other explosive devices such as bombs, rockets, grenades, and mines that are fired from ordnance (e.g. Artillery pieces and cannons), dropped from aircraft, launched (e.g. Multiple Launch Rocket System), thrown, or planted in order to cripple or destroy personnel and equipment

The generic prototype of the exploding munition is the shell

Two basic types of exploding

(1) Antipersonnel exploding munitions: most commonly encountered in the form of grenades, rockets, bombs, and mines. They fall into two classifications:
    (a) Random-Fragmentation munitions are munitions where the shell casing splinters unpredictably, and the resulting fragments vary in size, shape and velocity
    (b) Improved-Fragmentation munitions are munitions where the casing is made of a fragmented material that breaks up in a more controlled fashion or they are filled with preformed fragments, which disperse in a much more evenly in the target area
(2) Antimaterial munitions that have antipersonnel effects
    (a) Kinetic-Energy Antimaterial Warheads (e.g. The Armor Piercing Fin Stabilized Discarding Sabot fired by tanks), these munitions rely on the speed and the density of the projectile to disable or destroy the target. The principle injuring mechanisms of the kinetic energy warhead to personnel are:
        (i) The penetrator (Projectile)
        (ii) Fragments from the target when struck
        (iii) Secondary fires
    (b) Explosive Antimaterial Warheads (e.g. Light Anti-tank Weapon LAW, Anti-tank 4 rocket AT4) are most commonly found in the form of a shaped charge or hollow charge

warhead. The principle wounding agents from these weapons are:
(i) Fragments from the casing and or target
(ii) Blast
(iii) Flame
(iv) Secondary fires

The principle injuring mechanisms of these weapons are caused by a complicated mix of ballistic, blast, and burn injuries.

The type and severity of wounds sustained is primarily dependent on the casualties' distance from the epicenter of the explosion.

(1) Casualties close to the epicenter of the explosion are likely to suffer from all three wound-causing agents of the munition
(2) Those casualties who sustain wounds from all three wound-causing agents usually suffer from mutilating blast injury and are not likely to survive
(3) Those casualties who are farther away from the epicenter are likely to experience a combination of blast from the explosion and penetrating trauma from primary and secondary missiles created by the explosion

Wounds and complications of wounds resulting from explosive munitions

(1) Ballistic injuries sustained from the primary and secondary missiles created by exploding munitions are in principle the same type of ballistic injuries sustained from small arms fire. However, the size of the projectile striking the casualty may be considerably larger and the injuries sustained will be proportional in nature.
  (a) The nature and extent of ballistic injuries generated by explosive munitions will vary considerably. Examples of factors, which influence these, are:
    (i) Proximity to the explosion
    (ii) Size and shape of the missile or fragment
    (iii) Velocity of the missile or fragment
    (iv) Tissue struck
  (a) Primary blast injury: due solely to the direst effects of the pressure wave on the body. The injury from the primary blast is seen almost exclusively in the gas containing organs of the body, with injury to the lungs causing the greatest morbidity and mortality.
  (b) Secondary blast injury: occurs from penetrating or nonpenetrating injury caused by ordinance projectiles or secondary missiles, which are energized by the explosion and strike the victim
  (c) Tertiary blast injury: results from whole body displacement and subsequent traumatic impact with environmental objects (Trees, buildings, vehicles, etc.)
  (d) Other indirect effects include crush injury from collapse of structures and toxic effects from inhalation of combustion gases

Burn injuries

From explosive munitions are the result of heat and flame generated by the detonation of the explosive filler material in the munition casing and secondary fires started on the target. They usually occur when the casualty is at the epicenter of the explosion or the target is burning. The further the distance from the explosion the less likely that burns will be suffered from the explosion.

Identify flame and incendiary munitions, their agents and their effects

Flame, incendiary, and phosphorus-containing munitions are weapons that use a combustible material source to expel people from strongholds or hidden positions and destroy material

Although flame and incendiary munitions theoretically constitute separate classes of weapons, they both use fire as the means to achieve the objectives of the user

The fear of being burned is the crucial incapacitating factor in the effectiveness of these weapons

Flame and incendiary munitions and their means of delivery

(1) Flame munitions
  (a) Areal delivered such as Napalm bombs
  (b) Flame throwers
  (c) Rocket launched warheads
(2) Incendiary weapons
  (a) Areal delivered bombs
  (b) Grenades
(3) Phosphorus-containing munitions
  (a) Areal delivered bombs
  (b) Artillery shells
  (c) Grenades
  (d) Phosphorus ignites spontaneously in air at 111.2 degrees Fahrenheit
  (e) Burns at 1,472 degrees Fahrenheit
  (f) Will continue to burn until it is deprived of air and the continued presence of Phosphorus on the skin results in dermal penetration and tissue necrosis.

The wounding agent for all flame, incendiary, and phosphorus-containing munitions is the intense heat and fires that they generate and from fumes produced by the fires Injuries and complications of injuries produced by flame, incendiary, or phosphorus-containing munitions.

(1) First degree burns
(2) Second degree burns
(3) Third degree burns
(4) Smoke inhalation

Identify the medical implications of conventional weapons

The weapons of conventional land warfare are designed to inflict physical harm on personnel by wounding with bullets or fragments, damaging internal organs with blast effects or burns.

Military medical personnel must be adequately prepared to treat all of these types of injury.

Ballistic injuries

Most casualties in modern conventional hostilities are by weapons that cause ballistic wounds. Although the severity the wound depends to some extent on the nature of the projectile or fragment the most important factor in a ballistic injury is the anatomical site hit.

Blast injuries

May not be obvious to medical personnel.
As weapons increasingly take advantage of the physical properties of blast waves, medical personnel should be aware that a blast injury may be present in a casualty whose only overt injuries are the more immediately threatening blunt, penetrating or thermal trauma.

Burns

Responsible for relatively few casualties in conventional warfare
Can be so disfiguring and painful
Have serious psychological implications for both combat and medical personnel, as well as intensive medical-resource allocation requirements.

TERMINAL LEARNING OBJECTIVE

Given a standard fully stocked M5 Bag or Combat Medic Vest System, oxygen, suction and ventilation equipment (if available), and documentation forms. You encounter a casualty with a burn injury. The casualty has been assessed and injury(ies) prioritized. The casualty's airway has been established. The types of burn agents are unknown.

Stabilized the associated effects of the burned casualty for prevention of respiratory compromise, shock, pain, and for protection of wounds.

Recognize the mechanism of injury and eliminate the source of a burn

The source of the burn must be eliminated before any evaluation or treatment of the casualty can occur

Thermal burns

(1) If the casualty's clothing is on fire, cover the casualty with a field jacket or any large piece of nonsynthetic material and roll him or her on the ground to put out the flames. All clothing should be removed.

Chemical burns

(1) Remove liquid chemicals from the burned casualty by flushing with as much water or other nonflammable fluid as possible

(2) Remove dry chemicals by carefully brushing them off with a clean, dry cloth. If large amounts of water are available, flush the area. Otherwise, apply no water. Small amounts of water applied to a dry chemical burn may cause a chemical reaction, transforming the dry chemical into an active burning substance.

(3) Smother burning white phosphorus with water, a wet cloth, or wet mud; keep the area covered with the wet material to exclude air and to prevent the particles from burning

Electrical burns

(1) If the casualty is in contact with an electrical source, turn the electricity off if the switch is nearby. If the electricity cannot be turned off, drag the casualty away from the source using any nonconductive material (rope, clothing, or dry wood). Do not touch the casualty or the electrical source with bare hands.

(a) Electrical Currents

(i) Alternating Current (AC) - is a range that includes house current in most locales and tends to cause ventricular fibrillation if the pathway includes the heart

(ii) Direct Current (DC) - is much less dangerous than AC; however, electrochemical skin burns have been reported from DC current

Inhalation injuries

(1) Classified as carbon monoxide poisoning, heat or smoke inhalation injuries

(2) These injuries account for more than half of the 12,000 burn-related deaths per year

Laser burns

(1) Move the casualty away from the source while avoiding eye contact with the beam source. Be careful not to view or walk into the beam or you may become a casualty.

(2) Never look at the beam source, and if possible, wear appropriate eye protection. Sources of laser beams include range finders, weapons guidance systems, communication systems, and weapons simulations.

Assess the severity of the burn

Initial evaluation of a burn patient

(1) Depth of burn
(2) Extent of burn
(3) Age of the patient
(4) Pulmonary injury
(5) Associated trauma
(6) Special considerations- electrical, chemical
(7) Preexisting illnesses

Depth of burn

(1) First degree - minor tissue damage to the outer epidermal layer only, causing an intense and painful inflammatory response
   (a) Various medications used to help speed healing and reduce the painful inflammatory response
   (b) Also described as a superficial burn because there are layers of skin cells left that can multiply with resultant healing
      (i) Cause -minor flash or sun
      (ii) Skin color -red
      (iii) Skin surface -no blisters and dry
      (iv) Sensation -painful
      (v) Healing -3 to 6 days

(2) Second degree -may cause damage through the epidermis and into a variable depth of the dermis
   (a) Burns will normally heal without scaring
   (b) Treatment includes antibiotic creams or various specialized types of dressings
   (c) Provide appropriate medical evaluation and care for these patients
   (d) Also described as a partial thickness burns because there are layers of skin cells left that can multiply with resultant healing
      (i) Cause -flashes, flame, or hot liquids
      (ii) Skin color - mottled red
      (iii) Skin surface -blisters with weeping
      (iv) Sensation painful

(v) Significant fluid loss and subsequent shock may occur
(vi) Healing -depending on depth, 2 to 4 weeks

(3) Third degree - damage to all layers of the epidermis and dermis
(a) There are no layers of skin cells left
(b) Healing is impossible except in small third-degree burns that usually scar in from the sides
(c) All third-degree burns leave scars
(d) Deeper third-degree burns usually result in skin protein becoming denatured and hard, leaving a firm leatherlike covering that is referred to as eschar
(e) All layers of skin are destroyed, no skin cells remaining to allowing healing
(f) Referred to as full thickness burn
(i) Cause -electricity, chemicals, hot metals and flame
(ii) Skin color - charred translucent and/or pearly white; parchment like
(iii) Skin surface - dry with thrombosed blood vessels
(iv) Sensation - anesthetic
(v) Healing - skin grafting required

(4) The severity of burn injuries depends on the depth and extent of the burn -management and initial care must concentrate on limiting progression of these two factors

Determine the extent of the burn

(1) Apply the rule of nines to the burn casualty to determine the percentage of body area burn in an adult
(a) Head and neck equals 9 percent
(b) Anterior trunk equals 18 percent
(c) Posterior trunk equals 18 percent
(d) Anterior upper extremities equal 9 percent
(e) Posterior upper extremities equals 9 percent
(f) Anterior lower extremities equal 18 percent
(g) Posterior lower extremities equal 18 percent
(h) Perineum (groin) equals 1 percent

Estimating scattered burns:

The patient's palm surface of the hand represents approximately one percent of his/her total body surface area (BSA).
Using the palmar surface as a guideline, even the extent of irregularly disposed burns can be estimated.

(2) Apply the rule of nines to the burn casualty to determine the percentage of body area burn in an infant/child
(a) Head and neck equals 18 percent
(b) Anterior trunk equals 18 percent
(c) Posterior trunk equals 18 percent
(d) Anterior upper extremities equal 9 percent

(e) Posterior upper extremities equals 9 percent
(f) Anterior lower extremities equal 14 percent
(g) Posterior lower extremities equal 14 percent
(h) Perineum (groin) equals 1 percent

The heads of infants and young children are larger in relationship to the rest of the body than adults and require a modification to the rules of nine in estimating the extent of burns.

Age of the patient
(1) Age has a significant impact on survival
(2) The very young and the very old respond poorly to burn injury

Pulmonary Injury
(1) Smoke inhalation accounts for over ½ of the burn deaths annually
(2) Most inhalation injuries are caused by smoke particles, carbon monoxide and toxic fume inhalation. These injuries are not immediate apparent.
(3) ALWAYS assume an inhalation injury in an enclosed space fire

Associated trauma
(1) Explosions and lightening may throw patients some distance from the original injury. Assess for related traumatic injury

Special considerations
(1) Electrical burns are usually more serious than they appear on the skin surface

Preexisting illnesses
(1) Chronic cardiac, pulmonary, renal or liver diseases have a negative impact on a patient's prognosis

Manage the casualty with thermal burns

First priority: remove the burn source

Dangers in removing the burn source:
(1) "Flash-over" - a sudden explosion into flames -temperature rising instantaneously to over 3,000 degrees. Removal of victims from burning buildings takes priority over all other objects in the environment- there is no warning for a flashover.
(2) Rescuers become victims of chemical burns because of the inability to note sources of caustic and toxic chemicals. All rescuers should be trained in hazardous materials management.
(3) Electrical wire is hazardous and dangerous. Unless you are trained to do so, DO NOT attempt to remove wires. Objects commonly felt to be safe, i.e., wooden sticks, manila rope, firefighters gloves, may not be protective and may result in electrocution. If at all possible, turn off the source of electricity before any rescue attempt is made.

Management of burns

(1) Primary Survey
- (a) A, B, C, D, E
- (b) Initiate IV hydration with large bore needle and Ringer's Lactate solution or Normal Saline
- (c) Fully expose the patient removing all clothing, watches and jewelry as combat situation dictates
- (d) Oxygen initiation, if available
- (e) Cardiac monitoring, if available

(2) Record the mechanism of injury, depth of burn, extent of burn, age of the patient, any associated pulmonary injury, preexisting illnesses and chemical/electrical details.

(3) Secondary survey
- (a) Continue evaluation of the burn
- (b) Estimate of the depth based on appearance
- (c) Rough calculation of the burn size by using the rule of nines
  - (i) The body is divided into areas that are assigned either 9% or 18% of total body sizes
  - (ii) By roughly drawing in the burned areas, the size can be estimated
  - (iii) Estimate the size, for smaller or irregular burns, using the surface of the victim's hand as about 1% of the total body surface area
- (d) Calculation of IV rehydration rates for burn patients
  - (i) The burn patient needs 2 to 4 ml. of Ringer's Lactate solution/Normal Saline per kg of body weight per percent of body surface burn in the first 24 hours to maintain blood volume and urinary output.
  - (ii) One-half of the total estimated fluid is infused in the first eight hours, the remainder of the fluid is infused over the next sixteen hours. Calculate as post burn requirements not after arrival at the BAS.
  - (iii) Calculate fluid requirements based on the time from injury, not from the time fluid resuscitation started
  - (iv) Example: 70 kg patient with 50% second degree burn
    4 ml X 70 kg X 50% = 14,000 ml of IV fluid/24 hr.
    7,000 ml of IV fluid/8 hr.
  - (v) As with all burn formulas, this is an estimate of fluid resuscitation

(4) Wound Care
- (a) Wrap patient's burns in a dry sterile dressing.
- (b) DO NOT apply ointments or solutions
- (c) DO NOT open blisters

(d) If hands or toes are burned, separate digits with sterile gauze pads. Moisten the pads with sterile water. Apply loosely. The hand should be in a position of function.
(e) Burns to the eyes - Do not open eyelids if they are burned. Be certain burn is thermal and not chemical. Apply moist sterile gauze pads to both eyes.

(5) Considerations
(a) Medications are rarely needed for the burn itself. Use extreme caution when administering pain medications – the status of associated injuries is unclear, and thus medication administration can be dangerous. When administering Morphine Sulfate, be aware of the indications and contraindications of this drug as they relate to burns.
(b) Tetanus - when in doubt administer

Manage the casualty with chemical burns

Countless types of chemicals can cause burn injuries
(1) Most chemical burns are caused by industrial sources of chemicals
(2) Most are caused by strong acids, bases (alkali), or organic compounds
(3) The fumes can cause inhalation burns
(4) The eyes may be involved

Signs and symptoms
(1) Reddening, blistering skin
(2) Pain (mild to intense)
(3) Obvious deterioration of skin
(4) Chemical odor

Chemicals not only injure the skin, but also may cause internal organ failure due to absorption
(1) Lung tissue damage through inhalation and subsequent life-threatening respiratory failure
(a) Frequently deceiving -initial skin changes may be minimal and burns may not be obvious
(b) Take precautions not to get these chemicals on yourself
(c) The pathologic process causing the tissue damage continues until the chemical is either consumed in the damage process or until it is removed
(2) Inactivation using neutralizing chemicals is dangerous because these neutralizing chemicals generate other chemical reactions that may worsen the injury

To remove the chemical:
(1) Wear protective gloves, eyewear, etc.
(2) Remove all clothing covered with chemicals
(3) Irrigate copiously, with any source of available water or other irrigant, to flush chemicals off the body

(4) Wipe or scrape any retained agent that sticks to the skin
(5) Continue flushing 15 minutes (unless a critical or unstable situation warrants transport sooner)
(6) Irreversible damage will occur in the eye quickly because of caustic chemicals -irrigate to prevent severe and permanent damage to the corneas
(7) During irrigation, remove contact lenses. Although soldiers will not generally be wearing contact lens, be aware of this precaution when treating aircrew members.
(8) Brush off dry chemicals on the skin before performing irrigation
(9) Chemical burns to the eyes
  (a) Immediately flood the eyes with water
  (b) Hold eyelids open; wash medial (nasal) to lateral
  (c) Wash for at least 20 minutes; transport while washing
  (d) Cover both eyes with moistened pads
  (e) DO NOT use neutralizers such as vinegar or baking soda
(10) PROTECT YOURSELF DURING THE WASHING PROCESS.

Manage the casualty with electrical burns

Electricity entering the body and traveling through the tissues causes tissue damage. Because of their small size, extremities usually have more significant tissue damage. This damage is due the higher local current density

(1) Severity of electrical injury is determined by:
  (a) The type and amount of current, path of the current, and duration of contact with the current
  (b) Immediate cardiac dysrhythmias are the most serious injury that occurs due to electrical contact. A careful, immediate evaluation of a patient's cardiac status and continuous monitoring of cardiac activity is necessary -the patient may initially appear to be stable
  (c) Common life threatening dysrhythmias are premature ventricular contractions, ventricular fibrillation and tachycardia fibrillation
    (i) Initiate aggressive advanced life support management of these dysrhythmias -these patients usually have normal healthy hearts and the chances for resuscitation are excellent
    (ii) Management for a patient in ventricular fibrillation with only basic life support available: Start cardiopulmonary resuscitation (CPR) and transport immediately to Level 3
    (iii) Provide field care as you would for thermal burns once the efforts at managing cardiac status are complete
  (d) Other electrical injuries include:
    (i) Skin burns at entrance and exit sites
    (ii) Surface flame burns (patient's clothing being ignited)

(iii) Dislocations and/or fractures (due to violent muscle contractions)
(iv) Internal injuries involving muscle damage and nerve damage

(e) The first priority at the scene of an electrical injury is to determine if the patient is still in contact with the electrical current
(i) If so, remove the patient from contact without becoming a victim yourself
(ii) Handling high-voltage electrical wires is extremely hazardous -special training and equipment are needed to deal with downed wires
(iii) Never attempt to move wires with makeshift equipment (pieces of wood, tree limbs, and manila rope may conduct high-voltage electricity)

(f) It is impossible initially to determine the total extent of the damage in electrical burns; all electrical burn patients should be transported to the nearest treatment facility

Causes

(1) Can be caused by high or low voltage
(2) Direct electrical current (deep injuries)
(3) Arc burns
(4) Lightning injuries (less deep injuries)
(a) People can be hit by lightning and survive.
(b) Usually briefly unconscious
(c) May develop arrhythmia or cardiac arrest
(d) Can be successfully resuscitated

Signs and symptoms

(1) They are burns where electrical energy enters and exits the body. A burn of exit wound is usually larger.
(2) Disrupted nerve pathways are displayed as paralysis
(3) Muscle tenderness, with or without twitching
(4) Respiratory difficulties or arrest
(5) Cardiac arrhythmia or arrest
(6) Elevated BP or low BP with signs of shock
(7) Restlessness or irritability
(8) Loss of consciousness
(9) Visual difficulties
(10) Fractured bones and dislocations from severe muscle contractions or from falling (can include spinal column)
(11) Seizures

Treatment and transport considerations

(1) Make certain that you and the patient are in a safe zone.

(a) DO NOT handle power lines unless you are certain the current is turned off
(b) If the patient is in contact with electricity, turn off the power before approaching him or her
(c) Power lines may have up to 50,000 volts. It is always safer to assume a fallen line is "alive."

(2) Open and maintain airway
(3) Provide basic cardiac life support as required. Use a cardiac monitor as soon as possible.
(4) Care for spinal injuries, head injuries, and severe fractures
(5) Evaluate the burn looking for the entrance and exit burn sites
(6) Remove clothing and assess the burn injury
(7) Apply dry, sterile dressings to the burn sites
(8) Care for shock and administer a high concentration of oxygen
(9) Initiate large bore IV access with IV running open- this will aid in preventing renal failure from muscle damage.
(10) Transport as soon as possible
(11) The major problems caused by electrical shock are usually not from the burn. Respiratory and cardiac arrest are real possibilities. Be prepared to provide basic cardiac life support measures.

Manage the casualty with inhalation burns

Inhalation injuries -classified as carbon monoxide poisoning, heat or smoke inhalation injuries.

These injuries account for more than half of the 12,000 burn-related deaths per year

(1) Asphyxiation and carbon monoxide poisoning -the most common cause of early death associated with burn injury
(2) A byproduct of combustion and is one of numerous chemicals in common smoke. Its presence is impossible to detect -odorless, colorless, and tasteless.
(3) Patients quickly become hypoxic (alteration in the level of consciousness is the most predominant sign of hypoxia)
(4) Treatment: high-flow oxygen by mask
(5) Begin basic life support ventilation using 100% oxygen if the patient has lost consciousness
(6) By having the patient breath fresh air, it will take up to seven hours to reduce the carbon monoxide-hemoglobin complex to a safe level - breathing 100% oxygen decreases this time to about 90- 120 minutes. Using hyperbaric oxygen (100% oxygen at 2.5 atmospheres) will decrease this time to about 30 minutes

Causes

(1) Can be caused from fumes or smoke in the air. You may not be able to smell the fumes!
(2) May be from stream
(3) The injury may be worse if inhalation occurred in a confined space

Signs and symptoms

(1) Difficulty breathing (dyspnea)
(2) Coughing, stridor
(3) Breath has "smoky" or "chemical" smell
(4) Black residue in patient's nose and mouth
(5) Nasal or facial hairs are singed
(6) There are burns to the head, the face, or the front of the trunk

Treatment measures

(1) Move the patient to a safe area
(2) Do an initial assessment and supply life support measures as needed
(3) Administer a high concentration of oxygen (humidified if possible) with a nonrebreather mask
(4) Care for possible spinal injuries and any other injury or illness requiring care at the scene
(5) Provide care for shock
(6) Stay alert for behavioral changes
(7) If difficulty breathing increases, prepare to intubate.

Transportation requirements

(1) Transport in a position of comfort if other injuries allow it
(2) Most conscious patients are able to breathe more easily when placed in an upright (seated) position

Assess for signs and symptoms of carbon monoxide poisoning

(1) Evaluate casualty's complains
    (a) Dizziness
    (b) Nausea
    (c) Headache
(2) Inspect casualty cherry-red colored skin and mucous membranes
(3) Assess casualty for tachycardia or tachypnea
(4) Monitor vital signs/airway

TERMINAL LEARNING OBJECTIVE

Given a standard fully stocked Combat Medic Vest System (CMVS) or fully stocked M5 Bag. Given a casualty with symptoms and findings consistent with heat injury. No other injuries were identified.

Recognize an environmental emergency

Environmental Emergency - a medical condition caused or exacerbated by the weather, terrain, atmospheric pressure, or other local factors

(1) Instances of environmental emergencies
(2) Environmental impact on morbidity and mortality
(3) Environmental factors that induce or exacerbate other medical or traumatic conditions

Risk Factors

(1) Age
(2) General health
(3) Fatigue
(4) Predisposing medical conditions
(5) Medications

Environmental Factors

(1) Climate
(2) Season
(3) Weather
(4) Atmospheric (barometric) pressure - the pressure exerted by the weight of the air. An increase in altitude decreases pressure.
(5) Terrain

Types of Environmental Injuries

(1) Cold injury
(2) Heat injuries
    (a) Heat Cramps
    (b) Heat Exhaustion
    (c) Heatstroke
(3) Localized injuries
    (a) Radiation burns, e.g., sunburn

Identifying and manage heat injuries

Heat cramps

A muscle cramp or spasm of the voluntary muscles of the arm, leg, or abdomen caused by depletion in the body of water and salt.

(1) Symptoms
    (a) Painful spasms of skeletal muscles including muscles of the extremities (arms and legs) and abdomen
    (b) Thirst
    (c) Skin may be moist or dry
    (d) Core temperature is normal or minimally elevated

(e) DO NOT ELIMINATE HEAT EXHAUSTION AS A POSSIBILITY. Heat cramps and heat exhaustion may co-exist.

(2) Treatment
- (a) Move casualty to shade
- (b) Loosen clothing
- (c) Gentle stretching of cramped muscles
- (d) Oral hydration with electrolyte solution. If nauseated, IV hydration with 0.9% Normal Saline
- (e) Obtain further medical advice if symptoms continue

Heat exhaustion

A systemic reaction to prolonged heat exposure and is due to sodium depletion and dehydration

(1) Symptoms
- (a) Profuse sweating with pale, moist, and cool skin
- (b) Headache
- (c) Weakness
- (d) Dizziness
- (e) Loss of appetite
- (6) Nausea (with or without vomiting)
- (f) Confusion
- (g) Core temperature may be normal or elevated

(2) Treatment
- (a) Move the casualty to a cool shady area
- (b) Loosen or remove the casualty's clothing and boots
- (c) Oral hydration with electrolyte solution, if tolerated
- (d) IV hydration with 0.9% Normal Saline solution preferred
- (e) Keep casualty supine
- (f) Monitor the casualty and always evacuate - may be heated at BAS and RTD if combat situation dictates

Heatstroke

Caused by failure of the temperature regulating system in the brain. Heatstroke usually involves excessive exposure to strenuous physical activity under hot conditions.

Elderly or chronically ill patients may develop heatstroke without strenuous physical activity.

The hallmark of this condition is altered mental status.

(1) Symptoms
- (a) Sweat may or may not be present
- (b) Skin is red (flushed), hot
- (c) Headache
- (d) Dizziness
- (e) Nausea
- (f) Confusion
- (g) Weakness
- (h) Seizures
- (i) May progress to coma

(j) Respiration and pulse may be rapid and weak
(k) Core temperature is above 104 F
(l) Heatstroke is a medical emergency that will result in death if treatment is delayed

(2) Treatment
(a) Act quickly to prevent further injury
(b) Remove from environment
(c) Active cooling
(i) Remove clothing
(ii) Misting with water and fanning
(iii) Moist wraps
(iv) Immersion in cool water. Do not lower core temperature below 102 degrees. Temperature will continue to drop after removing from water.
(v) Ice packs-groin, axilla
(d) Fluid therapy - IV hydration with 0.9% Normal Saline (if unable to tolerate oral fluids)
(e) Heatstroke is a medical emergency that will result in death if treatment is delayed. Start cooling measures immediately and continue them while waiting for transportation and during evacuation.

Sunburn

(1) Significance
(a) May require hospitalization
(b) Increase risk for further injuries
(c) Impact on readiness
(d) Usually preventable

(2) Prevention
(a) Limit exposure
(b) Cover skin
(c) Use sunscreen
(d) Be aware of potential medication reactions

Salt tablets are not used in the prevention of heat injury. Usually eating field rations or liberal salting of the garrison diet will provide enough salt to replace what is lost through sweating in hot weather.

Watch a heat injury casualty closely for life-threatening conditions, check for other injuries, and seek medical aid.

Heat Illness

The inability to respond (increase in core body temperature) adequately to environmental conditions, inadequate correction of fluid and electrolyte deficiencies, and malfunctions of the system through exogenous and endogenous causes

Heat Stress

A condition that increases the metabolism due to heat which may result in an increase of core temp, perspiration, and cardiac output and result in heat injuries if untreated

General assessment and prevention of heat illness

Heat injury assessment

(1) General assessment findings
- (a) VITAL SIGNS - continually reassess
  - (i) Core body temperature (rectal)
  - (ii) Blood pressure
  - (iii) Pulse
- (b) Nausea, vomiting, diarrhea
- (c) Skin
  - (i) Moist?
  - (ii) Dry?
  - (iii) Cool?
  - (iv) Hot?
- (d) Mental status assessment

(2) Predisposing factors
- (a) Age: pediatric and geriatric-high risk - extremes of age
- (b) General health and medications
  - (i) Cardiac disease
  - (ii) Diabetes
    - * Autonomic neuropathy interferes with vasodilation and perspiration
    - * Autonomic neuropathy may interfere with thermoregulatory input
  - (iii) Obesity
  - (iv) Recent illness
  - (v) Fatigue
- (c) Medications - inhibiting sweating
  - (i) Atropine
  - (ii) Antihistamines
  - (iii) Tranquilizers
  - (iv) Cold medications
  - (v) Antidiuretics
- (d) Acclimatization
- (e) Length of exposure
- (f) Intensity of exposure
- (g) Environment
  - (i) Humidity
  - (ii) Wind - wind chill
  - (iii) Ambient air temperature
- (h) Alcohol intake within 24 hours
- (i) Food consumption
- (j) Fever
- (k) Clothing, especially NBC gear
  - (i) The wet bulb globe thermometer (WBGT) index is used to determine the heat condition
  - (ii) Use of MOPP gear increases the WBGT by about 10 degrees

MOPP Gear

In an environment which protective gear or MOPP gear is worn, heat stress is an important factor to consider.

In environments with moderate and relatively comfortable temperatures, MOPP gear can greatly increase temperatures to the most severe and debilitating level of heat stress.

Therefore, it is important that soldiers in MOPP gear maintain adequate water consumptions, are frequently rotated to reduce occurrence of heat injuries, and establish appropriate rest and work periods to ensure adequate manpower is available.

Water consumption - recommendations:

(1) Follow recommendations on heat category chart
(2) "When" is as important as "how much"

Heat injury prevention

(1) Recommendations
  (a) Follow work/rest guidelines on heat category chart
  (b) Restrict or modify strenuous physical activities during high heat stress conditions - if combat situation permits
  (c) Have soldiers take breaks in the shade and drink water
  (d) Hold formations in the shade or off blacktop and concrete surfaces whenever possible
(2) Acclimatization
  (a) Allow two weeks for soldiers to become acclimated to the heat
  (b) Progressively increase the workload during the second week
  (c) During periods of sudden temperature change, treat all soldiers as non-acclimated
(3) Cumulative effect
  (a) Heat effects build up during the day and over several days
  (b) Recovery is slow even after temperatures have decreased
(4) Prevention
  (a) Do heavy work early in the day
  (b) Follow the highest heat category reached for the remainder of the day
  (c) Train the trainer
  (d) Verify heat injury reporting procedures
  (e) Early awareness

TERMINAL LEARNING OBJECTIVE

Given a standard fully stocked Combat Medic Vest System (CMVS) or fully stocked M5 Bag, given a casualty with symptoms and findings consistent with cold injury. No other injuries were identified.

Recognize an Environmental Emergency

Environmental Emergency

Medical condition caused or exacerbated by the weather, terrain, atmospheric pressure, or other local factors

(1) Instances of environmental emergencies
(2) Environmental impact on morbidity and mortality
(3) Environmental factors that induce or exacerbate other medical or traumatic conditions

Risk Factors

(1) Age
(2) General health
(3) Fatigue
(4) Predisposing medical conditions
(5) Medications
    (a) Peripheral vasodilator medications
    (b) Diuretics

Environmental Factors

(1) Climate
(2) Season
(3) Weather
(4) Atmospheric (barometric) pressure - the pressure exerted by the weight of the air. An increase in altitude decreases pressure.
(5) Terrain

Types of Environmental Injuries

(1) Heat injury (SEE C191W056, Treat a Casualty with a Heat Injury)
(2) Cold injuries
    (a) Chilblains
    (b) Frostbite
    (c) Immersion foot/trench foot
    (d) Snow Blindness
    (e) Hypothermia (general cooling)
    (f) Dehydration (cold weather)
(3) Localized injuries
    (a) Frostbite
    (b) Radiation burns, e.g., sunburn

Temperature Evaluation

(1) Oral
(2) Axillary
(3) Tympanic
(4) Rectal-only accurate method for determining core body temp
(5) Tactile
    (a) Core temp is higher than preipherial temp (skin)
    (b) When core temp drops to the level of peripherial temp (homeostasis) - this becomes a medical emergency

Mechanisms of heat loss

(1) Physiological
    (a) Conduction - transfer of heat from one substance to another due to difference in temperature
    (b) Convection - transfer of heat through gas or liquid by circulated heat particles
    (c) Evaporation - increase in temperature and a decrease in atmospheric pressure
(2) Environmental
    (a) Weather
    (b) Altitude
    (c) Atmospheric pressure

Predisposing factors

(1) Previous cold injury
(2) Discipline, training, experience
(3) Race/geographic origin
(4) General health and medications
    (a) Hypothyroidism
    (b) Malnutrition, dehydration
    (c) Hypoglycemia
    (d) Medications
(5) Fatigue and exhaustion
(6) Length and intensity of exposure
(7) Climate factors
    (a) Temperature
    (b) Wind
    (c) Precipitation
    (d) Humidity
(8) Activity factors
    (a) Type of combat
    (b) Mobility
    (c) Length of exposure
    (d) Tobacco Usage

Cold Injury preventative measures

(1) Dress
(2) Rest
(3) Food

(4) Limit exposure
(5) Injury control officer/NCO
(6) Plan operations around weather
(7) Provide rewarming tents and hot liquids
(8) Carbon monoxide precautions
(9) Frequent rotations
(10) Use buddy system

Perform specific assessment and management for cold injuries

Chilblains

Cause by repeated prolonged exposure of bare skin at temperature from 60F to 32F, or 20F for acclimated, dry unwashed skin

(1) Signs and symptoms are the following:
  (a) Redness or pallor of affected areas, (fingers, nose, ears)
  (b) Hot, tender, itching skin
  (c) Absence of pain (numb)
  (d) May have ulcerated or bleeding lesions
(2) Emergency care for Chilblains
  (a) Warm the injured body part
    (i) Elevate the affected body part
    (ii) Place the injured body part in contact with a warm object, such as a rescuer's hands or the casualty's body. Instruct the casualty to cross arms and place the hands under armpits.
    (iii) DO NOT RUB TISSUE. Do not apply heat or ice.
  (b) Protect the rewarmed injury from further cold exposure or trauma

Frostbite

An injury of tissue caused from exposure to cold, usually below 32 F depending on the wind-chill factor, duration of exposure, and adequacy of protection. The body parts most easily frostbitten are the cheeks, nose, ears, chin, forehead, wrists, hands, and feet. Signs and symptoms are the following:

NOTE: Signs and symptoms are listed in the order in which they would appear with increased exposure and time.

(1) Superficial
  (a) Loss of sensation or numb feeling in any part of the body
  (b) Sudden whitening of the skin in the affected area followed by momentary tingling feeling
  (c) Redness of skin in light-skinned soldiers, grayish coloring in dark-skinned persons
(2) Deep frostbite is a very serious injury that requires immediate first aid and subsequent medical treatment to avoid or minimize loss of body parts
  (a) Blisters
  (b) Swelling or tender areas

(c) Loss of previous feeling of pain in the affected area
(d) Pale, yellowish, waxy-looking skin
(e) Frozen area feels solid or wooden to the touch

(3) Emergency care for Frostbite

WARNING: **DO NOT** attempt to thaw the casualty's feet or other seriously frozen areas if the casualty will be required to walk or travel to receive further treatment. Thawing in the field increases the possibilities of infection, gangrene, or other injury.

(a) Warm the area at the first sign of frostbite using firm, steady pressure of the hand, underarm, or abdomen (aid giver or buddy's) depending on the area affected.
  (i) Face, ears, nose. Cover the area with the casualty's or a buddy's hands until sensation and color return.
  (ii) Hands. Place the casualty's hands inside his or her clothing against the body and close the clothing. Place the affected hands under the casualty's armpits.
  (iii) Feet Loosen and remove footgear. Place the casualty's bare feet under the clothing and against the body of another soldier.
(b) Loosen or remove tight clothing and watches
(c) Cover the casualty with a blanket or other dry material
(d) Do not cause further injury. Observe the following procedures:
  (i) Do not soak the frostbitten part
  (ii) Do not rub it with snow
  (iii) Do not expose it to any extreme heat source
  (iv) Do not rub or move the part in any way to increase circulation
  (v) Do not allow the casualty to smoke or drink alcohol
  (vi) Do not treat seriously frostbitten parts if the casualty must walk or travel to receive further treatment
  (vii) Exposing the frozen part to an open fire could cause burns because of the lack of feeling in the area
  (viii) Alcohol and tobacco reduce the body's resistance to cold
  (ix) The casualty should be prepared for pain when thawing occurs
(e) Evacuate patient to appropriate facility

Immersion Syndrome (Immersion foot/Trench foot)

Injuries that result from fairly long exposure of the feet to cool or cold water or mud. Inactive feet in damp or wet socks and boots, or tightly laced boots that impair circulation are even more susceptible to injury.

NOTE: Trench foot occurred frequently during WWI. Soldiers stood in cold, wet, muddy trenches for extended periods of time awaiting the order to move. During Vietnam, soldiers were also faced with the similar environmental conditions as in WWI. Paddy foot was a condition that frequently occurred during this period.

(1) Signs and symptoms of Immersion Syndrome
- (a) Early Stages/First phase
  - (i) Affected area feels cold
  - (ii) Numb and painless
  - (iii) Pulses diminished/absent
- (b) Later Stages/Advanced
  - (i) Limbs feel hot and burning
  - (ii) Shooting pains
  - (iii) Affected area is pale
  - (iv) Blisters, swelling, redness, ulceration
  - (v) Complications-infection, gangrene

(2) Treatment for Immersion Syndrome
- (a) Immediate treatment consists of protecting the extremity from trauma and infection
- (b) Gradually rewarm by exposing to warm air. Do not apply heat, ice, moisten or massage it.
- (c) Dry feet thoroughly and avoid walking
- (d) Elevate the affected part
- (f) Seek medical treatment (Evacuate casualty)

Snow Blindness

A burn to the eye from UV radiation. The damage is to the cornea and similar to a welding flash burn to the eye. It is more likely to occur in hazy, cloudy weather than in sunny weather.

(1) Signs and symptoms of Snow Blindness
- (a) Scratchy feeling in eyes, as if from sand or dirt
- (b) Watery eyes
- (c) Redness to eyes

(2) Emergency treatment for Snow Blindness
- (a) Perform visual acuity
- (b) Cover the eyes with a dark cloth
- (c) Patch both eyes
- (c) Evacuate the casualty for further medical care

Hypothermia

A systemic cold injury. Hypothermia is the decrease of body temperature below 95 degrees and generally occurs from prolonged exposure to temperatures above freezing, especially from immersion in cold water, wet-cold conditions, or from the effect of wind. Physical exhaustion and insufficient food

intake may also increase the risk of hypothermia. Hypothermia is a medical emergency.

(1) Signs and symptoms of Hypothermia
- (a) Mild hypothermia (Core Body temperature 90º-95ºF)
  - (i) Conscious, but usually apathetic or lethargic
  - (ii) Shivering
  - (iii) Pale, cold skin
  - (iv) Slurred speech
  - (v) Poor muscle coordination
  - (vi) Faint pulse
- (b) Severe hypothermia (Core Body temperature 90ºF or lower)
  - (i) Breathing is slow and shallow
  - (ii) Irregular heart action
  - (iii) Pulse weaker or absent
  - (iv) Stupor or unconsciousness
  - (v) Ice cold skin
  - (vi) Rigid muscles
  - (vii) Glassy eyes

(2) Emergency care for Hypothermia
- (a) Mild
  - (i) Rewarm the body evenly. (Must provide heat source, a campfire, or another soldiers body.)
  - (ii) Keep the casualty dry and protected from the elements
  - (iii) Give warm liquids
  - (iv) Evacuate patient to the nearest treatment facility immediately
- (b) Severe
  - (i) Gentle handling of patient

NOTE: A cold heart is more prone to V-Fib. if handled roughly.

  - (ii) Avoid further heat loss
  - (iii) Initiate IV
  - (iv) Place on cardiac monitor, if available
  - (v) Evacuate the casualty to the nearest medical treatment facility as soon as possible. Continuous monitoring of vital signs and level of consciousness while in route.

NOTE: Rewarming a severely hypothermic casualty is extremely dangerous in the field due to the great possibility of such complications as rewarming shock and disturbance in the rhythm of the heartbeat.

Dehydration

Occurs when the body loses too much fluid, salt, and minerals. When individuals engage in any strenuous exercises or activities, an excessive amount of fluid and salt is lost through sweat. The danger of dehydration is as

prevalent in cold regions as it is in hot regions. In cold weather, it is extremely difficult to realize that this condition exists.

(1) Signs and symptoms of Dehydration
- (a) Mouth, tongue, and throat are parched and dry
- (b) Swallowing is difficult
- (c) Nausea and dizziness
- (d) Fainting
- (e) Tired and weak
- (f) Muscle cramps especially in the legs
- (g) Focusing eyes may be difficult

(2) Emergency care for Dehydration
- (a) Keep warm
- (b) Loosen clothes to improve circulation
- (c) Give oral and/or IV fluids for fluid and electrolyte replacement
- (d) Rest
- (d) Seek medical assistance

TERMINAL LEARNING OBJECTIVE

Given a standard fully stocked M5 Bag or Combat Medic Vest System. You encounter a casualty with suspected eye injury(ies). The casualty has been initially assessed and injury(ies) prioritized.

Assess and provide emergency medical care for an injury to the eye

Assessment of Ocular Trauma

Ocular trauma is classified as penetrating or nonpenetrating.

Trauma can lead to serious damage and loss of vision. Eye injuries are common in spite of protection of eye by the bony orbit.

(1) History/Physical Examination
- (a) Mechanism of injury - blunt trauma vs. penetrating injury? Was there a projectile or missile injury? (glass from a motor vehicle accident) Thermal, chemical or laser burn?
- (b) Does the patient wear glasses?
- (c) History of eye disease
- (d) Visual Acuity-Most important first step in evaluating extent of injury. Screen with any available printed material. If unable to read print, have the patient count your upraised fingers or distinguish between light and dark.

(2) Signs and Symptoms
- (a) Eyelid or corneal foreign bodies-pain, tearing, redness
- (b) Contusions and abrasions - swelling, redness, and impaired or double vision
- (c) Puncture wounds - eye or eyelid perforations; impaled object
- (e) Chemical burns - redness, severe pain, and tearing
- (f) Avulsions - eyelid or eyeball protrudes or is pulled from its socket
- (g) Orbit fractures - Pain, double or decreased vision, swelling, bruising and eyes not moving together if entrapment occurs
- (h) Eyelid lacerations- bruising, unequal eye movements

Emergency Medical Care for Ocular Trauma

(1) Eyelid or corneal foreign bodies (dust or dirt) – Irrigate the eye with copious amounts of water or IV solution. When irrigating the affected eye, turn the patient to the lateral recumbent position, as to not contaminate the unaffected eye. If the foreign body is embedded, cover the eye and evacuate the patient for further medical care.
- (b) Contusions and abrasions - Irrigate the eye, cover both eyes and evacuate
- (c) Puncture wounds - If there is no impaled object, cover the eye with a loose dressing. If impalement is present, stabilize with gauze rolls or folded gauze pads and protect with a cup. Do not remove impaled object and never try to

replace eye in socket or extruded eyeball. Evacuate immediately.

(d) Chemical Burns – Irrigate the eye with copious amounts of water or IV solution for at least 20 minutes while en route to the hospital

(e) Avulsions - Shield and gently cup the eye pulled from its socket with folded moist 4 x 4s. Do not try to force the eye back into its socket. Cover with a loose, moist dressing.

(f) Orbital fractures - Patch the affected eye

(g) With ANY eye injury, cover both eyes, even if only one eye is injured. The eyes use sympathetic movement. When one eye moves, the other eye duplicates the movement.

(h) With both eyes covered, the patient needs assistance for all activities, so you will have to serve as his eyes, keeping him reassured and oriented

Treatment steps for an ocular impalement

(1) Stabilize the object. Place a roll of 3-inch gauze bandage or folded 4 X 4s on either side of the object, along the vertical axis of the head in a manner that will stabilize the object

(2) Fit a disposable paper drinking cup or paper cone over the impaled object (In a field setting it is unlikely that a cup will be readily available. You will have to improvise using the underlying concept of object stabilization) and allow it to come to rest on the dressing roll. Do not allow it to touch the object. This will offer rigid protection and will call attention to the patient's problem. (DO NOT use a Styrofoam cup, which will flake.)

(3) Have another soldier stabilize the dressings and cup while you secure them in place with self-adherent roller bandage or with a wrapping of gauze. Do not secure the bandage on top of the cup.

(4) The uninjured should be dressed and bandaged to reduce sympathetic eye movements

(5) Provide oxygen and care for shock

(6) Continue to reassure the patient and provide emotional support

TERMINAL LEARNING OBJECTIVE

Given a fully stocked M5 Bag or Combat Medic Vest System, IV administration equipment and fluids, oxygen, suction and ventilation equipment (if available), selected medications, immobilization equipment, and documentation forms. You encounter a casualty with a suspected head injury. The casualty's airway has been established and secured. The casualty has been initially assessed and injury(ies) prioritized.

Assess and identify the severity of the head injury

NOTE: Airway, breathing, and circulation assessment and management must take a priority.

Primary assessment

(1) General assessment
(2) Assess airway
(3) Assess breathing
(3) Assess circulation

Secondary assessment - alteration of consciousness is the hallmark of brain injury

(1) Look for obvious injuries
  (a) Depressed or open skull fractures
  (b) Lacerations
  (c) All head injuries must be suspected of having cervical spine involvement and be managed accordingly
(2) Bleeding from ear or nose
  (a) Clear fluid from ear or nose
  (b) Swelling and/or discoloration behind the ear (Battle's sign)
  (c) Swelling and/or discoloration around both eyes (raccoon eyes): may indicate basil skull fracture
(3) Pupils
  (a) Brainstem injury is probable if both pupils are dilated and do not react to light: If pupils are dilated but react to light injury is often reversible
  (b) Other causes of dilated pupils that may or may not react to light:
    (i) Hypothermia
    (ii) Anoxia
    (iii) Lightning strike
    (iv) Optic nerve injury
    (v) Direct trauma to the eye
    (vi) Drug effect
  (c) Fixed/dilated pupils signify injury only in patients with decreased level of consciousness
(4) Extremities - Casualty has intact sensation/motor function if withdrawal or localized pain to pinching of fingers and toes occurs: Usually indicates there is or minimally impaired or normal brain function.
(5) Vital signs

(a) Can indicate changes in intracranial pressure
(b) Observe/record vital signs during secondary survey and each time you perform a reassessment
(c) Increasing intracranial pressure causes increased blood pressure, the reasons for this are:
    (i) In closed head injury Intracranial pressure increases as a result of swelling of the brain due to trauma.
    (ii) As the pressure increases on the brain cerebrovascular perfusion may be compromised.
    (iii) The result of this is an autonomic response by the brain to increase perfusion and this results in an increased blood pressure
(d) Low blood pressure caused by a head-injury is usually a terminal event
(e) Pulse: a decrease in pulse rate is caused by an increase in intracranial pressure
(f) Respirations
    (i) Increasing intracranial pressure causes respiratory rate to increase, decrease, and/or become irregular
    (ii) Unusual respiratory patterns may reflect level of brain/brainstem injury
    (iii) Prior to death, the casualty may develop a rapid, noisy respiratory pattern called central neurogenic hyperventilation
    (iv) Not as useful an indicator as other vital signs in monitoring the course of head injury. Could also be affected by:
        * Fear
        * Hysteria
        * Chronic illnesses
        * Chest injuries
        * Spinal cord injuries
(g) Assess neurologic status (See Glascow Coma Scale Handout)
    (i) Utilize the Glascow Coma Scale (GCS)
    (ii) Severe head injury: GCS is < 9
    (iii) Moderate head injury: GCS is 9 to 12
    (iv) Minor head injury: GCS is 13 to 15

(6) Reassess
(a) Record level of consciousness
(b) Record pupil size and reaction to light
(c) Record vital signs
(d) Decisions on casualty management are made based on changes in all parameters of the physical and neurological examination
(d) Baseline neurological status must be established. Future decisions on treatment depend on baseline evaluations.

Assess and provide emergency medical care for a traumatic facial injury

Impaled object in the cheek

(1) Signs and symptoms
- (a) Obvious object that has passed through an external cheek
- (b) Bleeding into the mouth and throat
- (c) Blood in the mouth and throat may induce nausea and vomiting

(2) Special considerations
- (a) Ensure an open airway
- (b) Ensure airway is free of obstructions (i.e., broken teeth/dentures or oral cavity bleeding)
- (c) If necessary, examine the external cheek and the inside of the mouth to determine if the object passed through the cheek wall.
- (d) If you see an impaled object in the cheek but cannot see both ends, stabilize the object in place. Do not try to remove it as long as the airway is intact.

(3) Treatment and transport considerations
- (a) Immobilize the head and neck
- (b) If the airway is open, leave the object in place and stabilize it. DO NOT TWIST THE OBJECT.
- (c) Pack the inside of the cheek with rolled gauze, leaving 3 to 4 inches exposed, and dress the external wound
- (d) Suction as needed
- (e) Full spinal immobilization
- (f) Transport in lateral recumbent position with head of spine board elevated to allow for drainage
- (g) Give oxygen via the nasal cannula
- (h) Monitor vital signs and airway every 3-5 minutes for any changes

Nasal injuries

(1) Signs and symptoms
- (a) Abrasions, lacerations, and punctures
- (b) Avulsions
- (c) Difficulty breathing through nares
- (d) Epistaxis

(2) Special considerations
- (a) Other injuries may be present
- (b) Ensure airway is patent. Even though the mouth may be clear, blood and mucus released from nasal injuries can flow into the throat causing an obstruction. Expect vomiting and be prepared to suction.
- (c) Treatment and transport considerations
  - (i) Abrasions, lacerations, and punctures - Control bleeding, apply a sterile dressing, then, bandage in place.

(ii) Avulsion - Return the attached flaps to the normal position. Apply a pressure dressing and bandage. Fully avulsed flaps of skin and avulsed portions of external nose should be kept cool and transported with the patient.
(iii) Foreign objects - DO NOT pull free or probe. Transport without disturbing the object.
(iv) Fully immobilize the spine if signs of C-Spine or head injury is present.
(v) Monitor vital signs, airway, and LOC every 3-5 minutes. Transport the patient in a sitting position if no signs/symptoms of a head/spinal injury are present.
(vi) Nosebleeds (epistaxis)
* For a patient with no signs or symptoms of skull fracture or spinal injury, place the patient in a slightly forward, seated position to allow for drainage, or lay the patient back with the head slightly elevated, or turn the head to one side.
* For an unconscious patient or if signs and symptoms of spinal injury are present, fully immobilize the patient on a long spine board. Elevate the board 6 inches and turn it to the side to facilitate drainage.
* You or the patient may pinch the nostrils to control bleeding. Apply pressure for at least 5 minutes and do not pack the nostrils.

CAUTION: If there is clear fluid or a mix of blood and clear fluid draining from the nose or the ears, the patient may have a skull fracture. Do not pinch the nostrils or attempt to stop the drainage flow.

Oral cavity injuries
(1) Signs and symptoms
(a) Lacerated lip or gum
(b) Lacerated or avulsed tongue
(c) Dislodged teeth
(2) Special considerations
(a) Airway obstruction - look for foreign objects i.e. blood, teeth, vomit, mucus, etc.
(b) Remove any dislodged teeth and dental appliances
(i) With a gloved hand, remove loose dentures and any parts of broken dentures
(ii) Transport any dental appliance and broken teeth with the patient. Place the tooth in a container of normal saline or milk. Do not rub the tooth.

(c) Ensure an open airway
(d) Lacerated lip or gum - Control bleeding by placing a rolled or folded dressing between the lip and the gum leaving a dressing “tail" exposed. For profuse bleeding, position the patient to allow for drainage. Monitor the patient and dressing closely. ONLY IF THE PATIENT IS FULLY ALERT.
(e) Lacerated or avulsed tongue - DO NOT pack the mouth with dressings. Position the patient for drainage. For a fully avulsed tongue, save and wrap the part, keep it cool, and transport it with the patient.
(f) Avulsed lip - Control bleeding with a pressure dressing and position for drainage. Do not bandage across the mouth. Save, wrap, label, and transport any fully avulsed tissues keeping the part cool.
(e) Transport the patient in a sitting position unless signs of spinal/head injury are present

Identify specific head injuries

Head injuries
(1) Scalp wounds
(a) Do NOT underestimate blood loss from a scalp wound
(b) Control with direct pressure
(2) Skull injuries
(a) Linear nondisplaced fractures, compound fractures, or depressed fractures
(b) In adults with large contusion or darkened swelling of scalp, suspect underlying skull fracture
(i) Placing direct pressure upon an obvious depresses or compound skull fracture should be AVOIDED
(ii) Leave penetrating object in the skull in place and immediately transport to the MTF
(iii) For a gunshot wound to the head, unless there is a clear entrance and exit wound to the head, assume the bullet may have ricocheted and be lodged in the neck near the spinal cord

Brain injuries
(1) Concussion
(a) Implication that there is no significant injury to the brain
(b) Trauma to the head with a variable period of unconsciousness or confusion and then a return to normal consciousness
(c) Amnesia from the injury may occur
(d) Short-term memory may be affected and there may be:
(i) Dizziness
(ii) Headache
(iii) Ringing in the ears

(iv) Nausea

(2) Cerebral contusion
- (a) Bruised brain tissue
- (b) History of prolonged unconsciousness or serious alteration in state of consciousness
  - (i) Profound confusion
  - (ii) Persistent amnesia
  - (iii) Vomiting
  - (iv) Abnormal behavior
- (c) Brain swelling may be severe and rapid
- (d) Casualty may appear to have suffered a cerebrovascular accident (stroke) or have focal neurological signs
- (e) Casualty may have personality changes dependent on location of cerebral contusion
- (f) Injured casualties with an altered level of consciousness should be hyperventilated and transported rapidly to a trauma center

(3) Intracranial hemorrhage
- (a) Three major types-epidural hematoma, subdural hematoma, and intracranial hematoma
- (b) Signs and symptoms include:
  - (i) Headache
  - (ii) Visual changes
  - (iii) Personality changes
  - (iv) Slurring of speech
  - (v) Confusion
  - (vi) Changes in level of consciousness and coma

(4) Special considerations
- (a) Suspect brain or C-spine injuries for all head, face, and neck wounds
- (b) Check mouth carefully for broken teeth/blood
- (c) Do NOT attempt to clean the surface of a scalp wound. To do so may cause additional bleeding.
- (d) Do NOT remove impaled objects; stabilize in place
- (e) Gently palpate for depressions
- (f) Do NOT apply a pressure dressing

(5) Treatment and transport considerations
- (a) Ensure an open and clear airway
- (b) Protect for possible neck/spinal injuries
  - (i) Do not lift or attempt to wrap the head of a casualty who is lying down if there are signs of a spinal injury
  - (ii) Neck movement worsens the injury of the casualty with a spinal injury
- (c) Control bleeding by gentle pressure
  - (i) If brain tissue is exposed or cranial/facial fracture suspected, do not apply pressure
  - (ii) Use only enough pressure to stop the flow of blood
  - (iii) Underlying fractures may be present

(d) Manage IV fluids, as indicated
  (i) Administer normal saline or .45 % normal saline only overload
  (ii) Restrict to minimal fluid infusion to avoid overload
(e) Assess for shock:
  (i) Administer fluids as needed to support circulation if hypovolemic shock is the cause
(f) Apply a dressing/bandage being careful not to compromise the airway
(g) If brain tissue is exposed, apply a sterile dressing. Local protocol will dictate whether to apply a moist or dry sterile dressing
(h) Administer a high flow of oxygen
(i) Reassess neurologic status and vital signs
(i) Increase in severity of headache
  (ii) Increase pupil size
  (iii) Progressive weakness on one side
(j) Stabilize impaled object
(k) Support with suction of secretions as needed if available
(l) Administer wound care. Evaluate last tetanus immunization for update, if appropriate
(m) Administer pain control as needed
(n) Full spinal immobilization
(o) Transport in head raised position by elevating the top of the litter or spine board 6 inches. If a facial wound is present, tilt the spine board towards the side of the injury to allow for drainage.
(p) Raise head of bed 30 degrees

TERMINAL LEARNING OBJECTIVE

Given a standard fully stocked M5 Bag or Combat Medic Vest System, IV administration equipment and fluids, oxygen, suction and ventilation equipment (if available), selected medications, immobilization equipment and splints, and documentation forms.
You suspect a casualty has sustained a neck spine injury. The casualty has been initially assessed and injury(ies) prioritized.

Identify immobilization devices

Manual

(1) Description
- (a) Stabilization of the C-spine by hand
- (b) Applied in conjunction with securing the airway, prior to application of the cervical collar

(2) Indications
- (a) Initially applied on all suspected spinal injury patients and unconscious patients. Provides temporary stabilization until the cervical collar is applied and the head is secured to the long spine board
- (b) AT NO TIME should the head/neck be twisted or excessively moved. This may create a spinal injury.

Cervical collar

(1) Description
- (a) A firm collar to assist in cervical stabilization
- (b) Cervical collars alone do not provide adequate in-line immobilization. Manual stabilization must not be released before the patient is fully secured to a long spine board.
- (c) Cervical collars **DO NOT** immobilize the cervical spine. Cervical collars keep the head in a neutral position.

(2) Indications - same as manual stabilization
- (a) Initially applied on all suspected spinal injury patients and unconscious patients. Provides temporary stabilization until the cervical collar is applied and the head is secured to the long spine board
- (b) AT NO TIME should the head/neck be twisted or excessively moved. This may create a spinal injury.

Too large of a cervical collar will hyperextend the head/neck, and too small of a cervical collar will hyperflex the head/neck and cause further injury.

Kendrick extrication device (KED)

(1) The KED is a common device

(2) Description
- (a) A short spinal stabilization device used to extricate patients from vehicles or confined spaces
- (b) Used to stabilize the head, the neck, and the spine until the patient can be secured to a long spine board

(3) Indications
- (a) Used when the patient is found in a sitting position or in a vehicle
- (b) When a long spine board cannot be inserted into a vehicle or aircraft because of obstructions

Manual head stabilization can be released only after the head is secured to the KED. Ensure that the straps and the cravats do not impede breathing.

Long spine board

(1) Description
- (a) A long board made of wood, metal, or plastic
- (b) The only device which provides complete spinal immobilization when the patient is properly secured

(2) Indications
- (a) When a patient with suspected spinal injuries is found in a lying or standing position
- (b) A patient extracted using a short board is then moved to the long board for complete spinal immobilization

Even with the collar in place, medic one maintains the head and neck in a neutral position until the logrolling maneuver is completed, and the patient's head is secured to the long spine board. The head, neck, and pelvis are kept in-line during the log roll.

Identify and treat injuries to the spine

Initial assessment of a casualty with a spine injury

(1) Ensure open airway
(2) Assess breathing
(3) Assess circulation. Look for major hemorrhage.

Secondary assessment of a casualty with a spine injury

(1) Consider mechanism of injury
- (a) Falls
- (b) Blunt Trauma
- (c) Penetrating trauma to the head, neck, or torso
- (d) Vehicle accidents

(2) Assessment of the responsive casualty

The patient's ability to walk should never be a factor in determining whether a patient needs to be treated for a spine injury. 20 percent of all spine injuries are seen walking around the accident scene.
- (a) Inquire about the mechanism of injury
- (b) Does your neck or back hurt? Where?
- (d) Can you move your hands and feet?
- (e) Can you feel me touching your fingers/toes? Paralysis or loss of sensation of the upper and/or lower extremities - the most reliable signs of a spinal cord injury if the patient is conscious
- (f) Inspect for:

(i) Contusions
(ii) Deformities
(iii) Lacerations
(iv) Punctures
(v) Penetrations
(vi) Swelling

(g) Palpate for areas of tenderness or deformity
(h) Assess the equality of the strength of the extremities.
(i) Handgrip
(ii) Gently push feet against hands
(i) Assess level of consciousness (LOC)

(3) Assessment of the unresponsive casualty
(a) Determine the mechanism of injury from witnesses
(b) Inspect for:
(i) Contusions
(ii) Deformities
(iii) Lacerations
(iv) Punctures
(v) Penetrations
(vi) Swelling
(c) Palpate for areas of tenderness or deformity.
(i) Tenderness with gentle palpation in area of injury
(ii) Deformity - obvious deformities are rare (i.e., "stepoffs")
(d) Check response to painful stimuli by pinching between the thumb and index finger of the patient or pinch the skin on top of each foot.
(e) Impaired breathing - may indicate damaged spinal nerves, which send information to the respiratory center of the brain
(i) Diaphragmatic breathing
(ii) Panting
(f) Life-threatening C-spine injuries occur with spinal column injuries from C-1 to T-8 due to damage to the spinal nerves and/or brain stem, which interrupt nerve transmission to the respiratory center
(g) Priapism - persistent erection of the penis often associated with a spinal cord injury
(h) Incontinence (bowel and/or bladder)
(i) Soft tissue injury with trauma

Provide Emergency Care of a casualty with a spine injury

(1) Establish and maintain manual in-line stabilization of the head and the neck during the initial assessment. Continue to maintain stabilization until the patient is properly secured to a long backboard.
(2) Assess airway, breathing, and circulation during the initial assessment. If necessary, open the airway using the jaw thrust.
(3) Continually assess pulse and motor and sensory functions in all extremities.

(4) Apply the proper size rigid cervical collar.
  (a) Cervical collars are referred to as extrication collars.
  (b) Stiff collars
  (c) Rigid collars
  (d) C-collars
(5) If patient is found in a lying position, immobilize the patient to a long spine board using the log roll method
  (a) One soldier medic must maintain in-line stabilization
  (b) The soldier medic at the head directs the movement of the patient
  (c) One to three other soldier medics control the movement of the rest of the body
  (d) Quickly assess the posterior body if not already done in the initial assessment
  (e) Position the long spine board under the patient
  (f) Roll the patient onto the board at the command of the soldier medic holding the head
  (g) Pad the voids between the patient and the board
    (i) Under the head and torso as needed
    (ii) Pad under the shoulders to the toes on the infant and child to establish a neutral position
  (h) Immobilize the torso to the board by applying straps across the chest and pelvis.
  (i) Immobilize the patient's head to the board
  (j) Fasten the legs proximal to and distal to the knees
  (k) Reassess and record pulse, motor, and sensation
(6) If patient is found in a sitting position, immobilize the patient to a short spine board. See handout for procedures - if available
(7) If patient is found in a standing position, immobilize the patient to a long spine board
  (a) One soldier medic stands behind the patient and maintains in-line stabilization and another soldier medic positions the board behind the patient. A soldier medic stands on each side of the patient and one additional soldier medic at the foot facing the patient.
  (b) The soldier medics on both sides of the patient reach with the hand closest to the patient under the arm to grasp the board and use the hand to secure the head
  (c) Once the position is assured, the medics on the sides place the leg closest to the board behind the board and begin to tip the top backward. The soldier medic at the foot of the board secures the board and the patient to prevent them from sliding, and the board is brought into a level horizontal position.
(8) Assist with ventilation as needed
(9) Care for other injuries
(10) Perform a rapid extraction if indicated
(11) Transport considerations
  (a) Transport immediately
  (b) Monitor for signs/symptoms of neurogenic shock

(c) Continue neurological assessment and monitor vital signs every 3-5 minutes
(d) Initiate two large bore IVs 0.9% Normal Saline

Identify injuries to the neck

Signs and symptoms

(1) Loss of voice or hoarseness
(2) Signs of airway obstruction when the mouth and nose are clear
(3) Contusions on or depressions in the neck
(4) Deformity, swelling, contusions, depressions, and open wounds
(5) Lacerations may produce profuse arterial or venous bleeding.
(6) Subcutaneous emphysema - is the presence of air in soft tissues causing a very characteristic crackling sensation on palpation
(7) Special considerations - With any neck injury, the medic should be concerned with a possible C-spine compromise as well as airway obstruction

Treatment and transport considerations

(1) Ensure a patent airway
(2) Head and neck stabilization
(3) Control bleeding
  (a) Severed neck artery
    (i) Apply direct pressure, or if possible, pinch the artery with the gloved thumb and forefinger/gauze pad until the bleeding stops
    (ii) Administer a high concentration of oxygen
    (iii) Apply an occlusive dressing
  (b) Severed neck vein
    (i) Apply direct pressure
    (ii) Apply an occlusive dressing
    (iii) Administer a high concentration of oxygen
(4) Care for shock and administer a high concentration of oxygen for all neck injury patients
(5) Transport the patient in a lateral recumbent position
(6) Monitor vital signs every 3-5 minutes. Assess for respiratory difficulties.
(7) Any deep, open wound to the neck may have also cut the trachea and may need an occlusive dressing
(8) Initiate two large bore IVs 0.9% Normal Saline

Spinal immobilization using backboards

Using a short backboard

(1) Used for casualties who are in a position that does not allow for use of long backboard.
(2) Priorities of evaluation and management are initiated before application of immobilization devices
(3) The first soldier should immobilize neck in a neutral position at the same time that you begin airway evaluation

(4) When casualty is stable, apply a semirigid extrication collar
(5) Position backboard behind casualty
  (a) The first soldier continues to immobilize neck while backboard is slipped/eased into place
  (b) Support the neck and back if casualty has to be moved forward
(6) Secure casualty to the board: Move strap over a leg, down between both legs, back around the outside of the same leg, across the chest, and attach to the opposite upper straps that were brought across the shoulders
(7) Tighten the straps until the casualty is securely held
(8) Transfer casualty to a long backboard
  (a) Turn casualty so that his back is to the opening through which he is to be removed
  (b) Support the legs so that the upper legs remain at a 90-degree angle to the torso
  (c) Position long backboard under casualty and slide casualty and short backboard up into position on long backboard
  (d) Loosen straps on short board and allow legs to extend out flat
  (e) Retighten the straps
  (f) Secure casualty to long backboard and secure head with padded immobilization device

Using a long backboard

(1) Log-rolling the supine casualty
  (a) Soldier 1 maintains spine immobilization in a neutral position. DO NOT apply traction.
    (i) Apply a semirigid extrication collar
    (ii) Soldier 1 maintains the head and neck in neutral position until log-rolling maneuver is completed
  (b) Casualty is placed with legs extended in normal manner and arms (palms inward) extended by his sides. Casualty will be rolled up on one arm with that arm providing proper spacing and acting as a splint for the body
  (c) Long backboard is positioned next to the body. If one arm is injured, place the backboard on injured side so that the casualty will roll up on the uninjured arm
  (d) Soldier 2 and 3 kneel at casualty's side opposite the board
  (e) Soldier 2 is positioned at the midchest area and soldier 3 by upper legs
  (f) With knees, soldier 2 holds casualty's near arm in place
    (i) Soldier 2 reaches across casualty and grasps the shoulder and hips, holding casualty's far arm in place
    (ii) Usually, it is possible to grasp the casualty's clothing to help with roll
  (g) With one hand, soldier 3 reaches across the casualty and grasps the hip. With the other hand, he holds feet together at lower legs.

(h) Soldier 1 gives order to roll casualty
(i) Soldier 1 carefully keeps head and neck in neutral position during the roll
(j) Soldier 2 and 3 roll victim up on his side toward them
  (i) Casualty's arms are kept locked to his side to maintain a splinting effect
  (ii) Head, shoulders, and pelvis are kept in line during the role
(k) When casualty is upon his or her side, soldier 2 quickly examine back for injuries
(l) Backboard is now positioned next to the casualty
  (i) Soldier 1 gives the order to roll casualty onto the backboard
  (ii) Head, shoulders, and pelvis are kept in line

(2) Log-rolling the prone casualty
(a) Casualty who in not breathing or who is in severe respiratory difficulty must be log-rolled immediately to manage the airway. Unless the backboard is already positioned, you must log-roll the casualty, manage the airway, and then transfer the casualty to the backboard when ready to transport.
(b) Casualty with profuse bleeding of the nose or mouth must not be turned to the supine position
  (i) Profuse upper airway bleeding in a supine casualty is a guarantee of aspiration
  (ii) Casualty will have to be carefully immobilized and transported prone or on his side, allowing gravity to help keep airway clear
(c) Casualty with an adequate airway and respiration should be logrolled directly onto a backboard

TERMINAL LEARNING OBJECTIVE
Given a standard fully stocked M5 Bag or Combat Medic Vest System, immobilization equipment and splints. You encounter a casualty who has suspected musculoskeletal injuries and/or complains of extremity pain. There is no spinal involvement. The casualty has been initially assessed and injury (ies) prioritized.

Assess the musculoskeletal injury

Primary assessment

(1) Assess airway
(2) Assess breathing
(3) Assess circulation - especially pulses distal to site of injury
(4) Assess for signs and symptoms of shock - fracture to larges bones such as the femur and pelvis may cause massive hemorrhage leading the hypovolemic shock.

Secondary assessment

(1) Consider mechanism of injury
  (a) Direct force
  (b) Indirect force
  (c) Twisting force (torsion)
(2) If casualty is conscious, ask:
  (a) Location of injury?
  (b) Pain?
  (c) Tenderness?
  (d) Can he/she move the extremity?
(3) Assess skin
  (a) Color
  (b) Sensation
  (c) Temperature
  (d) Capillary refill
(4) Obtain vital signs
(5) Assess fracture
  (a) Closed fracture
    (i) Bone injury is entirely internal
    (ii) No break in skin
    (iii) Loss of up to a liter of blood can be caused by a closed fractures of one femur - Two fractured femurs can cause hemorrhaging of a life-threatening nature
  (b) Open fracture - open wound of skin
    (i) Occur when sharp end of broken bone pushes out through the skin
    (ii) Made by an object such as a bullet that penetrates from the outside
    (iii) Usually involve extensive damage to tissues and likely to become infected
    (iv) Look for open wounds and the possibility of an open fracture
  (c) Fractured bone ends are extremely sharp and pose a serious threat to surrounding tissue

(i) Nerves, arteries, and which frequently are located near the bone or near the skin are often injured
(ii) Neurological injuries may be due to lacerations from bone fragments or from pressure due to hematomas or swelling

(d) Fractures of the clavicle
(i) Injured shoulder is lower than uninjured
(ii) Casualty is usually unable to raise arm above level of the shoulder
(iii) May attempt to support injured shoulder by holding elbow with other hand
(iv) Deformity
(v) Localized pain
(vi) Tenderness

(e) Fractures of the humerus
(i) Pain
(ii) Tenderness
(iii) Swelling
(iv) Wobbly motion at point of fracture
(v) If fracture is near the elbow, arm is likely to be straight with no bend at elbow

(f) Fractures of the radius and/or ulna
(i) When both are broken, the arm usually appears deformed
(ii) When only one bone is broken, the other acts as a splint and the arm retains a more natural appearance
(iii) Pain
(iv) Tenderness
(v) Inability to use forearm
(vi) Unstable fracture segment

(g) Simple rib fractures
(i) Pain localized at site of fracture
(ii) Possible rib deformity
(iii) Coughing or movement is usually painful
(iv) Casualty remains still and often leans toward injured side

(h) Fractures of the pelvis
(i) Can cause extensive bleeding in retroperitoneal space or abdomen
(ii) Usually fractures in several places
(iii) Bone fragments from a fractured pelvis may perforate/lacerate the bladder- an indication may be blood present in the urine
(iv) Bone fragments may lacerate large blood vessels in the pelvis that may cause fatal hemorrhage into the abdomen
(v) Severe pain
(vi) Loss of ability to use lower part of body

(vii) Unable to sit or stand

(i) Fractures of the femur
- (i) Muscle spasm
- (ii) Excruciating pain
- (iii) Unnatural position, external rotation
- (iv) Fractured leg is typically shorter than uninjured because of contraction of thigh muscle
- (v) Swelling at site of fracture
- (vi) Damage to blood vessels and nerves often result

(j) Fractures of the patella
- (i) Pain
- (ii) Deformity of patella

(k) Fractures of the tibia and fibula
- (i) Tenderness
- (ii) Swelling
- (iii) Pain at point of fracture

(6) Assess joints

(a) Injuries to joints and muscles often occur together

(b) Distinguishing between joint or muscle injury and fracture is difficult

(c) Possible joint and muscle injuries:

(i) Dislocations
- * Bone is forcibly displaced from its joint
- * Likely to bruise or tear the muscles, ligaments, blood vessels, tendons, and nerves near a joint
- * Rapid swelling and discoloration
- * Loss of ability to use joint
- * Severe pain
- * Muscle spasms
- * Possible numbness and loss of pulse below the joint
- * Stiff and immobile

(ii) Sprains
- * Injury to ligaments and soft tissues that support a joint
- * Pain or pressure at joint
- * Pain upon movement
- * Swelling and tenderness
- * Possible loss of movement
- * Discoloration

(iii) Strains
- * Forcible overstretching or tearing of a muscle or tendon
- * Pain
- * Lameness or stiffness - sometimes involving knotting of muscles
- * Moderate swelling at place of injury

* Discoloration
* Possible loss of strength in affected area
* Distinct gap felt at site

(iv) Contusions
* Caused by blunt trauma that may damage bones, muscles, tendons, blood vessels, nerves, and other body tissues
* Immediate pain
* Swelling occurs - blood from broken vessels oozes into soft tissues under the skin
* Initial skin reddening due to irritation
* Later, characteristic black and blue marks appear
* Skin eventually turns yellowish or greenish
* Bruised area is usually very tender

(7) Assess Amputations
(a) Potentially life-threatening injuries due to severe tissue damage with subsequent hemorrhage and shock
(b) Massive hemorrhage can occur but most often the bleeding will control itself with a spontaneous retraction of major vessels and ordinary pressure applied to the stump
(c) If possible, locate the amputated part and transport with the patient

Provide emergency care for extremity injuries

Expose the area

Control bleeding

(1) Direct pressure
(2) Pressure dressing
(3) Pressure points

NOTE: Splinting i.e. immobilization is the most effective method to control bleeding of fractures. Splint the fracture(s) in the position found. DO NOT attempt to reposition or straighten the injury.

Treat specific fracture

(1) Fractures of the clavicle
(a) If fracture is open, control bleeding - immobilize
(i) Pressure dressing
(ii) Pressure points
(b) Apply sling and swathe if possible
(i) Bend casualty's arm on injured side and place forearm across the chest
(ii) Raise hand about 4 inches above the level of the elbow

(iii) Support forearm in position by means of a wide sling. A wide roller bandage may be used to secure the casualty's arm to the chest
(iv) A figure-of-eight bandage may also be used for a fracture clavicle
(c) Assess for signs and symptoms of shock
(d) Evacuate to nearest treatment facility

NOTE: Splint in the position you find it and evaluate circulation.

(2) Fractures of the humerus
(a) If fracture is open, control bleeding
(i) Pressure dressing
(ii) Pressure points
(iii) Immobilize
(b) If fracture is in upper part of arm near shoulder:
(i) Place a pad or folded towel in armpit
(ii) Bandage arm securely to body
(iii) Support forearm in narrow sling
(iv) Splint should extend from shoulder to elbow
(v) Fasten splinted arm firmly to body and support forearm in narrow sling
(c) If fracture is in middle of humerus:
(i) Fasten two wide splints or four narrow splints around the arm
(ii) Support the forearm in a narrow sling
(iii) Be sure sling does not extend too far up the armpit - this may cause compression of blood vessels and nerves
(d) If fracture is at or near elbow
(i) Do not attempt to straighten or move
(ii) Splint arm in position to prevent further nerve and blood vessel damage
(iii) Exception: if no pulse distal to fracture, gentle traction may be applied and arm splinted
(e) In all cases, assess for signs and symptoms of shock
(f) Transport to nearest treatment facility
(3) Fractures of the radius and/or ulna
(a) If fracture is open, control bleeding
(i) Pressure dressing
(ii) Pressure points
(iii) Immobilize
(b) Straighten forearm is possible
(c) Apply two well-padded splint to forearm, one on top and one on bottom
(i) Splints should be long enough to extend from elbow to wrist
(ii) Use bandages to hold splints in place
(iii) Place forearm across the chest

(iv) Support forearm in position by means of wide sling and cravat bandage
(v) Raise hand about 4 inches above level of elbow
(i) Assess for signs and symptoms of shock
(j) Transport to nearest treatment facility

(4) Simple rib fractures
(a) Ordinarily, rib fractures are not bound, strapped, or taped if the casualty is reasonably comfortable
(b) Provide analgesia available in combat vest
(c) Place casualty in position of comfort
(d) Transport to nearest treatment facility

(5) Fractures of the pelvis
(a) Initiate large bore IV 0.9% Normal Saline
(b) Provide analgesia available in combat vest
(c) Minimize movement - only move unless necessary
(d) Assess for signs and symptoms of shock
(e) Keep casualty supine. Legs may be straight or bend, depending on comfort
(f) Immobilize
(i) Fractures of the hip are best treated with traction splints
(ii) Adequate immobilization can also be obtained by placing folded poncho's, poncho liners or blankets between legs
(iii) Use cravats, roller bandages, or straps to hold the legs together
(iv) Fasten casualty securely to stretcher or improvised support
(g) Transport to nearest treatment facility

(6) Fractures of the femur
(a) If fracture is open, control bleeding - immobilize
(i) Pressure dressing
(ii) Pressure points
(b) Carefully straighten the leg. Apply two splints:
(i) One on the outside of the injured leg - should reach from armpit to foot
(ii) One inside - from groin to foot
(c) Fasten splints
(i) Around ankle
(ii) Over knee
(iii) Just below hip
(iv) Around pelvis
(v) Just below armpit
(d) The legs can be tied together to support injured leg
(e) Assess for signs and symptoms of shock
(f) Transport to nearest treatment facility

(7) Fractures of the patella
(a) Straighten the injured limb

(b) Immobilize fracture by placing padded board under injured limb. The board should be at least 4 inches wide and reach from buttock to heel
(c) Place extra padding under knee and just above heel
(d) Use strips of bandage to fasten the leg to the board
(i) Just below the knee
(ii) Just above the knee
(iii) At the ankle
(iv) At the thigh
(e) Be sure not to cover the knee. Any bandage of tie fastened over the knee could created a problem should swelling occur.
(f) Transport to the nearest treatment facility

(8) Fractures of the tibia and fibula
(a) If fracture is open, control bleeding
(i) Pressure dressing
(ii) Pressure points
(b) Carefully straighten the leg
(c) Consider PASG or apply three splints
(i) Pad each splint well, particularly under the knee and at the bones on each side of the ankle.
(ii) Place splints on both sides and leg and one underneath
(iii) A folded poncho liner and two side splints may be used
(d) When available, use traction splints
(e) Assess for signs and symptoms of shock
(f) Transport to nearest treatment facility

Treat specific joint injury

(1) Dislocations
(a) Loosen clothing around injured part
(b) Place casualty in position of comfort
(c) Support injured part by means of a sling, pillows, bandages, splints
(d) Treat all dislocations as fractures
(e) Evacuate to the nearest treatment facility

(2) Sprains
(a) Treat all sprains as fractures in the field
(b) Apply cold packs for the first 24 to 48 hours to reduce swelling and to control internal hemorrhage
(c) Elevation and rest of affected area
(d) Apply snug, smooth, figure-of-eight bandage to control swelling
(e) Provide immobilization
(f) Transport to nearest treatment facility

(3) Strains
(a) Keep affected area elevated and at rest
(b) Apply cold packs for the first 24 to 48 hours to control hemorrhage and swelling

(c) Apply mild heat to increase circulation and aid healing 24 hours after the last cold pack
(d) Muscle relaxants, adhesive straps, and complete immobilization of the area may be indicated

(4) Contusions
(a) Slight bruises do not require treatment
(b) Apply an elastic bandage to contused area as needed for comfort
(c) Elevate injured part
(d) A sling may be used for a bruised arm or hand. Folded ponchos, poncho liners, clothing, or blankets may be used to elevate a bruised leg
(e) Ice may be applied to contused area for 24 to 48 hours

Assess Amputations

(1) Apply pressure to stump to control bleeding
(2) Cover stump with damp sterile dressing and elastic wrap. Apply tight enough to apply uniform, reasonable pressure across entire stump
(3) If direct pressure does not control bleeding, a tourniquet may be used
(4) Care for the amputated part
(a) Place amputated parts in plastic bag, if available
(b) Place bag in larger bag or container containing ice and water - cooling slows the chemical processes and will increase viability in excess of four hours
(b) Do NOT place amputated part directly on ice

Provide on-going management

(1) Continue to monitor casualty's airway and breathing
(2) Monitor circulation
(a) Reassessing skin for
(i) Color
(ii) Sensation
(iii) Temperature
(iv) Capillary refill
(b) Reassess distal pulses
(3) Monitor vital signs
(4) Continue non-pharmacological and pharmacological interventions
(a) IV fluids
(b) Antibiotics
(c) Analgesics

Principles of splinting

Purposes of Immobilizing Fractures:

(1) To prevent the sharp edges of the bone from moving and cutting tissue, muscle, blood vessels, and nerves
(2) To reduce pain and help prevent or control shock
(3) To prevent bone fragments from converting closed fracture to open fracture
(4) To control bleeding - one of the best ways to control bleeding

Splints are used to immobilize fractures to prevent further damage. In the field, some splints may need to be improvised.

(1) Splints may be improvised from such items as
    (a) Boards
    (b) Poles
    (c) Sticks
    (d) Tree limbs
    (e) Rolled magazines, newspapers, or cardboard
(2) Narrow materials such as wire or cord should not be used to secure a splint in place
(3) If raw materials are not available, anatomical splints may be utilized. For example: the chest wall can be used to immobilize a fractured arm and the uninjured leg can be used to immobilize (to some extent) the fractured leg
(4) Splints should be padded in order to prevent pressure points on bony prominences if standard padding materials are unavailable, padding may be improvised from such items as:
    (a) Clothing
    (b) Blankets
    (c) Ponchos
    (d) Shelter halfs
    (e) Leafy vegetation

Slings, a sling is a bandage (or improvised material such as a piece of cloth, a belt and so forth) suspended from the neck to support an upper extremity

(1) Slings may be improvised by using
    (a) The tail of a coat or shirt
    (b) Pieces torn from such items as clothing and blankets
    (c) The triangular bandage is ideal for this purpose
(2) Remember when applying a sling that the casualty's hand should be higher than his elbow, and the sling should be applied so that the supporting pressure is on the uninjured side

Swathes are bands (pieces of cloth, pistol belts, and so forth) that are used to further immobilize a splinted fracture

(1) Triangular and cravat bandages are often used as or referred to as swathe bandages
(2) The purpose of the swathe is to immobilize, therefore, the swathe bandage is placed above and/or below the fracture - not over it

Prepare the Casualty for Splinting the Suspected Fracture

(1) Reassure the casualty
(2) Loosen any tight or binding clothing
(3) Remove all the jewelry from the casualty distal to the fracture site. If the jewelry is not removed at this time and swelling occurs later, further bodily injury can occur

Procedures for Splinting Suspected Fractures

(1) Gather splints or material for an improvised splint
(2) Ensure that splints are long enough to immobilize the joint above and below the suspected fracture
(3) If possible, use at least four ties (two above and two below the fracture) to secure the splints. The ties should be nonslip knots and should be tied away from the body on the splint.
(4) If splinting material is not available and suspected fracture CANNOT be splinted, then swathes, or a combination of swathes and slings can be used to immobilize an extremity
(5) Pad the splints where they touch any bony prominences. Padding prevents excessive pressure to the area
(6) Check the circulation distal to the injury
    (a) Note any pale, white, or bluish-gray color of the skin which may indicate impaired circulation
    (b) Assess capillary refill
(7) Check the temperature of the injured extremity
    (a) Use your hand to compare the temperature of the injured side with the uninjured side of the body
    (b) The body area below the injury may be cooler to the touch indicating poor circulation
(8) Question the casualty about the presence of numbness, tightness, cold, or tingling sensations
(9) Casualties with fractures to the extremities may show impaired circulation, such as numbness, tingling, cold and/or pale to blue skin distal to injured site. These casualties should be treated and evacuated as soon as possible. Prompt medical treatment may prevent possible loss of the limb

Apply the Splint in Place

(1) Splint the fracture(s) in the position found. DO NOT attempt to reposition or straighten the injury.
(2) If it is an open fracture, stop the bleeding and protect the wound
(3) Cover the wound before applying a splint
(4) If bones are protruding (sticking out), DO NOT attempt to push them back under the skin
(5) Apply padding to protect the area
(6) Place one splint on each side of the arm or leg. Make sure that the splints reach, if possible, beyond the joints above and below the fracture.
(7) Tie the splints. Secure each splint in place above and below the fracture site with improvised (or actual) cravats. Improvised cravats, such as strips of cloth, belts, or whatever else you have, may be used

(8) With minimal motion to the injured areas, place and tie the splints with the bandages
(9) Push cravats through and under the natural body curvatures (spaces), and then gently position improvised cravats and tie in place
(10) Use nonslip knots. Tie all knots on the splint away from the casualty. DO NOT tie cravats directly over suspected fracture/dislocation site.
(11) Check the Splint for Tightness
  (a) Check to be sure that bandages are tight enough to securely hold splinting materials in place, but not so tight that circulation is impaired
  (b) Recheck the circulation after application of the splint
    (i) Check the skin color and temperature. This is to ensure that the bandages holding the splint in place have not been tied too tightly.
    (ii) A finger tip check can be made by inserting the tip of the finger between the wrapped tails and the skin
  (c) Make any adjustment without allowing the splint to become ineffective

Apply a Sling if Applicable

(1) An improvised sling may be made from any available nonstretching piece of cloth such as
  (a) A fatigue shirt or trouser
  (b) Poncho or shelter half
  (c) The tail of a coat, belt, or a piece of cloth from a blanket or some clothing
  (d) A pistol belt or trouser belt also may be used for support
  (e) A sling should place the supporting pressure on the casualty's uninjured side
  (f) The supported arm should have the hand positioned slightly higher than the elbow
(2) Insert the splinted arm in the center of the sling
(3) Bring the ends of the sling up and tie them at the side (or hollow) of the neck on the uninjured side
(4) Twist and tuck the corner of the sling at the elbow

Apply a Swathe if Applicable

(1) You may use any large piece of cloth, such as a soldier's belt or pistol belt, to improvise a swathe
(2) The swathe should not be placed directly on top of the injury, but positioned either above and/or below the fracture site
(3) Apply swathes to the injured arm by wrapping the swathe over the injured arm, around the casualty's back and under the arm on the uninjured side. Tie the ends on the uninjured side
(4) A swathe is applied to an injured leg by wrapping the swathe(s) around both legs and securing it on the uninjured side

Evacuate and Provide on-going care and watch closely for development of life-threatening conditions and if necessary, continue to evaluate the casualty

TERMINAL LEARNING OBJECTIVE

Given a standard fully stocked M5 Bag or Combat Medic Vest System. You encounter a casualty who has suspected abdomen injury(ies) and/or complains of abdominal pain. There is no spinal involvement. The casualty has been initially assessed and injury(ies) prioritized. Performed appropriate treatment for life threatening abdominal injury(ies). Managed the associated effects of the abdominal injury.

Determine the mechanism of injury

History should be obtained quickly - major cause of mortality or morbidity is delaying in diagnosis.

Index of suspicion

The primary factor in assessing abdominal trauma is NOT the accurate diagnosis of the injury, but rather that an abdominal injury exists. Based on mechanism of injury and visual assessment

(1) Did the casualty fall from a height or hit by a vehicle?
(2) Was there an explosion that hurtles the victim against immobile objects or transmitted blast pressure to organs inside the abdomen?
(3) Ask the victim if a weapon was used:
  (a) Type of weapon i.e. gun, knife, etc.
  (b) Distance from weapon

Blunt mechanisms

(1) Most common type of abdominal injury
(2) High probability of accompanying injuries to other parts of the body
(3) Injury may be from:
  (a) Direct compression of the abdomen
    (i) Solid organs being fractured
    (ii) Blowout of hollow organs
  (b) Deceleration: tearing of organs or their blood vessels
(4) Casualties may have little or no pain with minimal external evidence of injury

Penetrating objects: Energy imparted to the body

(1) Gunshot wounds: Potential injury to abdominal viscera
  (a) Low velocity
    (i) Knife/bayonet
    (ii) Ice pick
  (b) Medium velocity
    (i) Gunshot wounds
    (ii) Shotgun wounds
  (c) High velocity
    (i) High power hunting rifles
    (ii) Military weapons
    (iii) Ballistics
    (iv) Trajectory
    (v) Distance
(2) Stab wound

(a) Casualty may not initially appear to be in shock unless knife penetrates a major vessel or organ
(b) Life-threatening peritonitis can develop within a few hours
(3) The path of the penetrating object may not be apparent from the wound location

The location is also dependent on whether the patient is inhaling or exhaling. This could cause the injury to be an abdominal, lung, or heart injury.

(a) A stab to the chest can penetrate the abdomen
(b) The course of a bullet may pass through numerous structures in various body locations
(c) You must be aware of the possibility of intra-abdominal bleeding with hemorrhagic shock
(d) NEVER REMOVE AN IMPALED OBJECT

Provide emergency care for an abdominal injury

Assessment findings

(1) Perform a primary assessment to ensure airway, breathing, and circulation prior to assessing the abdomen
(2) Secondary survey (specific to abdominal injuries)
  (a) Inspect for:
    (i) Abrasions
    (ii) Contusions
    (iii) External blood loss
    (iv) Wounds
    (v) Impaled objects
    (vi) Evisceration
    (vii) Carefully logroll the casualty to inspect posterior abdomen for exit wounds, bruising
  (b) Palpate for:
    (i) Tenderness
    (ii) Guarding/rigidity
    (iii) Pelvic instability - indicates a pelvic fracture
    (iv) Distention
(3) Severe hemorrhage would be associated with:
  (a) Distension
  (b) Tenderness or tenseness, though tenderness may not be a reliable indicator if causally presents with an altered mental status
(4) The diaphragm is the only muscle sheet separating the chest from the abdomen. Injury is common to both.
(5) Abdominal injuries may present with shoulder pain
(7) Absence of signs and/or symptoms does not rule-out abdominal injuries
(8) Assess for shock (See LP C191W004, Treat for Shock)

Provide emergency medical care for abdominal injury

(1) Ensure open airway

(2) Provide supplemental oxygen
(3) IV access - administer IV antibiotics (Ancef) 1-2 gm
(4) Manage abdominal injuries
  (a) Expose wound
  (b) Control bleeding
  (c) Prevent further contamination
  (d) Apply dry sterile dressing to the wound and bandage securely in place
  (e) Keep casualty calm
  (f) Treat for shock
  (g) Apply oxygen if available
(5) Manage abdominal eviserations
  (a) Do NOT touch or attempt to push abdominal contents protruding from a wound back into the abdomen.
  (b) Cover any organ or viscera protruding from a wound with saline or water moistened gauze: Intestines may become irreversibly damaged if they are allowed to dry
(6) Manage impaled objects
  (a) Do NOT remove a foreign body that is impaled in the abdomen
  (b) Stabilize the object in place
  (c) Expose the wound area
  (d) Control bleeding: bulky dressing may also assist in stabilizing the object (Also see C191W003, Treat for Shock)
  (e) No food or drinks
(5) Transport to a facility with surgical capability

TERMINAL LEARNING OBJECTIVE

Given a Combat Medic Vest System or All-purpose Lightweight Individual Carrying Equipment standard packing list, IV administration equipment and fluids, oxygen, suction and ventilation equipment (if available), selected medications, and documentation forms.

You encounter a casualty who has a suspected chest injury. The casualty has been initially assessed and injury(ies) prioritized.

General Assessment of thoracic trauma

Determine mechanism of injury

(1) A penetrating thoracic wound at the fourth intercostal space (level of the nipples) or lower should be assumed to be an abdominal injury as well as thoracic injury

(2) Thoracic injuries may be result of penetrating objects or blunt trauma
- (a) Penetrating injuries
  - (i) Gunshot or stab wounds
  - (ii) Distribute forces of injury over a lesser area
  - (iii) Trajectory of a bullet can be unpredictable and all thoracic structures are at risk
- (b) Blunt trauma
  - (a) Force is distributed over a large area
  - (b) Visceral injuries occur from:
    - (i) Deceleration
    - (ii) Compression
    - (iii) Bursting
    - (iv) Sheering forces

Assess the casualty

(1) Identify signs and symptoms
- (a) Major symptoms of chest injury include:
  - (i) Shortness of breath
  - (ii) Respiratory distress
  - (iii) Chest pain
- (b) Signs indicative of chest injury include:
  - (i) Shock
  - (ii) Cyanosis
  - (iii) Hemoptysis
  - (iv) Chest wall contusion
  - (v) Flail chest
  - (vi) Open wounds
  - (vii) Distended neck veins
  - (viii) Tracheal deviation
  - (ix) Subcutaneous emphysema

(2) Assess vital signs
- (a) Pulse

(b) Blood pressure
(i) Hypertension
(ii) Hypotension
(c) Respiratory rate and effort
(i) Tachypnea
(ii) Bradypnea
(iii) Labored
(iv) Retractions
(v) Evidence of respiratory distress

(3) Assess skin
(a) Diaphoresis: secretion of sweat
(b) Pallor: absence of color
(c) Cyanosis
(d) Open wounds
(e) Ecchymosis

(4) Assess the neck
(a) Position of trachea
(b) Subcutaneous emphysema
(c) Jugular venous distension
(d) Penetrating wounds

(5) Assess chest
(a) Contusions
(b) Tenderness
(c) Asymmetry
(d) Open wounds or impaled objects
(e) Crepitation
(f) Paradoxical movement
(g) Lung sounds
(i) Absent or decreased
* Unilateral
* Bilateral
(ii) Location
(iii) Bowel sound in lung area
(h) Lung sounds - percussion
(i) Hyperresonance
(ii) Hyporesonance
(i) Heart sounds
(i) Muffled
(ii) Distant

Identify major, immediate life-threatening thoracic injuries

Pneumothorax
(1) Blunt or penetrating trauma
(2) Fractured ribs may be caused in blunt trauma
(3) Caused by accumulation of air within potential space between visceral and parietal pleura

(4) Diagnosis is based:
- (a) Pleuritic chest pain
- (b) Dyspnea
- (c) Decreased breath sounds on affected side
- (d) Hypertympany to percussion

(5) Management
- (a) Administer oxygen
- (b) Establish two large bore IVs
- (c) Transport to nearest treatment facility
- (d) Chest tube as directed by physician/PA
- (e) Constant Monitoring

Open pneumothorax

(1) Caused by penetrating thoracic injury and may present as a sucking chest wound. Air does not enter the lung, oxygenation of the blood is reduced, ventilation is impaired and hypoxia results

(2) Management
- (a) Ensure an airway
- (b) Quickly close chest wall defect by any available means
  - (i) Occlusive dressing may cause casualty to develop a tension pneumothorax
  - (ii) To avoid, tape occlusive dressing on three sides to produce a flutter valve: air escapes but will not enter the chest
- (c) Administer oxygen
- (d) Insert two large-bore IVs 0.9% Normal Saline to keep vein open (TKO)
- (e) Transport to nearest treatment facility

Tension pneumothorax -closed

(1) Occur when a one-way valve is created from either penetrating or blunt trauma (not open to the outside i.e. penetrating rib etc.)
- (a) Air can leave pleural space
- (b) Causes collapse of affected lung, pushes mediastinum in opposite direction

(2) Clinical signs include:
- (a) Dyspnea
- (b) Anxiety
- (c) Tachypnea
- (d) Diminished breath sounds
- (e) Hyperresonance to percussion on affected side
- (f) Distended neck vein
- (g) Hypotension
- (h) The development of decreased lung compliance in intubated casualty should alert you to the possibility to tension pneumothorax

(i) Late finding is tracheal deviation and its absence does not rule out the presence of a tension pneumothorax

(3) Management
- (a) Establish an open airway
- (b) Administer high-concentration oxygen
- (c) Decompress the affected side of the chest needle decompression. Indication to perform emergency decompression includes:
  - (i) Loss of radial pulse
  - (ii) Loss of consciousness
  - (iii) Respiratory distress
  - (iv) Cyanosis
- (d) Insert two large bore IVs 0.9% Normal Salin TKO
- (e) Transport to nearest treatment facility

Massive hemothorax

(1) At least 1500 cc blood loss into thoracic cavity or 200 ml/hr from chest tube

(2) Signs and symptoms include:
- (a) Hypotensive, from:
  - (i) Blood loss
  - (ii) Compression of heart or great veins
- (b) Neck veins are usually flat secondary to profound hypovolemia, but could be distended due to mediastinal compression
- (c) Dullness to percussion on the affected side and decreased breath sounds

(3) Management
- (a) Secure an airway
- (b) Apply high-flow oxygen
- (c) Rapid transport to appropriate echelon of care - requires surgical management
- (d) Carefully replace volume after IV insertion
- (e) Maintain BP just high enough to maintain a peripheral pulse
- (f) Closely observe for possible development of a tension pnuemothorax, which would require acute chest decompression

Flail chest

(1) Occurs when three or more adjacent ribs are fractured in at least two places
- (a) Result is a segment of chest wall that is not in continuity with the thorax
- (b) Flail segment moves with paradoxical motion relative to the rest of chest wall

(c) Force necessary to produce this injury also bruises the underlying lung tissue: a pulmonary contusion will also contribute to hypoxia
(d) Casualty is at risk for development of hemothorax or pneumothorax and may be in marked respiratory distress
(e) Chest wall palpation may reveal crepitus in addition to the abnormal respiratory motion

(2) Management
(a) Ensure airway
(b) Administer oxygen
(c) Assist ventilation. Pneumothorax is commonly associated with a flail chest, chest decompression may be needed
(d) Rapid transport to appropriate echelon of care
(e) Establish IV
(f) Initiate manual pressure to stabilize the flail segment
(i) Stabilize casualty on backboard
(ii) Try to maintain manual pressure on flail segment while performing log-rolling(in the opposite direction of site of injury) can be dangerous to maintain a stable spine
(g) Monitor heart - myocardial trauma is frequent

Pulmonary contusion

(1) Common chest injury produced by blunt trauma. This bruising of the lung can produce marked hypoxemia

(2) Management consists of:
(a) Oxygen administration
(b) IV insertion
(c) Transport to nearest treatment facility

Myocardial contusion

(1) Potentially lethal lesion resulting from blunt chest injury
(a) Blunt injury to anterior chest is transmitted via the sternum to the heart
(b) In the field, a casualty with significant chest trauma is assumed to have a myocardial contusion

(2) Cardiac Contusion
(a) Chest pain
(b) Dysrhythmia
(c) Cardiogenic shock (rare)

(3) Management
(a) Administer oxygen
(b) Establish two large bore IVs 0.9% Normal Saline
(c) EKG monitoring
(d) Transport to nearest treatment facility

Cardiac tamponade

(1) Usually from a penetrating injury

(2) Pericardial sac is an inelastic membrane surrounding the heart
- (a) When blood rapidly collects between heart and pericardium form a cardiac injury, the ventricles of the heart compress
- (b) Small amount of pericardial blood can compromise cardiac filling

(3) Diagnosis (common but not always present):
- (a) Hypotension
- (b) Muffles heart sounds
- (c) Distended neck veins

(4) Management
- (a) Ensure airway and administer oxygen
- (b) Initiate two large bore IVs 0.9% Normal Saline - electrolyte solution may increase the filling of the heart and increase cardiac output
- (c) Cardiac tamponade is rapidly fatal and cannot be readily treated in the field by medic but may be treated by physician/PA
- (d) Evacuate to nearest treatment facility immediately

Identify thoracic injuries

Fracture of the scapula - first or second rib requires a large force

(1) Transport to appropriate echelon of care after:
- (a) Airway is open
- (b) IV access initiated
- (c) Oxygen has been started

Simple rib fracture

(1) Pain will prohibit casualty from breathing adequately

(2) On palpation, area of rib fracture may be unstable and will be tender

(3) Management
- (a) Give oxygen
- (b) Monitor of pneumothorax or hemothorax
- (c) Encourage casualty to breathe deeply
- (d) Pain Management

Diaphragmatic tears

(1) Can result from a sever blow to the abdomen
- (a) Sudden increase in intra-abdominal pressure can tear the diaphragm and allow herniation of the abdominal organs into the thoracic cavity

(b) Large radial tears in the diaphragm result from blunt trauma

(2) Marked respiratory distress is caused from herniation of abdominal contents into the thoracic cavity: Diminished breath sounds and infrequently bowel sounds may be heard when chest is auscultated

(3) Abdomen can appear scaphoid if a large quantity of abdominal contents are in the chest

(4) Management
- (a) Ensure an airway
- (b) Administer oxygen
- (c) Insert an IV
- (d) Transport to appropriate echelon of care

Traumatic asphyxia

(1) Results from severe compression injury to the chest

(2) Sudden compression of heart and mediastinum transmits to force the capillaries of the neck and head

(3) Casualties appear similar to those of strangulation with cyanosis and swelling of the head and neck

(4) Lips and tongue may be swollen and conjunctival hemorrhage may be evident

(5) Management includes:
- (a) Airway maintenance
- (b) IV access
- (c) Treating other injuries
- (d) Transport to appropriate echelon of care

Impalement injuries

(1) Caused by penetrating object

(2) Do NOT remove object

(3) Management
- (a) Ensure airway
- (b) Stabilize object
- (c) Insert IV
- (d) Transport to appropriate echelon of care

Traumatic aortic rupture

(1) Most common cause of death in falls from heights

(2) Diagnosis is impossible in the field and may be missed in the MTF. History from the field is critically important since many of these casualties have no obvious signs of chest trauma

(3) Management
- (a) Ensure an airway
- (b) Administer oxygen
- (c) Transport to the appropriate echelon of care
- (d) Establish two 14 gauge IV access
- (e) Administer fluids

Tracheal or bronchial tree injury

(1) Resulting from penetrating or blunt trauma
- (a) Penetrating upper airway injuries frequently have associated major vascular injuries and extensive tissue destruction
- (b) A blunt injury can rupture the trachea or main stem bronchus near the carina

(2) Presenting signs include:
- (a) Subcutaneous emphysema of the chest, neck, or face
- (b) Associated pneumothorax or hemothorax

(3) Management
- (a) Prompt transport to appropriate echelon of care
- (b) Observe for signs of a pneumothorax or hemothorax

Combat Trauma Treatment and Management
(PE for Treat a Casualty with a Spine Injury)
Appendix A
Competency Skill Sheets

KED

Soldiers Name: _____ SSN: _____ CO: _____ TM: _____
Start: _____ Stop: _____ Initial Evaluator: _____
Start: _____ Stop: _____ Retest Evaluator: _____
Start: _____ Stop: _____ Final Evaluator: _____

		1st	2nd	3rd
a.	Verbalized BSI precautions.	P / F	P / F	P / F
b.	Directed assistant to maintain manual/neutral in-line head stabilization.	P / F	P / F	P / F
c.	Assessed motor/sensory function and distal circulation in upper and lower extremities.	P / F	P / F	P / F
d.	Applied appropriate sized extrication collar before applying KED.	P / F	P / F	P / F
e.	Moved the patient forward as a unit. Positioned KED behind the patient.	P / F	P / F	P / F
f.	Attached chest straps and adjusted as necessary.	P / F	P / F	P / F
g.	Ensured straps do not interfere with breathing.	P / F	P / F	P / F
h.	Attached pelvic straps and adjusted.	P / F	P / F	P / F
i.	Evaluated the need and padded the patients head and neck as necessary.	P / F	P / F	P / F
j.	Secured the patient's head to the KED with cravats while maintaining a manual in-line position.	P / F	P / F	P / F
k.	Reassessed motor/sensory function and distal circulation prior to extrication from vehicle.	P / F	P / F	P / F
l.	Extricated patient from vehicle onto long board, without compromising spinal integrity.	P / F	P / F	P / F
m.	Reassessed motor/sensory function and distal circulation.	P / F	P / F	P / F

Long Spine Board

Soldiers Name: _____ SSN: _____ CO: _____ TM: _____
Start: _____ Stop: _____ Initial Evaluator: _____
Start: _____ Stop: _____ Retest Evaluator: _____
Start: _____ Stop: _____ Final Evaluator: _____

		1st	2nd	3rd
a.	Verbalized BSI precautions.	P / F	P / F	P / F
b.	Directed assistant to maintain manual/neutral in-line head stabilization.	P / F	P / F	P / F
c.	Assessed motor/sensory function and distal circulation in upper and lower extremities.	P / F	P / F	P / F
d.	Applied appropriate sized extrication prior to log-rolling patient.	P / F	P / F	P / F
e.	Positioned long board correctly.	P / F	P / F	P / F
f.	Directed/assisted with log-rolling the patient onto the long board without compromising spinal integrity.	P / F	P / F	P / F
g.	Padded any voids between the patient and the board.	P / F	P / F	P / F
h.	Directed/assisted with immobilization of the patients torso to the board with two straps.	P / F	P / F	P / F
i.	Directed/assisted with immobilization of the patient's head to the board.	P / F	P / F	P / F
j.	Secured patient's legs to the board.	P / F	P / F	P / F
k.	Secured patient sufficiently to prevent excessive movement.	P / F	P / F	P / F
l.	Reassessed motor/sensory function and distal circulation.	P / F	P / F	P / F

Combat Trauma Treatment and Management
Treat a Casualty with a Chest Injury
Appendix B
Competency Skill Sheets

Sucking Chest Wound

Soldiers Name: _____ SSN: _____ CO: _____ TM: _____
Start: _____ Stop: _____ Initial Evaluator: _____
Start: _____ Stop: _____ Retest Evaluator: _____
Start: _____ Stop: _____ Final Evaluator: _____

		1st	2nd	3rd
a.	Exposed injury by cutting away clothing.	P / F	P / F	P / F
b.	Hand sealed the wound immediately (with a gloved hand).	P / F	P / F	P / F
c.	Covered the wound with large sterile, non-porous dressing, covering the larger wound first if multiple injuries are identified.	P / F	P / F	P / F
d.	Taped three sides down to provide a flutter-type valve.	P / F	P / F	P / F
e.	Maintained C-spine alignment and log-rolled the patient on injured side. Examined the back for an exit wound.	P / F	P / F	P / F
f.	Covered the exit wound with an occlusive dressing.	P / F	P / F	P / F
g.	Taped four sides of the occlusive dressing down.	P / F	P / F	P / F
h.	Placed patients on INJURED side and transported.	P / F	P / F	P / F