Medical Emergencies

• The most common injuries or illnesses that an EMTF/EMPF is most likely to encounter on the fireline are:
  • Traumatic Injuries
  • Bites & Stings
  • Allergic Reactions
  • Gastrointestinal Problems
Medical Emergencies

• Traumatic Injuries
  • Soft Tissue Injuries
  • Sprains, Strains & Fractures
  • Burns
  • Eye Injuries
Medical Emergencies

• Soft Tissue Injuries

• Broadly categorized as either “closed” or “open”
• Damage to the skin, cells and blood vessels
• May result in extensive injuries to the internal organs and bones
Medical Emergencies

- Soft Tissue Injuries
  - Contusions
  - Hematomas
  - Abrasions
  - Lacerations
  - Avulsions
  - Amputations
  - Penetrations / Punctures
  - Blisters
  - Crush Injuries
Medical Emergencies

• Soft Tissue Injury - Treatments
  • The basic care for any soft tissue injury is the proper use of wound dressings and bandages

• The functions of the dressings and bandages are to stop bleeding, to protect wounds from further damage, and to prevent further contamination
Medical Emergencies

• Fractures, Dislocations, Sprains & Strains

• Injuries to the bones, muscles, and connective tissues result when excessive or abnormal force is applied to the musculoskeletal system.

• There are three basic mechanisms by which this force can be applied:
  • Direct Force
  • Indirect Force
  • Twisting Force
Medical Emergencies

- Fractures, Dislocations, Sprains & Strains

  - It will not be your responsibility to diagnose exactly what type of injury has occurred

  - The fact is that any painful, swollen and deformed extremity will receive the same emergency medical care
Medical Emergencies

• Fractures
  • When a bone is broken or is simply cracked
  • Can produce severe bleeding
  • Very painful
  • Potential for long-term disability
  • Classified as “Open” or “Closed”
Medical Emergencies

• Open Fracture
  • When the skin overlying a painful, swollen and deformed extremity is broken, then the condition is termed – an open fracture

• Closed Fracture
  • If there is no break in the continuity of the skin, then the condition is termed – a closed fracture
Medical Emergencies

• Fractures - Treatment
  • Control any bleeding from open wounds
  • Clean gross contamination
  • Dress bone ends loosely with moistened dressings (if needed)
  • Check for PMS (before & after splinting, including marking for distal pulses)
  • Splint with appropriate splint
  • Elevate and apply ice pack
  • Evacuate
Medical Emergencies

• Dislocations

• Disruption of the normal structure of a joint where one bone connects with another

• The extreme flexion or extension of a joint is what usually renders a joint “dislocated”
Medical Emergencies

• Sprains

  • A stretching or tearing of the ligaments that surround or support a joint

  • Commonly result from the application or twisting force to a body part
Medical Emergencies

• Strains

• The injury that results from the abnormal stretching of the tendons that connect muscles to bones and the muscles themselves
Medical Emergencies

• Dislocations, Sprains & Strains - Treatment
  • Control any bleeding from open wounds
  • Check for PMS (before & after splinting, including marking for distal pulses)
  • Splint with appropriate splint
  • Elevate and apply ice pack
  • Evacuate the patient
Medical Emergencies

• Burns
  • Burns can cause the death of patient in various ways, some immediate and some delayed
  • Immediate causes of burn-related deaths include airway compromise and inadequate respirations
  • Delayed causes are largely related to the loss of normal skin coverage and include profound fluid loss resulting in hypoperfusion and overwhelming infections
Medical Emergencies

- Burns

- Classification of burns is based on three major elements
  - Mechanism of burn injury
  - Depth of the burn
  - Percentage of body surface area burned (BSA)

- When you describe a burn, your description should include each of these elements
Medical Emergencies

• Mechanism of Injury
  • Thermal
    • Most commonly encountered by the EMTF/EMPF
  • Chemical
  • Electrical
  • Radiation
Medical Emergencies

• Depth of the Burn
  • Superficial or 1st Degree
    • Least serious of burns
    • Only involve the epidermis
    • Reddened skin at the burn site
    • Painful and irritating
Medical Emergencies

• Depth of the Burn
  • Partial Thickness or 2\textsuperscript{nd} Degree
    • Involves both the epidermis and the dermis
    • Red, white, or blotchy skin and blisters at the burn site
    • Burned skin is moist due to body fluids seeping out through the damaged area
  • Very painful
Medical Emergencies

- Depth of the Burn
  - Full Thickness or 3\textsuperscript{rd} Degree
    - Most extensive tissue damage
    - Involves all layers – epidermis, dermis and subcutaneous layers
    - Damage may extend deeper to the muscles, bones or internal organs
    - Dry leather-like appearance
    - White, brown, or charred color
    - Little or no pain
    - Surrounding areas will be painful
Medical Emergencies

• Body Surface Area
  • The amount of a patient’s body surface area that is burned also affects how severe the burn
  • The most widely used system for estimating the extent of BSA burned in adults is called the “Rule of Nines”
  • You may also use the “Palm Method”
Medical Emergencies

• Rule of Nines
  • Each area of the body represents 9 percent of BSA
    • Head and Neck
    • Each upper arm
    • The Chest
    • The Abdomen
    • The upper back
    • The lower back
    • The front of each lower extremity
    • The back of each lower extremity
Medical Emergencies

- Palm Method

- The surface area of the palm of the patients hand represents 1% of the patients BSA
Medical Emergencies

• Burn – Treatment
  • Stop the burning process
  • Continually monitor the airway
  • Remove any surrounding clothing
  • Evaluate the severity of the burn
  • Cover with a dry sterile dressing
    • Separate fingers & toes
  • Keep patient warm
  • Evacuate the patient
Medical Emergencies

• Eye Injuries
  • Most common injuries are corneal abrasions that result from foreign bodies
  • Most commonly caused by airborne particulates and wind
  • May encounter other injuries to eyes such as
    • Trauma
    • Impales Objects
Medical Emergencies

• Eye Injury - Treatments

• Foreign Body
  • Lift the eyelid and let the action of tears help to flush it out
  • If unsuccessful, irrigate the eye with water
  • If eye pain or a feeling of a retained foreign body persists, evacuate the patient to the Medical Unit for further evaluation
Medical Emergencies

• Eye Injury - Treatment

• Trauma and Impaled Objects
  • Control any bleeding from open wounds
  • Do not apply pressure to the eye
  • Stabilize impaled objects and cover both eyes
  • Evacuate the patient
Medical Emergencies

• Environmental Illnesses
  • Bites and Stings
  • Allergic Reactions
  • Gastrointestinal problems
Medical Emergencies

• Bites and Stings
  • A large number of creatures are capable of delivering a bite or a sting
  • Bites and Stings usually produce only minor irritation and discomfort
  • In some cases, bites or stings can lead to life-threatening complications from venom or anaphylaxis
Medical Emergencies

• Insect Stings
  • Common insects include
    • Bees
    • Yellow Jackets
    • Hornets
    • Wasps
  • Insects inject venom, a substance poisonous to humans, through their stingers
  • Frequently leaving the venom sac attached
Medical Emergencies

• Insect Stings
  • Reactions to a sting may include
    • Localized pain
    • Redness
    • Swelling at the sting site
    • Generalized illness as a result of multiple simultaneous stings or systemic, life-threatening allergic reaction like anaphylaxis
Medical Emergencies

• Insect Sting – Treatment

  • Remove Stinger if still present
  • Clean sting site
  • Remove restrictive clothing or jewelry before swelling begins
  • Place sting site below level of patient’s heart
  • Monitor for signs of anaphylaxis
  • Evacuate if needed
Medical Emergencies

• Spider Bites
  • Venom delivered from most spiders causes local reactions
    • Swelling
    • Itching
  • Two species of spiders to remember
    • Black Widow
    • Brown Recluse
Medical Emergencies

• Black Widow
  • Found throughout the United States
  • Only one species of black widow has the classic red hourglass pattern
  • Venom causes systemic symptoms
    • Localized pain
    • Muscle cramps of the extremities and abdomen
Medical Emergencies

- Brown Recluse
  - Reported in over 20 states
  - Mostly in Southern and Central United States
  - Venom causes local tissue destruction
  - Systemic symptoms
    - Fever
    - Chills
    - Nausea & Vomiting
Medical Emergencies

• Spider Bites – Treatment
  • Clean sting site
  • Remove restrictive clothing or jewelry before swelling begins
  • Place sting site below level of patient’s heart
  • Monitor for signs of systemic symptoms
  • Evacuate if needed
Medical Emergencies

• Scorpion Stings
  • Common in the Southwestern United States
  • Stings of most species cause only local reactions
    • Redness, pain and swelling at sting site
  • Black scorpion can cause serious systemic effects
    • Increased heart rate
    • Excessive salivation
    • Roving eye movements
    • Difficulty in swallowing
Medical Emergencies

• Scorpion Sting – Treatment

  • Clean sting site
  • Remove restrictive clothing or jewelry before swelling begins
  • Place sting site below level of the patient’s heart
  • Monitor for signs of systemic symptoms
  • Evacuate if needed
Medical Emergencies

• Snake Bites
  • Approximately 45,000 reported snake bite victims annually in the US
  • Approximately 8,000 of those are from poisonous snakes
    • Pit Vipers
    • Rattlesnakes
    • Cottonmouth
    • Copperhead
    • Coral snake
Medical Emergencies

• Snake Bites

• 25% of Pit Viper bites are “dry”
• If only small amount of venom injected, the following may be present at the bite site
  • Swelling
  • Redness
  • Bruising
Medical Emergencies

• Snake Bites

  • If larger amounts of venom are injected, the following signs & symptoms are common
    • Swelling of an entire extremity
    • Nausea & Vomiting
    • Numbness in the mouth
    • Weakness & Dizziness
    • Increased heart & respiratory rate
    • Shock
    • Abnormal bleeding
Medical Emergencies

• Snake Bite – Treatment

  • Assure your own safety
  • Wash the area gently
  • Remove restrictive clothing or jewelry before swelling begins
  • Place sting site below level of patient’s heart
  • Minimize patient movement
  • Monitor for signs of shock
  • Evacuate
Medical Emergencies

• Allergic Reactions
  • Exaggerated immune response to a substance
  • Results in release of chemicals from cells
  • Chemicals cause the physiologic events that make up an allergic reaction
  • Physiological events lead to hypoperfusion
    • Anaphylactic Shock
  • A severe allergic reaction can be life-threatening
Medical Emergencies

- Allergic Reactions
  - Insect bites & Stings (5% of population)
    - Bees, wasps, hornets & yellow jackets
  - Plants
    - Poison oak & ivy, pollen from ragweed or grasses
  - Medication
  - Foods
  - Chemicals
Medical Emergencies

- Allergic Reactions Signs & Symptoms
  - Skin
    - Swelling of face, lips, tongue, neck or hands
    - Itching
    - Hives
    - Red flushed
  - Cardiovascular system
    - Increased heart rate
    - Signs of shock
Medical Emergencies

• Allergic Reactions Signs & Symptoms
  • Respiratory System
    • Cough
    • Rapid / Labored breathing
    • Hoarseness
    • Stridor
    • Wheezing
  • Decreased mental status
Medical Emergencies

• Allergic Reactions Signs & Symptoms
  
  • Generalized symptoms
    • Itchy, water eyes
    • Headache
    • Runny nose
    • Sense of impending doom
Medical Emergencies

• Allergic Reactions – Treatment
  • No signs of severe reaction
    • Remove restrictive clothing or jewelry before swelling begins
    • Do NOT administer an epinephrine auto-injector
    • Monitor for signs of severe allergic reaction
    • Evacuate as needed
Medical Emergencies

• Allergic Reactions – Treatment

  • Signs of severe reaction
    • Determine if patient has a prescribed epinephrine auto-injector
    • Monitor patient’s airway
    • Remove restrictive clothing or jewelry
    • Evacuate immediately
Medical Emergencies

- Gastrointestinal Problems
  - Abdominal cramping
  - Nausea & Vomiting
  - Diarrhea
  - Many symptoms are linked to poor hygiene
    - Poor hand washing
    - Camp Crud
    - Coyote or Spike operations
Medical Emergencies

• Gastrointestinal Problems - Treatment
  • Encourage the drinking of fluids in large quantities
  • Treat with anti-diarrhea medication, if needed
  • If fever persists, isolate patient
  • Attempt to track back
    • When did the patient first develop symptoms?
    • Where was the “contact point?”
    • Are there more patients?
Medical Emergencies

• One of the EMTF/EMPF primary functions is to help decide what level of treatment the injured crewmember requires

• Conventional vs. Unconventional
Medical Emergencies

• Identify the “Critical” vs “Minor patient

• Decisions that you may encounter
  • To treat an injury on the line and return the crewmember back to duty
  • Evacuate the crewmember to the Medical Unit for evaluation and treatment
  • Evacuate the crewmember to the hospital directly for evaluation and treatment
Medical Emergencies

- Decisions will be based on many factors
  - Severity of injury or illness
  - Environment
    - Time of day/night
    - Weather
    - Incident Activity
  - Transportation options
  - Operational Procedures
Medical Emergencies

• Major Medical Emergency
  • Life-threatening event
  • Patient may die if not treated immediately
• Communications will clear the air for “Emergency” communications only
• Resources may be redirected to emergency incident location
Medical Emergencies

• Request for Medical Aid
  • Non life-threatening event
  • Less serious injury or illness
  • Normal radio traffic may continue
  • Incident operations may continue
Medical Emergencies

• Severity of Illness or Injury
  • Does the patient have a true life-threatening injury or illness?
  • Are you able to stabilize the patient in the field?
  • Are medical supplies available to treat the patient?
  • Can the patient tolerate delayed treatment?
Medical Emergencies

- Environment
  - What type of terrain is the patient in?
    - Steep & Rugged
    - Isolated
    - Road access
  - What time of day or night?
    - Aircraft availability
    - Visibility
    - Available resources
Medical Emergencies

• Environment
  • Weather
    • Wind
    • Temperature
  • What is going on with the incident?
    • Burn Operations
    • Secondary Emergencies
    • Air Operations
    • Radio traffic
Medical Emergencies

- Transportation Options
  - Can the patient walk
  - Litter teams
  - Road access
  - Aircraft availability
  - Ground ambulance availability
  - ETA to the hospital – Ground vs. air
  - Ground support
Medical Emergencies

• In steep or rugged terrain, it will require at least 15 crewmembers to carry a stretcher

• Do you have enough resources?
Medical Emergencies

• What if???
  • You respond to a crewmember who has an 8” long 1” deep laceration to his lower leg from a chainsaw accident
  • Minimal blood loss after bleeding control
  • Good neuro and motor to the injured leg
  • No other injuries
  • Found sitting in crew buggy
  • 30 minute drive to local clinic approved by ICS 206
Medical Emergencies

• What if???
  • You respond to a crewmember with obvious fracture of lower leg from a boulder striking him
  • Obvious deformity with significant swelling to extremities
  • No other injury
  • 1945 hours
  • Remote location approximately 2 hour hike by foot
Medical Emergencies

• What if???
  • You respond to a crewmember who is complaining of chest pain and shortness of breath
  • Pale, cool and clammy skin signs
  • Slow pulse rate
  • Found sitting in the Div. Sup’s vehicle
  • Hospital is 2 hours by ground
  • No ALS air ambulance on ICS 206
Medical Emergencies

• What if???
  • You respond to an ill crewmember who is c/o nausea, vomiting and hallucinations with episodes of shortness of breath
  • Skin sign are pale, dry with slight tenting
  • Patient states that he ate a live snake but he washed it in a small stream before eating it (unknown what type of snake)
  • ETA of ambulance is one hour with a 3 hour transport to the closest hospital
  • Patient works for a private contractor
Exertional Heat Injuries

• Firefighters face unique factors as a result of several inherent job stressors
  • These include sudden surges in the sympathetic nervous system caused by:
    • Unexpected calls for response
    • Rapid shifts from low to high levels of exertion
    • Carrying, lifting and wearing heavy gear and equipment
    • Prolonged exposure to high temperatures
    • Excessive fluid loss
Exertional Heat Injuries

• These factors have been shown to contribute to dehydration and a rapid rise in core body temperature

• May lead to heat stress and insufficient blood flow to the heart – this combination can cause cardiovascular strain
Exertional Heat Injuries

• Unlike athletes or industrial workers, the critical nature of firefighting does not allow curtailment of environmental exposure during climatic extremes
Exertional Heat Injuries

• Heat Illness Research:
  • One episode of heat injury can WEAKEN you and make you vulnerable at the next event
  • Passive cooling does NOT decrease body core temperature
  • Hydration alone does NOT prevent heat illness
  • Minor signs of heat illness can rapidly progress to heat stroke (less than 30 min)
  • You can have an exertional heat stroke on cool days
Exertional Heat Stroke

• Definition: State of extreme hyperthermia >40 degrees C (104 degrees F) associated with Central Nervous System (CNS) disturbances
Exertional Heat Stroke

- EHS is an emerging study of heat illnesses as a result of activity-related conditions (National Athletic Trainers’ Association, 2002).
  - Exercise-associated muscle (heat) cramps
  - Heat syncope
  - Exercise induced (heat) exhaustion
  - Exertional heat stroke
  - Exertional Rhabdomyolysis
Exertional Heat Stroke

• 70% of the thermal burden experienced by wildland firefighters is due to metabolic heat production while wearing PPE.

• Losing as little as 1% of body weight could affect performance and hinder body’s ability to cool itself.
Heat Exhaustion

• Signs
  • Pounding headache
  • Suddenly fatigued
  • Dizzy
  • Nausea
  • Vomiting
  • Chills and goose bumps

• Feeling overwhelmed
• Talking nonsense
• Agitated
• Blank stare
• Wobbling or stumbling
Heat Exhaustion

- Treatment Priorities
  - Stop work immediately
  - Remove PPE
- Cooling
  - Wet towel
  - Cold water over-the-head
  - Ice towel
  - Fans
  - Ice pack – armpits, groin, neck, feet
  - Ice pool/tub immersion – trunk & extremities
- Hydration
- Nutrition
Heat Stress Control Measures

- Aerobic fitness
- Acclimate
- Pre-hydrate
- Hydrate
  - Minimum six bottles of water per day, plus drinks at meals.
  - During work – minimum 1L water per hour.
  - As exertion and sweating increase – add electrolyte replacement.
Heat Stress Control Measures

- Post Hydrate
- Nutrition: on-the-go carb replacements
- Adequate Work-Rest Ratios
- Buddy System/Personal Monitoring
- Rehab (40/20 Rule)
  - 40 min work
  - 20 min rest
- Personal Protective Clothing
Heat Stress Control Measures

• Some meds increase your risk of heat stress
  • Antihistamines; Decongestants
  • Ephedrine/Ephedra; Creatine
  • Amphetamines
  • Certain antibiotics, Diuretics, Beta-blockers
  • High sugar content beverages, Caffeine, Energy Drinks
Exertional Rhabdomyolysis

• Typically occurs in response to abrupt, excessive, prolonged, repetitive, or unaccustomed exercise.

• Degeneration of skeletal muscle or muscle necrosis.
Exertional Rhabdomyolysis

• Damage occurs to muscle membranes, allowing cellular components (such as creatine kinase, myoglobin, and potassium) to leak out into the blood system.

• Can lead to renal failure, heart arrhythmias, compartmental syndrome, ketoacidosis, death.
Exertional Rhabdomyolysis

• Symptoms
  • Persistent muscle pain/or weakness
  • Muscle swelling
  • Abdominal pain
  • Nausea or vomiting
  • Fever, rapid heart rate
Exertional Rhabdomyolysis

• Symptoms Cont.
  • Mental confusion
  • Dark urine (tea or cola colored)
  • May be accompanied with symptoms of heat illness
  • May include: fatigue, joint pain, seizures
After Action Review (AAR)

Green Sheet Summaries –
Wildland Fire Lessons Learned
Center
Dutch Creek Incident

• Shasta Trinity National Forrest – July 25, 2008
  – Traumatic Fatal Injury
    • Seriousness of the Injury
    • Treatment Decisions
    • Transportation Decisions
    • Who is In Charge?
Border #14 Incident
12-CA-MVU-007686

• July 20, 2012 – Heat Related Injuries – Heat Exhaustion
  • Awareness of Individual Limitations
  • Work Rest Cycles
  • Hydrations during firefighting operations
  • Delaying treatment can lead to further medical complications
Chihuahua3 Fire
11-CA-MVU-011073

• October 2, 2011 – Firefighter Collapsed with Altered Level of Consciousness
  • Pre-existing condition – poison oak treatment
  • OTC medications – Benadryl
  • Physical preparedness
  • Adequate nutrition
  • Pre-response hydration
IHC Heat Related Illness
Angeles National Forest USFS

• June 8, 2014
  • Heat related illness
    • Leg cramps
    • Ice chest submersion – arms
    • Hyponatremia – imbalance of water to salt
    • Electrolytes intake with water – monitor adequate replacement
    • Consider Rhabdomyolysis
Rapid Evacuation Module (REM)

• This is a fairly new concept that is starting to get momentum.

• REM is a six-person module intended to provide a safer and more efficient method of moving an injured patient off the fireline to a pick up point for transport to a medical facility.
Rapid Evacuation Module

A REM is outfitted with specialized equipped:

- Wheeled Stokes basket
- Backboard
- Lashing
- Low angle rope rescue equipment
Rapid Evacuation Module

• REM is managed and ordered through the Medical Unit Leader.
  • Based upon the complexity of the incident.
  • Remoteness of crews working on the fireline.
  • Terrain.
  • History of injuries – risk assessment.
  • Availability of trained personnel
Rapid Evacuation Module

• Upon arrival on-scene, the REM reports to the Division/Group Supervisor and assesses the situation.
  • Assesses the scene safety and condition of the patient.
  • Assesses the environment.
  • Assesses available resources.
Rapid Evacuation Module

• Develops and implements an effective plan of egress.
• Packages the patient for extrication.
• Transfers to the EMTF/EMPF for continued patient care and transport.