



# Austere Emergency Medical Support (AEMS) Field Guide



U.S. DEPARTMENT OF  
HOMELAND SECURITY

Homeland  
Security



---

# Table of Contents

|             |  |           |
|-------------|--|-----------|
| <b>I.</b>   | <b>Introduction.....</b>                                 | <b>1</b>  |
|             | A. Foreword .....  | 2         |
|             | B. Disclaimer.....                                       | 3         |
|             | C. Austere Medicine Defined .....                        | 4         |
|             | D. Using This Guide .....                                | 5         |
|             | E. Format of the AEMS Field Guide .....                  | 6         |
|             | F. AEMS Acronyms .....                                   | 7         |
| <b>II.</b>  | <b>General Considerations .....</b>                      | <b>10</b> |
|             | A. Medical Threat Assessment (MTA) .....                 | 11        |
|             | B. Prevention of Infection .....                         | 16        |
|             | C. Mass Casualty Incident Management.....                | 18        |
|             | D. Medico-Legal Considerations .....                     | 21        |
| <b>III.</b> | <b>Environmental Protocols .....</b>                     | <b>26</b> |
|             | A. Altitude-related Disorders .....                      | 27        |
|             | B. Animal-related Injuries: Mammals and Marine Life..... | 31        |
|             | C. Cold-related Disorders.....                           | 35        |
|             | D. Dehydration .....                                     | 39        |
|             | E. Dive Medicine.....                                    | 41        |
|             | 1. General .....   | 41        |
|             | 2. Drowning .....  | 42        |
|             | 3. Arterial Gas Emboli (AGE).....                        | 45        |
|             | 4. Decompression Sickness (DCS) .....                    | 47        |
|             | 5. Barotrauma of the Ear .....                           | 50        |
|             | 6. Other Barotraumas.....                                | 53        |
|             | F. Envenomation .....                                    | 55        |
|             | 1. Arthropods .....                                      | 55        |
|             | 2. Marine Life .....                                     | 57        |
|             | 3. Reptiles .....  | 60        |
|             | G. Heat-related Disorders.....                           | 64        |
|             | 1. Hyperthermia .....                                    | 64        |
|             | 2. Other Conditions .....                                | 72        |
|             | H. Vector-borne Illnesses .....                          | 75        |
|             | I. Lightning Injuries .....                              | 82        |
|             | J. Motion Sickness (Sea Sickness) .....                  | 85        |
| <b>IV.</b>  | <b>Trauma Protocols.....</b>                             | <b>89</b> |
|             | A. Advanced Hemostasis.....                              | 90        |
|             | B. Burns .....   | 93        |
|             | C. Epistaxis.....  | 97        |
|             | D. Field Dentistry .....                                 | 100       |
|             | 1. General Dental Care .....                             | 100       |
|             | 2. Alveolar Ridge Fracture.....                          | 101       |
|             | 3. Avulsed Tooth .....                                   | 103       |
|             | 4. Dislocated Tooth .....                                | 105       |

|   |            |
|---|------------|
| E. Fluid Resuscitation .....                                  | 107        |
| F. Management of Major Trauma .....                           | 109        |
| G. Orthopedic Injuries.....                                   | 113        |
| H. Specific Orthopedic Injuries.....                          | 117        |
| 1. Facial Fractures .....                                     | 117        |
| 2. Hand Disorders .....                                       | 121        |
| 3. Hand Injuries .....  | 124        |
| <b>V. Force Health Protection Protocols .....</b>             | <b>128</b> |
| A. Field Sanitation .....                                     | 129        |
| B. Emergency Medical Evacuation from Operational Sites.....   | 134        |
| C. Occupational Health Considerations .....                   | 141        |
| D. Sick Call Medicine.....                                    | 143        |
| E. Acute Abdomen .....  | 147        |
| F. Altered Mental Status .....                                | 149        |
| G. Cardiac Disorders.....                                     | 152        |
| H. Deep Vein Thrombosis (DVT).....                            | 154        |
| I. Extended Patient Care .....                                | 156        |
| J. Foot Care .....  | 162        |
| K. Gastrointestinal Disorders .....                           | 166        |
| L. Genitourinary Disorders .....                              | 168        |
| 1. Kidney Stones.....   | 168        |
| 2. Urinary Tract Infection (UTI) .....                        | 170        |
| M. Gynecologic Disorders .....                                | 172        |
| N. Pregnancy-Related Disorders.....                           | 174        |
| O. Head, Eyes, Ears, Nose and Throat .....                    | 177        |
| 1. Headache .....   | 177        |
| 2. Eye Disorders .....  | 178        |
| 3. Ear Infections and Disorders .....                         | 180        |
| 4. Upper Respiratory Infections (Sinusitis and Rhinitis)..... | 183        |
| P. Pulmonary Embolus.....                                     | 185        |
| Q. Respiratory Disorders.....                                 | 187        |
| R. Rhabdomyolysis.....  | 190        |
| S. Skin Disorders.....  | 193        |
| T. Subcutaneous Abscesses .....                               | 197        |
| U. Fever without Known Cause .....                            | 199        |
| V. Vaccinations .....   | 201        |
| W. Water-related Exposures.....                               | 205        |
| <b>IV. Procedures.....</b>                                    | <b>208</b> |
| A. Subcutaneous Abscesses .....                               | 210        |
| 1. Incision and Drainage (I&D) .....                          | 210        |
| 2. Needle Aspiration.....                                     | 212        |
| B. Alternate Wound Closure Techniques .....                   | 213        |
| C. Cervical Spine Clearance .....                             | 216        |
| D. Cricothyroidotomy.....                                     | 218        |

|             |   |            |
|-------------|---|------------|
| E.          | Dental Anesthesia.....  | 220        |
| 1.          | Apical Infiltration Anesthesia .....                                    | 220        |
| 2.          | Buccal Block.....   | 222        |
| 3.          | Inferior Alveolar Nerve Block.....                                      | 224        |
| 4.          | Superior Alveolar Nerve Block (Posterior Superior Alveolar Block) ..... | 226        |
| F.          | Dental Splinting .....  | 228        |
| 1.          | Atraumatic Tooth Restoration.....                                       | 228        |
| 2.          | Non-invasive Monofilament Fixation .....                                | 230        |
| G.          | Dislocations .....  | 232        |
| 1.          | Digit .....   | 232        |
| 2.          | Mandible .....  | 234        |
| 3.          | Patella .....   | 236        |
| 4.          | Shoulder .....  | 238        |
| H.          | Escharotomy .....   | 240        |
| I.          | Intraosseous (IO) Needle .....  | 242        |
| J.          | Local Anesthesia .....  | 243        |
| 1.          | Local Infiltrations.....  | 243        |
| 2.          | Digital Nerve Block.....  | 244        |
| 3.          | Hematoma Block.....   | 246        |
| 4.          | Intercostal Nerve Block (Rib Block) .....                               | 248        |
| 5.          | Posterior Tibial Nerve Block at the Ankle (Plantar Nerve Block) .....   | 250        |
| K.          | Nasal Packing.....  | 253        |
| 1.          | Anterior Nasal Packing.....   | 253        |
| 2.          | Posterior Nasal Packing .....   | 255        |
| L.          | Needle Thoracostomy .....   | 256        |
| M.          | Orthopedic Splints .....  | 257        |
| N.          | String Trick (Ring Removal) .....                                       | 263        |
| O.          | Subungual Hematoma.....   | 265        |
| P.          | Urethral Catheterization.....   | 266        |
| Q.          | Wound Care.....   | 269        |
| 1.          | Wound Prep and Irrigation .....   | 269        |
| 2.          | Laceration Closure.....   | 271        |
| 3.          | Simple Loop Suture .....  | 275        |
| 4.          | Vertical Mattress Suture.....   | 277        |
| 5.          | Instrument Tie .....  | 279        |
| 6.          | Two-handed Field Tie.....   | 281        |
| R.          | Suturing Tubes and IV Lines in Place.....                               | 282        |
| <b>VII.</b> | <b>Appendices .....</b>   | <b>283</b> |
|             | Appendix A. Pain Management .....                                       | 284        |
|             | Appendix B. Glasgow Coma Scale.....                                     | 285        |
|             | Appendix C. Mini-Mental Status Exam .....                               | 286        |
|             | Appendix D. IV Drip Chart.....  | 287        |
|             | Appendix E. Formulary .....   | 288        |



---

## **I. Introduction**

- A. Foreword
- B. Disclaimer
- C. Austere Medicine Defined
- D. Using This Guide
- E. Format of the AEMS Field Guide
- F. AEMS Acronyms

---

## A. Foreword

The following protocols outline the emergency medical support that can be administered under austere conditions by emergency medical services (EMS) providers credentialed by the Department of Homeland Security (DHS) Office of Health Affairs (OHA). These protocols are intended to supplement the DHS/OHA Basic Life Support (BLS) and Advanced Life Support (ALS) protocols when providers are operating in austere environments.

The protocols guide the management of individual patients while considering the circumstances under which patient evaluation and treatment may occur. Any given patient may require the use of a single protocol, a portion of a protocol, or a combination of several protocols. OHA expects that providers will use the protocols to assess, and to establish a treatment plan for each patient.

For DHS-agency EMS programs to implement these protocols, they will need both approval by the Program Medical Director and approved training and skills testing. As such, some specific components of the protocols may be unavailable to most DHS providers. The Program Medical Director must also approve a provider's scope of practice, including medication and equipment requirements, which are defined by training, competencies, and operational capabilities.

Much of the guidance in these protocols will be of greater use to other providers responsible for medical support to DHS operations under austere conditions.

EMS providers operating under remote, austere, or hostile conditions are expected to provide pre-hospital care in these dangerous environments with little or no support when operational security is a consideration. In some situations, communications are not assured and evacuation may be delayed significantly.

Three factors drive AEMS:

1. Mission
2. Overall Team Health
  - a. Self-Care
  - b. Buddy Care
  - c. Team Care
3. Protection of:
  - a. Team Members
  - b. Victims/Hostages
  - c. Bystanders
  - d. Perpetrators

Care providers in an austere situation may be forced to improvise and adapt their medical procedures based on extant circumstances to provide care for and prepare the patient for evacuation to a safer environment. This guide, in conjunction with standard EMT/paramedic protocols, is intended to improve the DHS providers' capability to provide the best possible pre-hospital care until the patient can be transferred for definitive medical treatment.

---

## **B. Disclaimer**

The AEMS field guide is intended to serve as a series of suggested best practices. Medical providers are strongly encouraged to follow these suggestions, and should consider doing so in whole or in part to the extent that his/her training or experience is sufficient.

---

## C. Austere Medicine Defined

“Austere EMS” is the delivery of EMS care under conditions of limited personnel and equipment resources, and outside the existing framework of normal EMS. An austere EMS environment may include elements of any of the following:

1. An ongoing physical environmental threat (e.g., heat, cold, water, wind, or altitude)
2. Limited medical supplies, technologies, or resources
3. Limited medical expertise available
4. Limited communications, including little or no access to medical direction or oversight
5. Limited availability of transportation
6. Altered condition of the medical responder
7. Urgent clinical situation requiring immediate intervention outside of standard protocols
8. Duration of care extended beyond standard operational situations
9. Any other factor or condition that alters the ability of the EMS responder to provide necessary emergency medical care
10. Limited capacity to provide care due to security environment

---

## D. Using This Guide

This guide, in conjunction with standard EMT/paramedic protocols, is intended to guide medical support and pre-hospital emergency care that may be required in austere environments. It should be considered a situation-based adjustment to a provider's normal scope of EMS practice, and may be followed—in whole or in part—when routine protocols are impossible or insufficient. The EMS provider on scene must consider the overall austere scenario, previous training, experience, medical direction, and the acuity of the clinical situation to determine when to deviate from routine EMS protocols and follow these guidelines. These guidelines assume that patients will be transferred to the appropriate level of medical care as expeditiously as possible.

### **Certification and Training Levels of Provider**

The medical care and procedures described in this field guide are divided into several levels of provider training, including Basic Life Support (BLS) and Advanced Life Support (ALS). Many of the protocols require completion of a minimum of a Wilderness upgrade to the basic certifications, since they are not taught as part of routine BLS or ALS training curricula. Medical directors are responsible for ensuring that the protocols implemented by their services match the training and competencies of their providers.

Much of the material described under Force Health Protection requires medical training beyond BLS and ALS curricula. These skills may best be implemented by more advanced providers, or by EMS personnel following completion of an 80-hour Sick Call Screeners Course.

---

## E. Format of the AEMS Field Guide

The AEMS guide is divided into the following sections:

- General Considerations (e.g., body substance isolation, medico-legal consideration)
- Environmental Protocols (e.g., altitude related disorders, heat related conditions)
- Trauma Protocols (e.g., advanced hemostasis, burns, orthopedic injuries)
- Force Health Protection Protocols (e.g., evaluation and care of team members who develop medical conditions during the mission)
- Procedures (e.g., cricothyroidotomy, nasal packing, wound care)
- Appendices (e.g., antibiotic therapy, pain management, charts and tables)

The Environmental Protocols, Trauma Protocols, and Force Health Protection Protocols use the following format:

- Review of Injury/Illness; may include
  - Risk Factors (optional)
  - Anatomy and Physiology (optional)
- Signs and Symptoms
- Management
  - BLS
  - ALS
- Evacuation Considerations
- Extended Care; may include
  - Management of Complications (optional)
  - Follow-up (optional)
- Other/Special Considerations (optional)
- Preventive Measures (optional)

---

## F. AEMS Acronyms

|         |                                   |        |  |
|---------|-----------------------------------|--------|--|
| A&P     | Anatomy & Physiology              | CPR    | Cardio Pulmonary Resuscitation         |
| ABC     | Airway, Breathing, Circulation    | CSF    | Cerebrospinal Fluid                    |
| ABD     | Abdominal                         | CVAT   | CostoVertebral Angle Tenderness        |
| ABX     | Antibiotics                       | D5LR   | Dextrose 5% Lactated Ringer's          |
| ACD     | Allergic Contact Dermatitis       | D5NS   | Dextrose 5% Normal Saline              |
| ACS     | Acute Coronary Syndrome           | DAE    | Dysbaric Air Embolism                  |
| AED     | Automatic External Defibrillator  | dB     | Decibel                                |
| AEMS    | Austere Emergency Medical Support | DCS    | Decompression Sickness                 |
| AEROVAC | Aeromedical Evacuation            | DIC    | Disseminated Intravascular Coagulation |
| AGE     | Arterial Gas Embolism             | DIP    | Distal Interphalangeal Joint           |
| AHA     | American Heart Association        | DNR    | Do Not Resuscitate                     |
| ALS     | Advanced Life Support             | DOE    | Dyspnea on Exertion                    |
| AMS     | Altered Mental Status             | DP     | Distal Phalanx                         |
| AMI     | Acute Mountain Illness            | DTR    | Deep Tendon Reflexes                   |
| ASA     | Aspirin                           | DVT    | Deep Vein Thrombosis                   |
| ASAP    | As Soon As Possible               | EAC    | External Auditory Canal                |
| AUB     | Abnormal Uterine Bleeding         | EDC    | Extensor Digitorum Communis            |
| AV      | Atrioventricular                  | EOM    | Extraocular Motion                     |
| BID     | Twice Daily                       | EOMI   | Extraocular Motion Intact              |
| BLS     | Basic Life Support                | ET     | Endotracheal                           |
| BM      | Bowel Movement                    | ETT    | Endotracheal Tube                      |
| BP      | Blood Pressure                    | FB     | Foreign Body                           |
| bpm     | Beats per Minute                  | fsw    | Feet Sea Water                         |
| BSA     | Body Surface Area                 | GI     | Gastrointestinal                       |
| BSI     | Body Substance Isolation          | GIC    | Glass Ionomer Cement                   |
| BVM     | Bag Valve Mask                    | GU     | Genitourinary                          |
| CASEVAC | Casualty Evacuation               | gtts   | Drops                                  |
| CF      | Cylinder Factor Constant          | HA     | Headache                               |
| CHF     | Congestive Heart Failure          | HACE   | High Altitude Cerebral Edema           |
| CK      | Creatinine Kinase                 | HAPE   | High Altitude Pulmonary Edema          |
| CNS     | Central Nervous System            | HAZMAT | Hazardous Materials                    |
| CO      | Carbon Monoxide                   | HEPA   | High-efficiency Particulate Air        |
| CO2     | Carbon Dioxide                    | HNF    | Head, Neck and Face                    |
| CONUS   | Continental United States         | HR     | Heart Rate                             |

|                 |                             |        |  |
|-----------------|-----------------------------|--------|--|
| HTS             | Hypertonic Saline (3%)      | NP     | Nasopharyngeal Airway                            |
| Hx              | History                     | NPO    | Nothing per Oral (Orally)                        |
| I&D             | Incision & Drainage         | NRBM   | Non-rebreathing Mask                             |
| I&O             | Intake & Output             | NS     | Normal Saline                                    |
| IC              | Incident Command            | NSAID  | Non-steroidal Anti-Inflammatory Drug             |
| ICD             | Irritant Contact Dermatitis | N/V    | Nausea/Vomiting                                  |
| ICNB            | Intercostal Nerve Block     | OCONUS | Outside the Continental United States (Overseas) |
| IEB             | Inner Ear Barotrauma        | OP     | Oropharyngeal Airway                             |
| IO              | Intraosseous                | OPSEC  | Operational Security                             |
| IM              | Intramuscular               | OTC    | Over the Counter                                 |
| IV              | Intravenous                 | PASG   | Pneumatic Anti-shock Garment                     |
| IVF             | Intravenous Fluid           | PBT    | Pulmonary Barotrauma                             |
| IVP             | Intravenous Push            | PE     | Pulmonary Embolus                                |
| JVD             | Jugular Venous Distension   | PHF    | Potentially Hazardous Food                       |
| kg              | Kilogram                    | PIP    | Proximal Interphalangeal Joint                   |
| KVO             | Keep Vein Open              | PMI    | Point of Maximum Intensity                       |
| LOC             | Level of Consciousness      | PMS    | Pulse, Motor, Sensory                            |
| lpm             | Liters per Minute           | pp     | Partial Pressure                                 |
| LR              | Lactated Ringer's           | PPE    | Personal Protective Equipment                    |
| LSI             | Life Saving Intervention    | PPM    | Parts Per Million                                |
| LUQ             | Left Upper Quadrant         | PR     | Per Rectum                                       |
| LZ              | Landing Zone                | PRN    | As Needed  |
| MCI             | Mass Casualty Incident      | PSI    | Pounds per Square Inch                           |
| MCP             | Metocarpal Phalangeal Joint | PVT    | Pulseless Ventricular Tachycardia                |
| MDI             | Metered Dose Inhaler        | PO     | By Mouth   |
| MEB             | Middle Ear Barotrauma       | q6h    | Every Six Hours                                  |
| MEDEVAC         | Aeromedical Evacuation      | QD     | Every Day (Daily)                                |
| mg              | Milligram                   | QHS    | Every Bedtime                                    |
| ml              | Milliliter                  | QID    | Four Times Daily                                 |
| MS              | Mental Status               | qt     | Quart  |
| MSE             | Mental Status Exam          | R/O    | Rule Out   |
| MTA             | Medical Threat Assessment   | RIG    | Rabies Immune Globulin                           |
| Na <sup>+</sup> | Sodium                      | ROM    | Range of Motion                                  |
| NC              | Nasal Cannula               | rp     | Residual Pressure                                |
| NG              | Nasogastric                 |        |  |

---

|                  |  |
|------------------|--|
| rpm              | Respirations per Minute  |
| RR               | Respiratory Rate   |
| SALT             | Sort, Assess, Life Saving Intervention, Treatment and/or Transport |
| SBO              | Small Bowel Obstruction  |
| SBP              | Systolic Blood Pressure  |
| SNa              | Serum Na <sup>+</sup>  |
| SPF              | Sun Protection Factor  |
| S/S              | Signs and/or Symptoms  |
| SL               | Sublingual   |
| SPO <sub>2</sub> | Oxygen Saturation  |
| SQ               | Subcutaneous   |
| STD              | Sexually Transmitted Disease                                       |
| TBSA             | Total Body Surface Area  |
| TB               | Tuberculosis   |
| TBI              | Traumatic Brain Injury   |
| TCCC             | Tactical Combat Casualty Care                                      |
| Td               | Tetanus-Diphtheria   |
| TID              | Three Times Daily  |
| TiG              | Tetanus Immune Globulin  |
| tp               | Tank Pressure  |
| TM               | Tympanic Membrane  |
| TMJ              | Temporal Mandibular Joint  |
| UCL              | Ulnar Collateral Ligament  |
| URI              | Upper Respiratory Infection  |
| USAR             | Urban Search and Rescue  |
| UTI              | Urinary Tract Infection  |
| UTM              | Universal Transverse Mercator                                      |
| UV               | Ultra Violet   |
| VF               | Ventricular Fibrillation   |
| VS               | Vital Signs  |
| WNV              | West Nile Virus  |

---

## II. General Considerations

- A. Medical Threat Assessment
- B. Prevention of Infection
- C. Mass Casualty Incident Management
- D. Medico-Legal Considerations

---

## A. Medical Threat Assessment (MTA)

### Overview

1. The medical threat assessment (MTA) is a detailed report, written before the mission, which analyzes the medical aspects and impacts of a tactical operation.
2. Preparation of the MTA is vital to mission-planning and operational risk-management.
  - a. MTA should be performed well in advance of the proposed operation, if possible
  - b. Data gathering for the MTA must be conducted in a manner that insures operational security (OPSEC)
3. Tactical EMS personnel are responsible for providing the mission commander and/or team with a briefing based on the MTA for law-enforcement missions.
4. The MTA should be mission- and site-specific.
5. Many agencies use a standard form for MTA.

### Elements of the Medical Threat Assessment

1. Type of operation and operational objectives.
2. Name of MTA preparer, assigned tactical or other EMS provider(s), and back-up EMS provider(s)
3. Location
  - a. Descriptive
  - b. Map
  - c. Aerial photographs
  - d. Longitude/latitude, Universal Transverse Mercator (UTM) grid coordinates
  - e. Local day/night visibility
    - Time of sunrise and sunset
    - Time of moonrise and moonset
  - f. Local roads and traffic patterns
  - g. Type of terrain (e.g., urban, industrial, forested, scrub, density, mountainous)
4. Weather conditions
  - a. Based on climactic data, long- and short-range forecasts and direct observation
    - Climactic data and long-range forecasts are used to plan advanced missions and extended operations
    - Short-range forecasts and direct observation are used immediately before and during the operation
  - b. Data should include:
    - Ambient temperature
    - Humidity
    - Wet bulb globe temperature or heat index
    - Wind speed, direction, and gusts

- 
- c. Data for advanced planning, long-term operations should consider:
    - Typical climactic patterns and conditions for a given locale
      - Average temperatures and temperature extremes, humidity, precipitation
      - Wind patterns (e.g., typical speed, direction)
      - Hazards (e.g., probability of severe weather, avalanche risk)
  - d. Current weather data and observations are vital when operations involve significant fire hazards and possibility of HAZMAT exposure
  - e. Measures to be taken to reduce weather threat risk to personnel (e.g., adjusting work/rest cycles for heat index)
5. Asset staging
- a. Fixed facility medical assets (additional considerations if operating OCONUS)
    - Location of nearest hospital emergency department
    - Location of nearest trauma center
    - Location of nearest burn unit
    - Location of other medical specialty services such as hyperbaric chambers if appropriate to the mission or personnel
    - Data must include:
      - Level of emergency care available
      - Quickest ground route to facility
      - Alternate ground routes to facility
      - Contact telephone numbers of facility
  - b. Aeromedical assets (MEDEVAC)
    - Type of aeromedical assets available (Note: it may be necessary to plan for CASEVAC—evacuation of casualties using tactical aircraft with little or no on-board medical capability—if medical assets are unavailable or circumstances on the ground do not allow MEDEVAC)
      - Name of provider agency
      - Contact telephone numbers
      - Radio frequency of aircraft/dispatch
      - Patient carrying capacity
      - If appropriate, decrease response time by pre-staging aeromedical assets nearby
      - If operating OCONUS, coordinate aeromedical evacuation requirements with State Department, and ensure timely access when needed
      - All communications regarding the need for MEDEVAC will use the standardized categories describing transport priorities as outlined in the table below
    - Identification of primary landing zones (LZ) and alternate LZ
      - Obtain GPS coordinates for primary LZ and alternate LZ
      - Marking and identification of LZ (e.g., strobes, panels, lights, smoke)

- 
- Identify ground surface and slope at LZ
  - Identify any hazards near the LZ
  - Wind direction
  - If agency policy permits, conduct policy inquiries
    - Flight over tactical hot zone
    - Landing in the tactical hot zone
    - Tactical team weapons on board
    - Transport of HAZMAT exposed or potentially infectious patients / personnel
    - Transport of prisoners
  - c. Ground medical assets
    - Location and staging of local vs. deployed EMS providers and assets
      - » Type available and provider level of training
      - » Proposed staging location for local EMS assets
      - » Contact telephone numbers
      - » Radio operating frequencies
    - Fire / rescue assets as indicated by nature of operation
      - Type of specialized teams available
        - » Fire suppression, HAZMAT
        - » Technical rescue teams
        - » Urban search and rescue (USAR) or building collapse response teams
      - Location of staging area(s) for fire / rescue assets
      - Contact telephone numbers
      - Radio operating frequencies
    - Public works and infrastructure
      - Utility (e.g., electric, water, and gas) companies
      - Construction (e.g., heavy equipment, cranes, dozers)
      - Proposed staging location for public works and infrastructure assets
      - Contact telephone numbers
      - Radio operating frequencies
    - Logistics
      - Safe food accessibility
      - Potable water
      - Hygiene and sanitation
      - Shelters

## 6. Specific threat assessment

### a. Suspected weapons threats

- Firearms
- Sharp-edged weapons
- Booby traps
- Explosive devices

### b. Potential animal and plant threats include:

- Infectious disease risk, endemic or operation specific
- Indigenous wild animal threats (e.g., poisonous snakes)
- Domestic animal threats (e.g., service dogs, guard dogs, pets, exotic animals)
- Poisonous or noxious plants (e.g., poison ivy, stinging nettles)
  - Location and contact information for nearest anti-venom banks
  - Identification and contact information for animal control agency

### c. Additional medical considerations

- Determine if language interpreters are needed and available
  - Contact information for interpreter(s) on-scene or remote
- Potential for pediatric patients
- If hostages exist, attempt to discern if there are medical conditions and/or special needs
- Provisions for mass casualty management if appropriate
- Patient transport categories

| Category           | Patient Description   |
|--------------------|---|
| <b>Urgent</b>      | Patients whose condition will probably deteriorate without significant intervention that can be offered quickly. These patients need evacuation within 2 hours if survival is to be expected. |
| <b>Priority</b>    | Patients who have serious injuries but who are unlikely to deteriorate within the next 4 hours.   |
| <b>Routine</b>     | Patients with injuries / illnesses that are unlikely to deteriorate in the next 24 hours.   |
| <b>Convenience</b> | Those patients who have minor injuries or illnesses.  |

- Medical support for agency service animals (e.g., dogs, horses) if utilized
  - Location of nearest capable veterinary hospital
  - Name and contact information for local veterinarian
- Fire suppression and HAZMAT provisions
  - Fire/rescue staging and preparation

- 
- Identification of potential HAZMAT risks
  - HAZMAT decontamination plan (e.g., protection from pepper spray, tear gas)
    - » Separate plan for team, suspects and incidental bystanders
    - » Use of local HAZMAT assets
  - Communications plan
    - » Contact information for key personnel
    - » Contact information for hospitals, aeromedical assets, EMS providers, fire/rescue services, utilities
    - » Radio frequencies of responding agencies
    - » Back-up communications plan for communications failures

---

## B. Prevention of Infection

To keep the protocols current, once a year and during major incidents that involve infectious agents, review CDC recommendations and OSHA standards for preventing exposure to infectious diseases.

1. “Universal Precautions” are routinely used to prevent exposure to HIV and Hepatitis B.
  - a. These involve placing barriers (e.g., gloves) between potentially infectious body fluids, such as blood, and the skin or mucous membranes of the health care provider.
  - b. Universal precautions require methods and devices that decrease the likelihood of needle stick or other injury that could carry infectious material through broken skin into EMS personnel.
2. Separate guidelines and standards regarding respiratory protection of health care providers are published by OSHA (29 CFR 1910.134), and periodically updated for specific threats by CDC.
3. It is the responsibility of all EMS programs to train its personnel and to provide all necessary equipment for compliance with current guidelines and standards.
4. Use “Standard Barriers” for every response involving patient contact. These include:
  - a. Non-Latex Gloves for every patient contact.
  - b. N95 Masks (when recommended by CDC or required by OSHA)
  - c. If airborne or highly contagious droplet pathogen such as tuberculosis is suspected, wear high-efficiency particulate air (HEPA) respirator if available.
  - d. Gowns (as recommended).
  - e. Eye protection and face shield (as recommended, and especially during wound care and/or placement of advanced airway).
  - f. Washing hands with soap and water or alcohol-based hand cleaners before and after contact with each new patient and during patient care as indicated.
5. If **two or more** of the “Symptoms Requiring Extra Measures” listed below exist, use “Extra Measures” along with “Standard Barriers.” Extra measures are intended to prevent the spread of highly transmissible infections/pathogens.
  - a. Fever greater than 102°F (38.9°C)
  - b. Bleeding from gums or nose
  - c. Yellow eyes, skin, or tongue
  - d. Small red or purple spots on palate, throat, mouth, or anywhere on body
  - e. “Bloodshot” eyes
  - f. Painful, goose-egg shaped, bruised-appearing or draining lymph nodes
  - g. Insect bites (e.g., fleas, ticks, mosquitoes)
  - h. Any report of “pox” or “pox-like” skin rash or lesion
  - i. History of exposure to sewage, body fluids, animals (dead or alive)
  - j. Febrile Illness that progressed rapidly over a period of less than three days
  - k. Bloody stools, black “tarry” stools, or vomiting of blood

- 
- l. Report of a “positive tourniquet test” or petechiae where skin has been compressed.
  - m. If two or more patients present with same symptoms
6. Use all standard barriers, plus the following “Extra Measures,” to protect medical providers from potentially infectious patients who satisfy the criteria outlined in #5:
    - a. Put a surgical mask (if no difficulty breathing or hypoxia) or non-vented oxygen mask on the patient.
    - b. Contact medical director, receiving hospital, or appropriate designated occupational medical provider to report symptoms and potential for exposure.
    - c. In the field, keep patient downwind of all personnel.
    - d. Minimize the number of people who treat, or come in contact with, the patient.
    - e. Decontaminate with sterilizing solutions/wipes, all items that came in contact with the patient.
    - f. Talk with appropriate medical resource (e.g., receiving facility, service infection control officer) about post-exposure prophylaxis for oneself and anyone who may have been exposed to the patient.

---

## C. Mass Casualty Incident Management

### Review

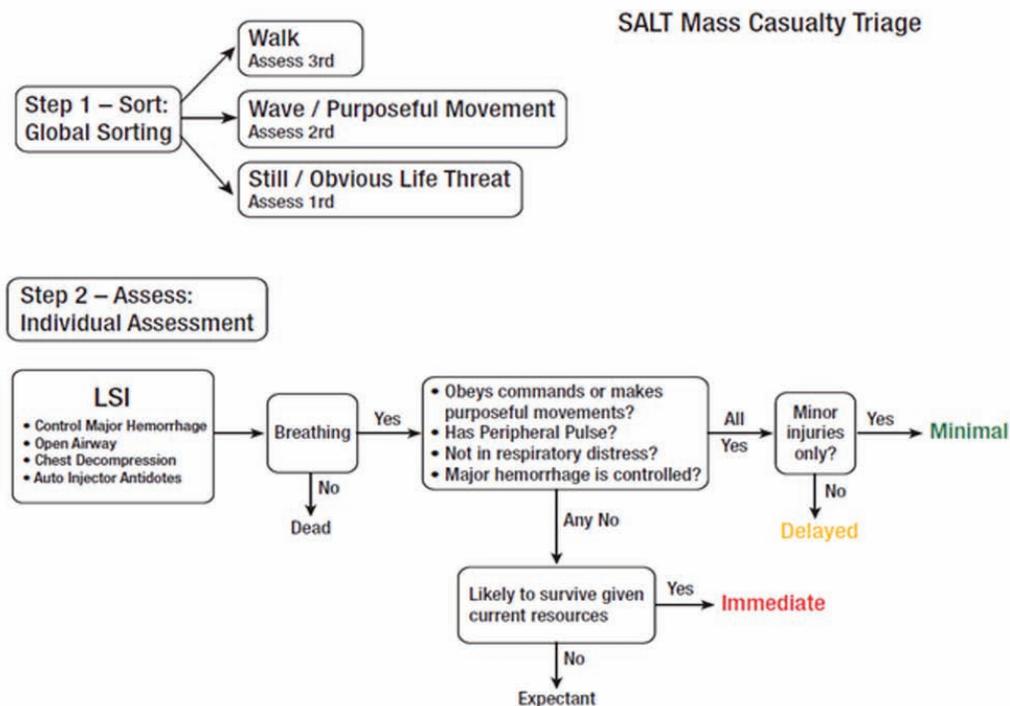
EMS is typically one of many public safety services that respond to a mass casualty incident (MCI). The complexity of the incident and its consequences, combined with the large number and different responsibilities of the responders and agencies, requires that the emergency response be organized to be effective. Responsibility for organizing the overall response seldom rests with EMS, so it is critical that EMS providers understand how to integrate with the incident command structure to carry out its medical operations at the incident scene.

### Disaster Scene EMS Operations

1. Follow approved area or agency-specific Incident Management System procedures. Integrate medical activities with law enforcement, fire, and EMS agencies as directed by Incident Commander.
2. When managing patients in a potentially hazardous area:
  - a. Survey scene for potential hazards, number of patients, and possible need for specialized help.
    - Protect rescuers first; wait until gas spills are treated, power lines de-energized, etc.
    - Call for medical or technical backup as needed
    - Implement hazardous materials management procedures
    - Stage vehicles prior to entry
  - b. Initiate patient triage using Sort, Assess, Life-Saving Intervention, Treatment/Transport (SALT) algorithm
  - c. If patient has no pulse or respirations and extrication is necessary before CPR can be provided, the patient should be considered dead
  - d. Expedite safe extrication by specialists after management of life-threatening problems
    - Perform or repeat complete secondary survey once patient is extricated
  - e. In treatment areas or as soon as possible after triage:
    - Apply cervical collar; immobilize spine prior to extrication if feasible
    - Perform quick secondary survey as possible; splint extremity fractures, if possible
    - Perform routine ALS procedures
    - Re-prioritize for transport according to SALT algorithm
3. Organize medical parts of response.
  - a. **Triage area:** The triage area should be safely located away from the dangers of the hazard, generally uphill and upwind of the hazard.
  - b. **Staging area:** As incoming ambulances arrive, they should be directed to the staging officer at the staging area. They should not go directly to the triage area.
  - c. **Ambulance assignments:** Ambulance crews should remain with their ambulances until given an assignment by the medical or staging officer. Keys should remain in the vehicles.
  - d. **Ambulance supplies:** The ambulance supplies and equipment should be placed in a supply pool that is near the treatment area, if so directed by a medical officer. A responsible EMT provider should be placed in charge of the pool.

- e. **After discharge of patient:** As ambulance crews discharge their patients and return to the scene, they should return to the staging area and report to the staging officer.
  - f. **Temporary morgue:** It may be necessary to establish a temporary morgue since bodies will not be removed from the scene until all the injured have been transported.
  - g. **Volunteers:** Volunteers can and should be used at a disaster scene to free firefighters, rescuers, and ALS personnel from activities that take them away from rescue and patient care duties. Volunteers may be used to:
    - Block or control the flow of traffic if there are not enough police officers on the scene.
    - Assist medical personnel in carrying patients to triage and treatment points.
    - Help to load the ambulances
    - Assist the “walking wounded”
    - Comfort victims and care for children
    - Carry items from the supply pool to the treatment area when requested
4. **Triage System:** The SALT mass casualty incident (MCI) triage system should be used whenever many patients require pre-hospital medical treatment and/or transport. This allows for an organized approach to treatment that includes a system for prioritizing the patients who require immediate medical care for survival. Triage is a continuous process; it is necessary to reevaluate patient priorities as his/her clinical status improves or deteriorates and more resources become available.

The SALT triage system assigns patients into one of five categories based on the urgency of his/her medical conditions and potential for survival:



- 
5. Communications: Incident Command (IC) and local protocol(s) will determine radio channels or other alternatives that should be used for medical communications during disaster operations. EMS personnel should follow local protocol and/or IC direction for designating and communicating with receiving hospitals for their patients. EMS personnel should follow local protocol and/or IC direction for patient tracking, medical documentation, and transfer of care to hospital or other providers. If possible, the following information should accompany the patient and be kept by EMS as part of the record of treatment:
- a. Triage tag
  - b. Patient care record (electronic or written)
  - c. Name
  - d. Age
  - e. Date of Birth
  - f. Injuries
  - g. Initial status (immediate, delayed, minimal)
  - h. Current status (immediate, delayed, minimal)
  - i. Treatment or procedures performed
  - j. Transportation location and time transported

---

## D. Medico-Legal Considerations

### Review

1. In general, the medico-legal considerations in an austere context parallel those in traditional EMS.
2. Medico-legal considerations that create unique concerns in an austere environment include:
  - a. Scope of Practice
  - b. Standard of Care
  - c. Cessation of CPR in an Austere Environment
  - d. Declaration of Death in a Remote Setting
  - e. Abandonment Issues
  - f. Transfer of Care
  - g. Accident Scene Issues
  - h. Disaster Issues
3. In the United States, these issues are somewhat compounded due to the varying statutes between the states and between state and federal laws.

### Scope of Practice

1. Scope of practice is determined on a state by state basis.
2. Many states have austere or wilderness medical protocols for EMS providers.
3. Components using austere medical protocols should contact the appropriate state agency to discuss the application of these protocols in that state.

### Standard of Care

1. Care provided must be reasonable in light of the circumstances.
2. Factors which influence the standard of care in an austere environment are generally considered. These factors include:
  - a. Location of the event or accident, relative remoteness
  - b. Planning for capability to manage illness or injury that should be anticipated for the location and type of operation
  - c. Hazards to the providers
  - d. Available equipment and/or lack of resources
  - e. Physical condition of the involved parties
3. Providing care to someone whom the provider does not have a duty to treat is generally covered by Good Samaritan provisions.
  - a. BLS measures typically have the least potential liability
  - b. Provider generally must provide a level of care appropriate to his/her level of training and resources

- 
- c. Consultation with medical direction is highly recommended, if possible, when providing care under the AEMS protocols
  - d. Advanced consultation with state agencies concerning such care is desirable in the United States
4. Lawsuits involving medical care provided under Good Samaritan provisions in an austere environment are relatively uncommon.

### **Cessation of CPR in an Austere Environment**

1. The decision to withhold or cease cardiopulmonary resuscitation measures is a medical, not a legal, decision.
2. The likelihood of a successful resuscitation is extremely low in an AEMS environment for:
  - a. Trauma patients in cardiopulmonary arrest
  - b. Any patient who does not respond to treatment after 30 minutes of CPR

### **Cessation of CPR After Trauma**

1. If in a remote location characterized by significant delay in evacuation:
  - a. CPR may be withheld if cardiopulmonary arrest occurs secondary to major trauma
  - b. If CPR is initiated and patient fails to respond, CPR may be discontinued after 30 minutes
2. Likelihood of successful resuscitation is very low under these conditions.

### **Cessation of CPR Secondary to a Non-Traumatic Medical Event**

1. CPR may be discontinued if patient fails to respond to treatment after 30 minutes of CPR.
2. Likelihood of successful resuscitation is very low after 30 minutes.

### **Patients with an Advance Directive or Do Not Resuscitate (DNR) Order**

1. If an advanced directive or “Do Not Resuscitate” (DNR) order is found with the patient or the deceased, CPR may be withheld.
2. The advance directive or DNR order must be the original signed form to be legally binding and acceptable.
3. The form must be attached to the patient documentation and brought to medical direction or base facility for review.

### **Declaration of Death in a Remote Setting**

1. Establishing death is primarily a medical, not a legal, concern.
  - a. A physician need not be present in an austere setting
  - b. Statements from individuals who saw the body and determined the absence of signs of life are usually satisfactory
2. Producing a body for examination by a medical examiner or coroner is not strictly required.
  - a. Applies if the body cannot be recovered due to remote setting, burial by debris, or destruction of remains

- 
- b. Applies if the body cannot be found, but facts are presented that confirm the likelihood of death
3. A medical examiner or coroner can make this determination based upon the statements of individuals who witnessed the death and other factors.
    - a. In the face of compelling evidence, a declaration can be made quickly
    - b. In the absence of compelling evidence, a waiting period may be set
      - This is usually a 7 year period
      - After this period, the person is declared dead if no information is found that suggests that the individual is still alive
      - Insurance benefits, last will and testament provisions, and other benefits may be denied to survivors of the deceased for years
        - May cause severe hardship for the survivors of the deceased
        - Accurate and detailed statements from those who witnessed the death or accident scene are imperative
          - » Statements should be written as soon as possible after the event
      - Statements regarding the circumstances also help prove accidental death and assist in the additional award of accidental death insurance benefits
    - c. Declaration of death may be expedited in cases where the death is not actually witnessed, but is highly likely
      - Most likely to be determined if subject had no known financial or personal difficulties in which disappearance would be of benefit
      - Circumstances surrounding the death are compelling
        - Pilot of a small plane crashes in a remote area during a storm
        - An abandoned and still equipped/supplied campsite is discovered in a remote setting
      - The subject's vehicle is abandoned and located
      - No evidence of intentional disappearance
        - No large cash withdrawals from financial accounts
        - No use of credit cards or other electronic transfers of funds since disappearance
        - No evidence of other personal difficulties or estrangement
    - d. If not recovered, the location of the body should be recorded and noted on a suitable map

### **Abandonment Issues**

1. Rescue
  - a. Rescue attempts can be withheld if the rescue jeopardizes the safety of the rescuers.
  - b. The rescue attempt, once begun, can be terminated at any time if safety of the rescuers is threatened (e.g., an entangled hoist cable can be jettisoned and the attached victim lost, or if the safety of the aircraft and crew is compromised)
  - c. Private individuals, in an off-duty capacity, are not obligated to perform a rescue

- 
- d. Once initiated by a private individual, the rescue attempt may be abandoned for any reason without liability unless the following occurs:
    - The need for rescue was caused by the rescuer's negligence
    - The rescue attempt placed the victim in a worse situation
    - The victim relied totally on the private individual's efforts and declined other opportunities for assistance during the rescue

2. Medical care

- a. Standards for abandonment are generally the same as in traditional EMS
- b. Care can be terminated in an austere context if the following occurs:
  - The patient fully recovers and no longer needs medical care
  - The patient refuses treatment or declines further care
    - Patient must be competent to make this decision
    - No findings of loss of consciousness, altered mental status, or intoxication
    - A written statement regarding refusal of care from the patient is useful, but should be witnessed by a third party
    - In lieu of a statement from the victim, written statements from witnesses to the refusal are useful
  - The provider becomes disabled
  - Further efforts jeopardize the safety of the provider

### **Transfer of Care**

- a. In cases where medical care has been rendered under an austere medical protocol, the patient's care can only be transferred to another individual trained to the same level or higher of expertise, and in the same general procedures
- b. When this is not possible, the provider must accompany the patient to the receiving medical facility
- c. If traditional EMS systems are used to transport the patient and differences in patient management arise between the use of austere medical protocols and traditional EMS protocols, the provider should consult his/her austere medical direction for guidance
- d. In the event that austere medical direction cannot be consulted, then the local EMS medical direction should be consulted
- e. Ideally, austere and traditional medical direction officers can discuss and resolve any treatment issues while the patient is en route, and relay this information to the providers

### **Accident Scene Issues**

1. A detailed, written statement regarding the accident scene and events is important.
2. Statement should be written as soon as possible from notes made in the field.
3. The condition of equipment related to the accident should be described and photographed, if possible (e.g., a frayed and abraded rope used in climbing accident, an improperly secured climbing harness).

- 
4. Diving equipment should accompany the patient to the referral medical facility for inspection and evaluation.
    - a. A good dive history and dive profile are useful in diving related accidents
    - b. **DO NOT clear the patient's dive computer.**

### **Disaster Issues**

1. The Stafford Act is the primary mechanism through which states request Federal resources in a disaster, including medical personnel.
  - a. A Federal disaster declaration must be requested by the state and approved by the Federal government
2. In general, health care practitioners are held to the same scope of practice and standards that would apply in his/her home state or states where his/her operating environment is located.

---

### **III. Environmental Protocols**

- A. Altitude-related Disorders**
- B. Animal-related Injuries: Mammals and Marine Life**
- C. Cold-related Disorders**
- D. Dehydration**
- E. Dive Medicine**
  - 1. General**
  - 2. Drowning**
  - 3. Arterial Gas Emboli (AGE)**
  - 4. Decompression Sickness (DCS)**
  - 5. Barotrauma of the Ear**
  - 6. Other Barotraumas**
- F. Envenomation**
  - 1. Arthropods**
  - 2. Marine Life**
  - 3. Reptiles**
- G. Heat-related Disorders**
  - 1. Hyperthermia**
  - 2. Other Conditions**
- H. Vector-borne Illnesses**
- I. Lightning Injuries**
- J. Motion Sickness (Sea Sickness)**

---

## A. Altitude-related Disorders

### Review of Injury/Illness

High altitude illnesses include a continuum of diseases with symptoms ranging from headache to pulmonary and/or cerebral edema. Onset of symptoms is most frequent 24-48 hours after ascent to elevations > 2,500 m (~8,000 ft).

Early descent is the key to effective treatment. Without appropriate treatment, patients can progress rapidly to death. Indication for immediate descent are neurological findings (e.g., ataxia, confusion) and/or pulmonary edema.

### Signs and Symptoms

#### **Acute Mountain Illness (AMI) (> 1,800 m)**

- \* Headache
- \* Anorexia
- \* Nausea/vomiting
- \* Insomnia

#### **High Altitude Pulmonary Edema (HAPE) (> 3,000 m)**

- \* Symptoms are on a continuum (4-7 days, possibly later)
  - Early: Fatigue, Weakness, Dyspnea on Exertion (DOE)
  - Severe: Dyspnea at rest, audible chest congestion
  - Late: Pink or blood-tinged sputum

#### **High Altitude Cerebral Edema (HACE) (> 3,600 m)**

- \* Symptoms are on a continuum (4-7 days, possibly later)
- \* Severe headache, PLUS one or more of the following:
  - Ataxia
  - Confusion
  - Disorientation
  - Impaired Judgment
  - Severe Lassitude

**HAPE occurs in ~90% of HACE victims. HACE occurs in ~20% of HAPE victims.**

### Preventive Measures

1. Altitude-related illnesses occur most frequently when ascending rapidly to sleeping altitudes greater than 3,000 m. Ideally, one should spend 2-3 nights at 2,500-3,000 m before ascending higher. Spend an extra night of acclimatization for each 600-900 m of ascent. Day trips to higher altitude with descent for sleeping aids acclimatization.
2. Prophylaxis for rapid ascent speeds acclimatization:
  - a. Acetazolamide (Diamox®) 250 mg PO BID. However, it may take 24-48 hours for full effect. Start 48 hours prior to ascent, if possible.
  - b. Only 10% of patients with sulfa-allergy have an allergic reaction to acetazolamide (Diamox®)

- 
3. Dehydration occurs rapidly at high altitude due to increased respiration and low humidity.
    - a. Rehydrate aggressively (4-5 qt fluid QD).
    - b. Be sure to use warm fluids when providing IVF. (Refer to Protocol III.A.)
  4. Susceptibility Factors
    - a. Rate of ascent
    - b. Genetic predisposition
    - c. Altitude of residence
    - d. Prior altitude exposure (within 2 months)
    - e. Previous episode of AMI

## **Management**

### **BLS**

1. Acute Mountain Illness
  - a. Halt Ascent. Descend 1,000-3,000 ft, or until the patient feels better.
  - b. Assess and treat for dehydration. (Refer to Protocol III.D.)
  - c. Assess and treat for cold related conditions. (Refer to Protocol III.C.)
  - d. Administer pain management medications. (Refer to Protocol VII.A.)
  - e. **DO NOT** administer alcohol, sedatives, or sleeping pills to the patient.
2. HAPE, HACE
  - a. Halt Ascent. **Immediately** descend 3,000 ft. Descent is life-saving therapy
  - b. Administer oxygen and monitor pulse oximetry, if available.
  - c. Assess and treat for dehydration. (Refer to Protocol III.D.)
  - d. Assess and treat for cold related conditions. (Refer to Protocol III.C.)
  - e. Administer pain management medications. (Refer to Protocol VII.A.)
  - f. Patients with HACE should be monitored at all times.
  - g. Treat with hyperbaric therapy using a Gamow-bag, if available.

### **ALS**

1. Acute Mountain Illness
  - a. Administer Acetazolamide (Diamox<sup>®</sup>) 250 mg PO BID.
  - b. Administer nausea/vomiting management medications per local protocol.

c. For severe case of AMI:

- Administer Dexamethasone (Decadron<sup>®</sup>) 8.0 mg IV/IO/IM/PO initially, followed by 4.0 mg IV/IO/IM/PO q6h for 3 days.
- The initial treatment of AMI with Acetazolamide and Dexamethasone may worsen symptoms prior to improvement.

2. HAPE

- a. Administer AMI treatments.
- b. Administer Dexamethasone (Decadron<sup>®</sup>) 8.0 mg IV/IO/IM/PO initially, followed by 4.0 mg IV/IO/IM/PO q6h for 3 days.
- c. Administer Nifedipine 10 mg PO x1; repeat q6h if BP is stable and descent is not possible.
- d. Treat with hyperbaric therapy using a Gamow-bag, if available.

3. HACE

- a. Administer AMI treatments.
- b. Administer Dexamethasone (Decadron<sup>®</sup>) 8.0 mg IV/IO/IM/PO initially, followed by 4.0 mg IV/IO/IM/PO q6h for 3 days.
- c. Treat with hyperbaric therapy using a Gamow-bag, if available.

**Evacuation**

1. Conduct urgent evacuation for continuing or worsening symptoms of Severe AMI, HAPE, or HACE.
2. Conduct routine evacuation for HAPE/HACE patients with resolution of symptoms.
3. Evacuation is usually not required for AMI that responds to treatment.

**Extended Care**

1. Descent is the priority for anyone with severe symptoms.
2. Maintain warmth and monitor for hypothermia.
3. Calculate and monitor O<sub>2</sub> supplies.
4. Dehydration occurs quickly; evaluate frequently.

**Follow-up**

1. For Severe AMI, HAPE, or HACE, seek definitive medical care ASAP.

**Other/Special Considerations**

1. Gamow-bag (portable, inflatable one-person hyperbaric chamber) can be a very effective temporary treatment for HAPE and HACE.
  - a. Inflation of 2 PSI is equivalent to descending 1,600 m.
  - b. A few hours of treatment improves symptoms.
  - c. Hyperbaric therapy is equivalent to low flow O<sub>2</sub> and can help preserve O<sub>2</sub> supplies.

- 
2. Carbon Monoxide (CO) Poisoning is a constant danger with cooking or heating water in enclosed spaces, such as wind resistant tents, at altitude.
    - a. CO poisoning exhibits symptoms similar to AMI.
    - b. Supplemental O<sub>2</sub>, combined with forced hyperventilation, rapidly reverses CO poisoning.
  3. Snow Blindness (Ultraviolet Keratitis)
    - a. Pain and swelling generally subsides in a day.
    - b. Treat both eyes as if they have suffered a severe corneal scratch. (Refer to Protocol V.O.2.)

---

## B. Animal-related Injuries: Mammals and Marine Life

### Review of Injury/Illness

Animal bites and other animal-related penetrating injuries are a specialized type of wound requiring a somewhat different management approach.

These wounds carry a high risk of infection due to inoculation of contaminants from animal mouth flora and the potential for a retained foreign material (e.g., teeth, claws, dirt, debris).

### Signs and Symptoms

- \* **Encounter with animal has resulted in a bite**
- \* **Bite mark, accompanied by localized swelling**
- \* **Signs and symptoms can vary depending on the animal**

### Basic Guidelines for Animal-Induced Injuries

1. Initiate antibiotic prophylaxis according to local protocol prior to beginning definitive treatment.
2. Perform wound prep and irrigation of all wounds with normal saline or clean, disinfected water. (Refer to Protocol VI.AB.)
  - a. Do not use seawater, due to risks of contamination and infection.
3. Repeat irrigation with 1% povidine-iodine diluted (50:50) with irrigating solution.
4. Repeat irrigation with normal saline or clean disinfected water to rinse out the povidine-iodine.
5. Explore wound for retained teeth and debris; remove all foreign material.
  - a. Debride obviously devitalized tissue.
6. **DO NOT** close puncture wounds, wounds with gross contamination, cat bites and scratches, wounds caused by humans or other primates, or wounds that cannot be properly prepped and irrigated.
  - a. All such wounds should be referred for delayed primary closure.
  - b. Facial wounds caused by primates may be loosely closed.
  - c. Loosely closed facial wounds should be referred for possible revision by a plastic surgeon or other cosmetic wound reconstruction specialist.
7. Lacerations caused by minor injuries may generally be closed.
  - a. Close these wounds loosely, using the least invasive method possible based on both medical and operational considerations. (Refer to Protocol VI.B, Protocol VI.Q.1, Protocol VI.Q.2, and Protocol VI.Q.3.)
  - b. If infection develops, remove enough closures (e.g., tape, staples, sutures) to allow sufficient drainage of infectious material from the wound.
8. Immobilize extremity wounds for 24-48 hours or longer, if needed.
9. Evaluate tetanus vaccination status and administer anti-tetanus prophylaxis, as needed. (Refer to Protocol V.V.)

---

## **Mammalian Bites**

1. Assess all mammalian wounds for rabies risk potential.
  - a. Rabies is a fatal disease, with only a handful of rare exceptions
  - b. Unprovoked attacks carry a high rabies risk.
    - If the injury is considered a risk for rabies, initiate rabies prophylaxis/vaccine. (Refer to Protocol V.W.)
    - Determining if the attack was provoked or unprovoked is one of the keys to anti-rabies management.
      - Unprovoked attacks include bites by animals with abnormal behavior.
        - » Nocturnal animals active in daylight and vice-versa
        - » Normally shy animals demonstrating aggressiveness, lack of fear, etc.
      - Provoked attacks include:
        - » Attacks incurred while attempting to handle or pet the animal
        - » Attacks incurred when animal's territory was entered
        - » Attacks caused by a perceived threat to the animal's offspring
  - c. Domesticated animals can be quarantined for 7 days and observed for signs of illness, before deciding whether to administer anti-rabies prophylaxis.
    - If the animal becomes ill, it should be killed and sent for rabies testing.
    - If the animal was killed, the carcass can be analyzed for rabies. Wear PPE according to Protocol II.B.
  - d. For a high risk bite or wound, and no animal is present for observation or examination, immediately make arrangements for initiation of rabies prophylaxis.
2. Many mammals have extensive mouth flora which could induce infection (e.g., cellulitis).
  - a. Administer dual antibiotic prophylaxis, using penicillin and a first generation cephalosporin, or clindamycin and a fluoroquinolone. (Refer to Protocol VII.E.)

## **Other Mammalian-Induced Injuries**

### **Porcupines**

1. Porcupine quills can migrate as much as 10" (25 cm) into tissue.
  - a. Carefully remove all quills by pulling them straight out of wound. (A small incision, or nick, in the skin may be needed if quill barbs prevent easy removal.)
  - b. Local anesthesia may be necessary. (Refer to Protocol VI.J.)

### **Skunks**

1. If sprayed in the eyes:
  - a. Irrigate eyes with water immediately for a minimum duration of 20 minutes using a Morgan Lens, if available.
  - b. If patient complains of burning or irritation beyond the initial irrigation, continue irrigating eyes until the pain subsides.

- 
2. To alleviate odor:
    - a. Wash/rinse the affected areas with household bleach (5.25%) diluted (1:5 or 1:10) with water.
    - b. Then clean with soap (green soap) and water.
    - c. Repeat rinse with diluted bleach solution.
    - d. Rinse with water.
    - e. Tomato juice has been widely recommended for contaminated hair.
      - Shampoo hair with tomato juice
      - Rinse with diluted bleach (1:10)
      - Then rinse again with water.

### **Marine Life Bites**

1. Wounds may be caused by the bites of many marine organisms, which include:
  - a. Sharks
  - b. Eels (e.g., Moray, Electric)
  - c. Fish (e.g., barracuda, bluefish, northern pike, muskellunge)
2. Extensive wounds, primarily from sharks, require major trauma care. (Refer to Protocol IV.F.)
3. Initiate antibiotic prophylaxis appropriate for treating *Vibrio* and/or *Aeromonas* species. (Refer to Protocol VII.E.)
  - *Vibrio* contamination is a risk associated with salt water organisms.
  - *Aeromonas* contamination is a risk associated with fresh water organisms.

### **Other Injuries Caused by Marine Life**

#### **Electric Shock**

1. Atlantic torpedo (electric ray), *Torpedo nobiliana*
  - a. May produce an electric shock of 220 volts.
  - b. May need to treat for electric shock injury
  - c. Has not been known to seriously injure humans
  - d. Range is from Nova Scotia to Florida and the northern Gulf of Mexico

#### **Penetrating Wounds**

1. Needlefish, marlin, sailfish (snout-induced)
  - a. Creates puncture wound
  - b. Part of bill or snout may break off into wound
    - Explore wound thoroughly and remove any foreign matter. (Refer to “Basic Guidelines for Animal-Induced Injuries.”)

---

## **Evacuation**

1. Conduct urgent evacuation for any injury resulting in major, life-threatening trauma.
2. Conduct priority evacuation for any injury resulting in significant trauma; wounds with quickly spreading cellulitis or lymphangitis.
3. Conduct routine evacuation for any wounds with a rabies risk, wounds involving tendons, joints, bone or deep structures.
4. Evacuation is not required for minor injuries that resolve with treatment.

## **Extended Care**

1. If antibiotic prophylaxis has been initiated, continue in accordance with Protocol VII.E.
2. Serial dressing changes may be necessary.
3. Continue supportive care. (Refer to Protocol VI.)

## **Management of Complications**

1. If infection develops in patients who did not receive antibiotic prophylaxis, begin treatment with a suitable antibiotic. (Refer to Protocol VII.E.)
2. If an infection redevelops after the completion of a course of antibiotics, consider the possibility of a retained foreign body. Obtain an X-ray, if possible.

---

## C. Cold-related Disorders

### Review of Injury

A “cold injury” is a tissue injury produced by exposure to cold. Cold injuries can occur at nonfreezing and freezing temperatures. Hypothermia and frostbite are the cold injuries of greatest significance. In cold environments, the body preserves heat by shunting blood to the core. Ensure adequate thermal protection or re-warming of the whole body, not just extremities that might be injured.

### Signs and Symptoms

#### **Mild hypothermia (core body temperature 98.6-92° F)**

- \* Shivering
- \* Unable to perform complex tasks with hands
- \* Poor judgment
- \* Amnesia

#### **Moderate hypothermia (core body temperature 91-86° F)**

- \* Violent shivering to potential loss of shivering reflex
- \* Dazed consciousness, slurred speech, irrational behavior
- \* Loss of fine motor coordination
- \* Dilated pupils
- \* Mild to moderate hypotension
- \* Diminished respiratory rate and effort

#### **Severe hypothermia (core body temperature $\leq 85^{\circ}$ F)**

- \* Shivering occurs in waves until it ceases as body temp drops
- \* Severe altered mental status
- \* Absent response to pain
- \* Muscle rigidity, skin becomes pale
- \* Pupils dilate, pulse rate decreases, breathing becomes erratic
- \* Cardiac abnormalities, hypotension

#### **Frostbite**

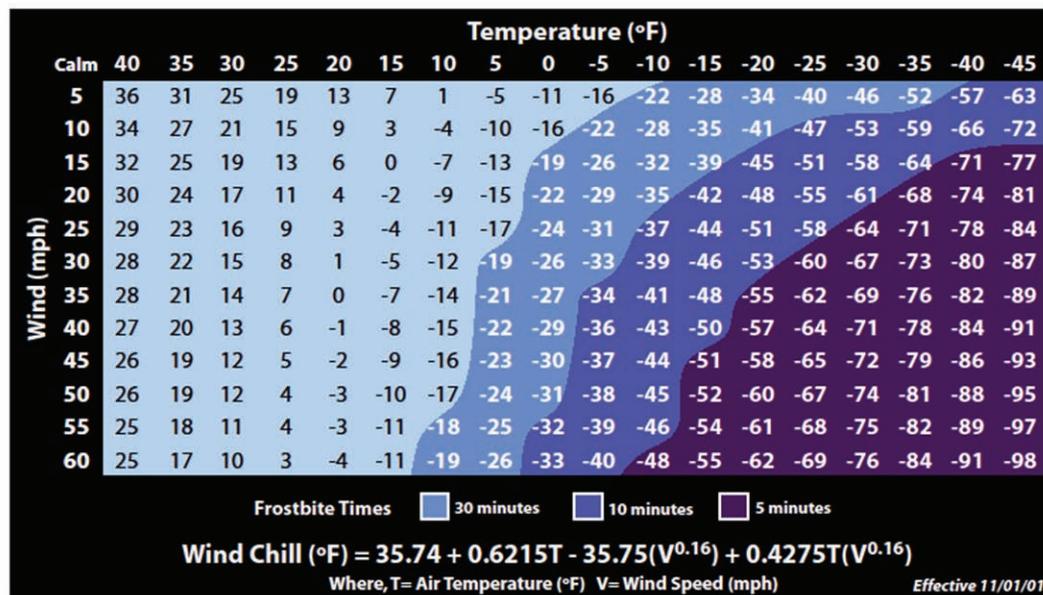
- \* Skin has white or waxy appearance
- \* Skin feels hard to the touch
- \* Loss of mobility and sensation
- \* Poor perfusion (no capillary refill; no pulses in frostbite with proximal extension from extremities toward trunk)
- \* Blisters in cases of severe frostbite

## Preventive Measures

1. Layer clothing to keep warm and protect from wind.



## Wind Chill Chart



- Maintain dry clothing. Replace wet clothing with dry, if possible.
  - Wear properly fitting, non-constricting clothing.
  - Keep clothing clean and free from dirt.
  - Keep head covered with a cap (wool preferred) to reduce heat loss.
2. Dehydration occurs rapidly in cold environments. Hydrate to keep urine clear to light yellow.
  3. Avoid overheating, which causes sweating and could cause hypothermia later as person cools.
  4. Avoid alcohol, tobacco, and caffeinated beverages (can be used if nothing else is available) as they can have a vasoconstrictive effect.

## Management

### BLS

1. Mild Hypothermia
  - Minimize the patient's exposure to the elements.
  - Replace wet clothing with dry, if possible. Put cap on the patient's head
  - Re-warm the patient.
    - Wrap the patient in a rescue blanket, hypothermia wrap, cloth pads, blankets, sleeping bags, body bags, or other suitable material that will retain heat and keep the patient dry.

- 
- Ensure adequate insulation between patient and ground.
- d. Encourage PO hydration. (Refer to Protocol III.D and Protocol III.G.)
  - e. “Feed Hypothermia”: encourage patient to eat, if awake and able to swallow.
2. Moderate Hypothermia
    - a. Follow all treatments for mild hypothermia **except**:
      - Discourage foods and liquids
    - b. Handle patient gently and immobilize, if possible.
      - **DO NOT** massage or vigorously manipulate patient to reduce the chances of inducing cardiac dysrhythmia.
    - c. Actively re-warm the patient by placing warm water bottles, or other warm objects, on the groin, neck, and armpit regions. Always have clothing or material between the heat source and the skin, as hypothermic skin burns easily at low temperatures. **DO NOT** use a direct heat source warmer than 102° F.
  3. Severe Hypothermia
    - a. Follow all treatments for moderate hypothermia.
    - b. Determine if victim is breathing.
      - Be extra attentive. Listen for breath sounds with a stethoscope
      - If not breathing, assist ventilations with a bag valve mask (BVM) device, as needed.
    - c. Check for pulse at femoral and carotid arteries for up to one minute.
      - Unnecessary CPR can have severely negative consequences.
        - If there are any signs of life, **DO NOT** initiate chest compressions.
        - If no pulse, initiate CPR according to the current American Heart Association (AHA) guidelines.
          - » Continue CPR until patient is “warm and dead” or after consulting on-line medical direction.
  4. Mild Frostbite
    - a. Minimize the patient from exposure to the elements.
    - b. Put affected part against warm body parts (e.g., armpits and groin).
    - c. Replace wet clothing with dry, if possible. Layer clothing to keep warm and protect from wind.
    - d. Encourage PO hydration. (Refer to Protocol III.D and Protocol III.G.)
    - e. Protect from trauma or rubbing.
  5. Severe Frostbite
    - a. **DO NOT** thaw frozen part unless sure there is no potential for refreezing.
    - b. Move patient to a warm area. **DO NOT** allow the patient to walk on affected feet.
    - c. Do not rub the frozen body part.
    - d. If thawing is inevitable, immerse affected body parts into circulating warm water (104-108° F) for 30-40 minutes.
    - e. Cover the frozen body parts with loose, dry sterile dressing that is non-compressive and non-adherent. Affected fingers and toes should be separated with sterile gauze.

- f. **DO NOT** drain blisters in the field.
- g. Avoid alcohol, tobacco, and caffeinated beverages (can be used if nothing else is available) as they can have a vasoconstrictive effect.
- h. Administer pain management medications. (Refer to Protocol VII.A.)

## **ALS**

1. Hypothermia
  - a. Initiate 0.9% Normal Saline via IV/IO at KVO or saline lock. Use warm fluids, if available.
    - Administer initial fluid bolus 0.9% Normal Saline 250 ml, up to a maximum total infusion of 2,000 ml without consulting on-line medical direction. Titrate to maintain Systolic BP > 90 mm Hg. If rales are present, infuse up to 250 ml. Additional fluid infusion requires consulting on-line medical direction.
      - Use portable fluid warmer on all IV sites, if available.
  - b. Assess and treat for hypoglycemia according to local protocol.
2. Severe Frostbite
  - a. Administer one of the following antibiotics for any open wound if evacuation time is extended:
    - Levofloxacin (Levaquin<sup>®</sup>) 500 mg PO QD
    - Azithromycin (Zithromax<sup>®</sup>) 500 mg PO QD Day 1, then 250 mg PO QD Days 2-5
  - b. Administer pain management medications. (Refer to Protocol VII.A.)

## **Evacuation**

1. Conduct priority evacuation for severe hypothermia and severe frostbite. Evacuation is not required for mild to moderate cases that respond to treatment.
2. When transporting a hypothermic or frostbitten patient:
  - a. Stabilize injuries.
  - b. Bandage all open wounds.
  - c. Attempt to keep the patient supine.

## **Other/Special Considerations**

1. Pad all splints used for stabilization.
2. Do not rupture frostbite blisters. If blisters rupture, apply antiseptic ointment and dry sterile dressings.
3. Consider inhalation re-warming, if available and personnel are trained in its use.
4. Avoid a freeze-thaw-refreeze cycle.

---

## D. Dehydration

### Review of Injury/Illness

Dehydration can be caused by inadequate fluid intake, inapparent loss of fluids through sweating and evaporation, obvious fluid loss such as vomiting, diarrhea, excessive urination due to diuretic medication, or a combination of these factors.

There is increased risk of dehydration during prolonged operations, at high altitudes, and in both hot and cold climates. **Note:** Sweat may evaporate so quickly in arid environments that it may not be noticeable until onset of symptoms.

### Signs and Symptoms

- \* **Thirst (may not always be a reliable indicator)**
- \* **Hunger (may or may not be an indicator)**
- \* **Decreased urine output or dark-colored urine**
- \* **Dry mucosa**
- \* **Headache, especially upon waking**
- \* **Nausea**
- \* **Muscle cramping**
- \* **Decreased blood pressure, increased heart rate**
- \* **Degradation of performance and/or loss of coordination**
- \* **Altered mental status**

### Preventive Measures

1. Ensure proper acclimatization to new environment (approximately 3-10 days).
2. Use work/rest cycles, as operational situations allow.
  - a. Take breaks in shady, cooler areas.
  - b. Ensure and observe that the team drinks during breaks (forced water breaks).
    - Target a minimum of at least 1-2 liters/hour.
    - Frequent sips are more efficient than trying to catch up with larger volumes later.
    - Drink water, sports drink, or use a sports electrolyte solution to maintain electrolyte balance.
3. Remember to eat as well as to drink, to help maintain electrolyte balance.
4. Avoid alcohol, tobacco, and caffeinated beverages (can be used if nothing else is available) as they have a diuretic effect.
5. Use the buddy system to monitor for dehydration.

---

## **Management**

### **BLS**

1. Treat more severe symptoms, as needed. (Refer to Protocol III.G.)
2. Increase oral intake of fluids.
3. Have patient consume salty snack foods (high Na<sup>+</sup> content)
4. Move patient to a cooler, shaded environment.
5. Loosen patient's clothing. Remove any personal gear, as necessary.

### **ALS**

1. If unable to tolerate PO fluids:
  - a. Initiate 1 L bolus of 0.9% Normal Saline or LR via IV/IO.
  - b. Repeat attempt at oral hydration.
  - c. If still unable to tolerate PO fluids, repeat 1 L fluid bolus.
2. If symptoms of heat stroke are present, this is a life-threatening condition and the patient needs immediate cooling and evacuation. (Refer to Protocol III.G.)

### **Evacuation**

1. Conduct priority evacuation if the patient does not improve, or worsens, after treatment.
2. Evacuation is usually not required for patients that respond to rehydration treatment.

### **Extended Care**

1. Continue use of preventive measures.
2. Increase oral intake of fluids to maintain clear to light yellow urine output.
3. Monitor patient for changes in mental status and/or progressing signs of a heat emergency. (Refer to Protocol III.G.)

### **Other/Special Considerations**

1. Heat cramps (muscle cramps and twitching) are caused by Na<sup>+</sup> depletion and will improve with replacement. (Refer to Protocol III.G.)

## E. Dive Medicine

### 1. General

#### Review of Injury/Illness

The most common dive-related medical presentations involve minor ear disorders, but systemic and life-threatening emergencies occur every year. These include arterial gas emboli (AGE), decompression sickness (DCS), and barotraumas to the ears and other locations.

1. When dealing with a diving-related incident, it is important to transport the diver's equipment with him during evacuation, so it can be inspected and possibly analyzed. **DO NOT clear patient's dive computer.** The dive history obtained from a patient by an EMS provider should include at a minimum: the times, duration and depth of dives (includes bottom time), as well as the number of dives over the previous 3 days, surface intervals, activity performed while diving, and whether the dive(s) were complicated by events such as entrapment, running out of air, or rapid ascent. It is also important to record the time and rapidity of onset of symptoms.
2. Travel to high altitudes or flying too soon after diving increases the risk of decompression sickness (DCS) and other dive-related problems.

| Minimum Flight Delay | Dive History                                     |
|----------------------|--|
| 12 hrs               | Single, no-decompression dive                    |
| 18 hrs               | Multi-day diving, no-decompression dives         |
| 24 hrs               | Decompression required dive(s)                   |
| 3 days               | If treated for DCS or arterial gas embolus (AGE) |

3. Diver's Alert Network recommends a flight altitude of < 800 feet unless aircraft safety is compromised.
4. If emergency evacuation is required following recompression, patient should be transported in aircraft capable of pressurizing to sea level pressure, such as a C-130 or Lear Jet (most aircraft pressurize at 6,000-8,000 ft).

#### **Divers Alert Network**

To find the location of the nearest decompression chamber and to obtain emergency treatment advice, call:

**(919) 684-8111** (for emergencies only) OR **(919) 684-4DAN (4326)**

*Tell the operator you have a dive emergency.*

---

## 2. Drowning

### Review of Injury/Illness

Drowning is a leading cause of death in all age groups, but is an epidemic in children.

### Signs and Symptoms

- \* Hypoxia
- \* Respiratory distress
- \* Persistent cough
- \* Tachycardia

### Preventive Measures

1. Use a buddy system whenever near water.
2. Wear appropriate personal flotation devices near water.
3. Rescue methods (“Reach, Throw, Row, and Go”):
  - a. Attempt to reach victim with some object like a stick, clothing, or rope.
  - b. Throw something that floats to victim.
  - c. Row or paddle out to victim in a boat.
  - d. Only perform swimming rescue, if trained, and as a last resort.

### Management

#### **BLS**

1. Perform complete patient assessment including:
  - a. Evaluate for underlying injury/illness
    - Loss of consciousness
    - Head/C-spine injury
    - Diabetic
    - Seizures
    - Cardiac issues
    - Diving-related injuries
  - b. Approximate submersion time.
  - c. Obtain body core temperature and vitals.
2. Remove patient from water.
3. If patient is conscious put him/her in the Recovery position.

- 
4. If patient is unconscious, maintain an open airway by:
    - a. Perform chin lift; or jaw thrust if C-spine injury is suspected
    - b. Use nasopharyngeal (NP) or oropharyngeal (OP) airways
      - Lubricate the NP airway and insert with bevel toward the septum
      - Contraindicated if CSF fluid is coming from nose or ears
    - c. Do not perform Heimlich maneuver unless foreign matter is suspected of obstructing airway
  5. For respiratory arrest or cyanosis with decreased level of consciousness:
    - a. Administer high flow oxygen and assist ventilations with a bag valve mask (BVM), if available.
    - b. Perform CPR according to current American Heart Association (AHA) guidelines, as indicated.
    - c. Perform appropriate spinal immobilization, if indicated.
    - d. Assess and prevent/treat for hypothermia, if needed. (Refer to Protocol III.C.)
    - e. Assess and treat for traumatic injuries, as needed. (Refer to Protocol IV.F.)

## **ALS**

1. If respiratory arrest, consider advanced airway management:
  - a. Approved supraglottic device; or
  - b. Endotracheal intubation; or
  - c. Surgical cricothyroidotomy (Refer to Protocol VI.D.)
2. Initiate 0.9% Normal Saline via IV/IO at KVO or saline lock. Use warm fluids, if available.

## **Evacuation**

1. Conduct urgent evacuation for a patient suffering cardiac and/or respiratory arrest with a chance of survival.
2. Evacuation is not required for most submersion victims who do not exhibit continuing signs of respiratory distress.

## **Extended Care**

1. Closely observe all near-drowning injuries for a minimum of 6 hours.
2. Monitor cardiac rhythm and pulse oximetry, if available.
3. Monitor vitals on a periodic basis for 48 hours after submersion.

## **Follow Up**

1. All near drowning patients should be advised to see a personal or team physician upon return from an austere environment, since it is possible to develop delayed respiratory, renal, or other problems.

## Other/Special Considerations

1. Cold water immersions precipitate drowning because of profound cardiovascular and respiratory responses.

| Centigrade        | Fahrenheit        | Expected Time Before Exhaustion or Unconsciousness | Average Expected Survival Time                |
|-------------------|-------------------|--|---|
| Less than 2 °     | Less than 34 °    | < 15 minutes                                       | Less than 45 minutes                          |
| 2 °               | 34 ° to 40 °      | 15 - 30 minutes                                    | Less than 90 minutes                          |
| 4 ° to 10 °       | 10 ° to 50 °      | 30 - 60 minutes                                    | Less than 3 hours                             |
| 10 ° to 15 °      | 50 ° to 59 °      | 1-2 hours  | Less than 6 hours                             |
| 15 ° to 20 °      | 59 ° to 69 °      | 2-7 hours  | Less than 12 hours                            |
| Greater than 20 ° | Greater than 70 ° | 3-12 hours (70-80 F)<br>Indefinite (80+ F)         | Indefinite<br>(depends on physical condition) |

---

### 3. Arterial Gas Emboli (AGE)

#### Review of Injury/Illness

Arterial gas emboli (AGE) is the most common cause of sudden death in diving. Sudden collapse or loss of consciousness immediately or soon after surfacing should always be treated as AGE until proven otherwise. A complication of pulmonary barotrauma (PBT), AGE may cause near-drowning during ascent. It is most commonly seen in panicked or inexperienced divers making a rapid ascent while holding their breath, as the rapidly expanding air ruptures the pulmonary alveoli and allows gas bubbles to enter the blood stream across the capillary membranes. These bubbles may cause sudden loss of perfusion to the brain, heart, and other vital organs. Massive gas loading of the vasculature causes cardiac arrest that is refractory to resuscitation efforts.

#### Signs and Symptoms

- \* **Abrupt onset of symptoms occurring during ascent or within 10 minutes after surfacing**
- \* **Stupor, confusion, vertigo, coma, convulsions**
- \* **Unilateral or bilateral motor or sensory deficits**
- \* **Visual disturbances**

Symptoms may also include:

- \* **Aphasia**
- \* **Headache**
- \* **Chest pain related to myocardial ischemia**
- \* **Cardiac arrhythmias, cardiac arrest**
- \* **Symptoms of other barotrauma and decompression sickness (DCS) may also be present**

#### Management

##### BLS

1. Primary treatment is recompression in a hyperbaric chamber.
2. If aeromedical evacuation is necessary for rapid access to a hyperbaric chamber, ensure low altitude flight (800-1,000 ft).
3. Keep patient supine.
4. Administer oxygen, if available: 10-15 L/min NRBM to keep O<sub>2</sub> saturation at a minimum of 94%.
5. Transport diver equipment with patient during evacuation for inspection and possible analysis. **DO NOT clear patient's dive computer.** Urgently transport for decompression.
6. Check with a dive medical officer for consideration of oral pain medications, if patient is awake and able to swallow.

---

## ALS

1. Initiate 0.9% Normal Saline or LR via IV/IO.
  - a. Administer 1 L during the first 30 minutes and continue IV/IO infusion at 100-175 ml/hr.
  - b. DCS patients are often hypovolemic.
  - c. **DO NOT** use IV fluids that contain dextrose/glucose.
2. **DO NOT** administer aspirin or NSAIDs unless directed by a dive medical officer.
3. If neurological symptoms occur, consult a dive medical officer **before** administering:
  - a. Lidocaine® 0.5-1.0 mg/kg IV bolus at a rate of 25-50 mg/minute; may repeat at 0.5 mg/kg IV bolus, up to a maximum dose of 225 mg or 3.0 mg/kg, as needed. After loading doses, start a maintenance infusion at 2.0-4.0 mg/minute.
  - b. **NOTE: Patients with hypotension, cardiac arrest or biventricular heart failure should receive only a single loading dose of 100 mg.**
  - c. Lidocaine® is contraindicated in patients with known hypersensitivity, Adam-Stokes Syndrome, WPW, severe SA, AV, or heart block without a pacemaker.
4. If seizures develop, consult a dive medical officer **before** administering IV benzodiazepines (e.g., midazolam, diazepam or lorazepam). **DO NOT** give benzodiazepines as prophylaxis; use only to treat active seizing. (Refer to Protocol II.B.)

## Evacuation

1. Conduct urgent evacuation to the nearest hyperbaric chamber for a patient with symptoms of AGE.

## Extended Care

1. Closely observe all patients with suspected AGE until definitive care is reached.
2. Monitor cardiac rhythm and pulse oximetry, if available.

## Follow Up

1. All suspected AGE patients should be advised to see a personal or team physician trained in dive medicine upon return from an austere environment, since it is possible to develop delayed respiratory and/or neurological problems.

---

## 4. Decompression Sickness (DCS)

### Review of Injury/Illness

DCS, commonly known as “the Bends,” is an emergency condition requiring treatment in a decompression chamber. DCS most often occurs within the first 1-6 hours after diving; further deterioration is unlikely to occur after 24 hours. The onset of symptoms is directly related to the severity of the DCS; in severe cases, symptoms occur more rapidly. Several forms of DCS primarily affect the nervous system, muscles, joints, skin, inner ear and cardiopulmonary system.

At depth and under pressure (P), gas is absorbed into the tissues proportionate to depth and exposure time. Significant absorption most likely occurs following dives to depths > 33 feet of sea water (FSW). DCS results from the formation of bubbles of inert gas (e.g., nitrogen) within the intravascular and extravascular spaces as the diver ascends to the surface, when the ascent is too rapid to allow nitrogen to be released that is absorbed in the tissues during the dive.

### Signs and Symptoms

**Depending on the distribution of gas bubbles throughout the body, DCS may create a variety of symptoms:**

- \* Pruritus (early symptom), skin rash
- \* Unusual fatigue
- \* Joint pain, abdominal or thoracic pain (“girdling” pain)
- \* Shortness of breath, frothy sputum, hemoptysis
- \* Dizziness, vertigo, tinnitus, parasthesia, paralysis, seizures, tremors, staggering
- \* Altered mental status, confusion, amnesia, behavioral changes

### Useful Field Tests for DCS

1. BP cuff decompression
  - a. Inflate over painful joint or muscle 150-200 mm Hg.
  - b. Suspect DCS, if joint or muscle pain is temporarily relieved with cuff pressure.
  - c. Only diagnostic if positive (pain temporarily relieved); failure to temporarily relieve pain **DOES NOT** rule out DCS.
2. Romberg’s Test
  - a. Assists in determining presence of neurologic DCS (Romberg +)
  - b. Patients stand with feet together, eyes closed, and arms out to the side.
  - c. Observe for 1 minute: swaying or collapse indicates patient is Romberg positive.
3. Differentiation between CVA (stroke) and DCS
  - a. In CVA, the symptoms typically are focal and affect one side of the body (e.g., paralysis of the left arm and left leg and left sided facial droop).
  - b. In DCS, the symptoms are random and may be multi-focal, depending on distribution of gas bubbles.

---

## **Management**

### **BLS**

1. Primary treatment is recompression in a hyperbaric chamber.
2. If aeromedical evacuation is necessary for rapid access to a hyperbaric chamber, ensure low altitude flight (800-1,000 ft).
3. Keep patient supine.
4. Administer oxygen, if available: 10-15 L/min by non-rebreathing mask to keep O<sub>2</sub> saturation at a minimum of 94%.
5. Transport diver's equipment with patient during evacuation for inspection and possible analysis. **DO NOT clear patient's dive computer.**

### **ALS**

1. Initiate 0.9% Normal Saline or LR via IV/IO.
  - a. Administer 1 L during the first 30 minutes and continue IV/IO infusion at 100-175 ml/hr.
  - b. DCS patients are often hypovolemic.
  - c. **DO NOT** use IV fluids that contain dextrose/glucose.
2. **DO NOT** administer aspirin or NSAIDs unless directed by a dive medical officer.
3. If neurological symptoms occur, consult a dive medical officer **before** administering:
  - a. Lidocaine® 0.5-1.0 mg/kg IV bolus at a rate of 25-50 mg/minute; may repeat at 0.5 mg/kg IV bolus, up to a maximum dose of 225 mg or 3.0 mg/kg, as needed. After loading doses, start a maintenance infusion at 2.0-4.0 mg/minute.
  - b. **NOTE: Patients with hypotension, cardiac arrest or biventricular heart failure should receive only a single loading dose of 100 mg.**
  - c. Lidocaine® is contraindicated in patients with known hypersensitivity, Adam-Stokes Syndrome, WPW, severe SA, AV, or heart block without a pacemaker.
4. If seizures develop, consult a dive medical officer **before** administering IV benzodiazepines (e.g., midazolam, diazepam or lorazepam). **DO NOT** give benzodiazepines as prophylaxis; use only to treat active seizing. (Refer to Protocol II.B.)

### **Other/Special Considerations**

1. Flying following recompression and treatment for DCS:
  - a. Should not fly for additional 3 days after recompression treatment.
  - b. If further emergency evacuation is required, aircraft capable of sea level pressurization are preferred (C-130).
2. In-water recompression is the province of specially trained dive safety officers, dive medical technicians and professional dive teams and should not be attempted by anyone else.

- 
3. Corticosteroids were once recommended as having possible benefit.
    - a. **Latest guidance from current literature states that steroids have been shown to have no effect or benefit and are no longer recommended.**
  4. May increase risks of hyperbaric (recompression) treatment by increasing CNS oxygen toxicity.

### **Evacuation**

1. Conduct urgent evacuation to the nearest hyperbaric chamber for a patient with symptoms of DCS.

### **Extended Care**

1. Closely observe all patients with suspected DCS until definitive care is reached.
2. Monitor cardiac rhythm and pulse oximetry, if available.

### **Follow Up**

1. All suspected DCS patients should be advised to see a personal or team physician trained in dive medicine upon return from an austere environment, since it is possible to develop delayed respiratory and/or neurological problems.

---

## 5. Barotrauma of the Ear

### Review of Injury/Illness

There are 3 barotraumas related to the ear:

1. External ear barotrauma: Also known as barotitis externa media interna or “ear canal squeeze”; caused by air trapped in the external auditory canal (EAC) by:
  - a. Cerumen impaction.
  - b. Exocytoses (chronic narrowing of the EAC).
  - c. The use of ear plugs or a tight wet suit hood.
2. Middle Ear Barotrauma (MEB):
  - a. Barotitis media or “ear squeeze” and “reverse ear squeeze.”
  - b. Caused by failure of middle ear to equalize to ambient pressure (P).
3. Inner Ear Barotrauma (IEB):
  - a. Also known as barotitis interna or labyrinthine window rupture.
  - b. Caused by the pressure differential between inner ear and ambient pressure.
  - c. IEB may cause injury to the cochleovestibular system of the inner ear, may lead to permanent vestibular dysfunction or deafness.
  - d. It is important to distinguish IEB from the dizziness, balance problems, nausea, and vomiting that are also symptoms of decompression sickness (DCS).

### Signs and Symptoms

#### **External Ear Barotrauma**

- \* **Pain, swelling, and erythema to the EAC**
- \* **Petechiae or hemorrhagic blebs may be seen on the walls of the EAC**

#### **Middle Ear Barotrauma**

- \* **Pain, begins as slight pain and progressively worsens on descent/ascent**
- \* **Impaired hearing**
- \* **Nasal congestion**
- \* **Tympanic membrane (ear drum) rupture**
  - **Sudden severe pain**
  - **Vertigo, as water enters into the middle ear**
  - **Total loss of hearing in the affected ear**
- \* **Blood may be seen around the mouth and nose as well as in the EAC**

---

## Inner Ear Barotrauma

- \* Sudden pain, dizziness, vertigo, may be extreme
- \* Nausea and vomiting (vomiting underwater may lead to drowning)
- \* “Roaring” tinnitus, hearing loss
- \* Nystagmus, ataxia, facial nerve paralysis
- \* Pallor, diaphoresis, disorientation
- \* Ear may feel “blocked” or patient may relate a feeling of “fullness” in the ear
- \* Differentiation from inner ear Decompression Sickness (DCS):
  - IEB is usually associated with ear pain and clearing difficulties upon descent
  - In IEB, evidence of other barotraumas may be seen on ear exam
  - In inner ear DCS, symptoms are often noted upon ascent or shortly after surfacing
  - Other symptoms of decompression sickness are often present with inner ear DCS

## Management

### BLS

1. External Ear Barotrauma:
  - a. Discontinue use of ear plugs, switch to larger sized wetsuit hood.
  - b. If tympanic membrane (TM) is not ruptured, use oral pain medications if permitted by local protocol.
  - c. If TM is ruptured:
    - Diver should not resume diving and should be referred for otolaryngologist evaluation
    - Use oral pain medications if permitted by local protocol
2. Middle Ear Barotrauma (MEB):
  - a. If TM is not ruptured:
    - Use oral pain medications if permitted by local protocol
    - Patient should not resume diving until symptoms completely resolve and the diver can auto-inflate (clear) the ears without difficulty
  - b. If TM is ruptured:
    - Use oral pain medications if permitted by local protocol
    - Patient should not resume diving until the TM has completely healed (may take weeks or months)
3. Inner Ear Barotrauma (IEB)
  - a. Bed rest with head elevated (approximately 30-45 degrees).
  - b. Use oral pain medications, if permitted by local protocol.
  - c. Suspend all diving/water exposure until patient is cleared by an otolaryngologist.
  - d. Urgent transport required, especially if not able to distinguish clinically from DCS.

---

## **ALS**

1. Initiate 0.9% Normal Saline or LR via IV/IO at KVO or saline lock.
2. Administer pain management medication, if needed. (Refer to Protocol VII.A)

## **Evacuation**

1. Conduct routine evacuation for a patient with symptoms of barotrauma.

## **Extended Care**

1. Monitor vitals signs and re-assess evacuation priority if patient condition worsens.

## **Follow Up**

1. All barotrauma patients should be advised to see a personal or team physician trained in dive medicine upon return from an austere environment, since it is possible to develop delayed neurological problems.

---

## 6. Other Barotraumas

### Review of Injury/Illness

Barotraumas develop when a significant difference in pressure occurs between a body organ or tissue and the ambient pressure. Barotraumas of the ears and lungs are described in separate protocols.

- Mask squeeze is caused by failure to equalize mask pressure to ambient pressure during descent via nasal exhalations. The air volume inside the mask contracts and results in negative pressure, which then may cause capillary rupture in the sclera, conjunctiva, and the skin of the face and nose.
- Barosinusitis (sinus squeeze) occurs when the pressure within a sinus fails to equalize and affects the paranasal sinuses (ethmoid, frontal, maxillary, and sphenoid). It usually occurs during descent, with the suction causing damage with bleeding from the sinus wall mucosa. It may also occur during ascent from pressure exerted on the mucosa. Individuals with recent URI are at increased risk.
- Barodontalgia (tooth squeeze) is caused by expansion or contraction of the trapped air in the interior of a tooth or in structures surrounding a tooth, creating pain in and around the tooth.

### Signs and Symptoms

#### Mask squeeze

- \* **Skin ecchymosis in a mask-like pattern**
- \* **Conjunctival/scleral hemorrhage (similar to strangulation injury)**
- \* **Looks more serious than it is; dramatic presentation**

#### Barosinusitis

- \* **Sinus pain, may be severe**
- \* **Blood and/or mucous may be noted around the nose, mouth, and/or face mask**

#### Barodontalgia

- \* **Severe tooth pain**
- \* **Expulsion of a filling or crown**
- \* **Fractured tooth**
- \* **Exploded or imploded tooth**

### Management

#### BLS

1. Administer oxygen (10-15 L/min NRBM) and monitor pulse oximetry.
2. Rule out additional dive-related injuries or disorders.
3. Mask squeeze: Treatment is usually not required, resolves spontaneously.
4. Barosinusitis or Barodontalgia: Administer oral pain management medications, if permitted by local protocol. (Refer to Protocol VII.A)

---

## **ALS**

1. Initiate 0.9% Normal Saline or LR via IV/IO at KVO or saline lock.
2. Administer pain management medications, if needed. (Refer to Protocol VII.A)

## **Evacuation**

1. Conduct routine evacuation for a patient with symptoms of barotrauma.

## **Extended Care**

1. Monitor vitals signs and re-assess evacuation priority if patient condition worsens.

## **Follow Up**

1. All barotrauma patients should be advised to see a personal or team physician trained in dive medicine, or a dentist, upon return from an austere environment for further evaluation.

---

## F. Envenomation

### 1. Arthropods

#### Review of Injury/Illness

The most significant envenomation is from a black widow spider. Only the female is dangerous, identified by the red spot (usually hour glass-shaped) on its abdomen.

The brown recluse spider is a nondescript spider with a brown/purplish violin-shaped figure on its back. This spider can be found generally in the Southern United States, but has been identified as far north as Wisconsin.

Minor envenomation are from bees, wasps, hornets, and scorpions. The only poisonous scorpion species is the Bark Scorpion, indigenous to Arizona. Antivenin is only used for severe envenomation.

#### Signs and Symptoms

##### **Black Widow Spider**

- \* Mild prick sensation followed by severe muscle cramps and pain
- \* Pain progresses to chest, back, abdomen, and extremities
- \* Occasionally decreased blood pressure, respiratory distress, paralysis, and seizures
- \* Rarely fatal

##### **Brown Recluse (Fiddleback) spider (onset of symptoms up to 12 hours after envenomation)**

- \* Usually painless
- \* Ulcerative necrotic wound, in severe form
- \* Rare systemic reaction may occur (1-2 days after envenomation)
- \* Rarely fatal

##### **Scorpions**

- \* Significant localized pain and edema
- \* Little to no systemic effects
- \* May cause anaphylaxis or milder allergic reactions

##### **Bees**

- \* Familiar injury, localized pain, erythema and swelling (may be severe)
- \* May develop malaise, nausea, vomiting, fever
- \* May cause anaphylaxis or milder allergic reactions

#### Management

##### **General**

1. Black widow spider, brown recluse spider, and scorpion bites
  - a. Administer pain management medications. (Refer to Protocol VII.A.)
  - b. Apply ice/cold packs.
  - c. Monitor for development of systemic symptoms and/or anaphylaxis.

- 
2. Bee stings
    - a. Scrape away stinger.
    - b. Apply ice/cold packs.
    - c. Apply papain (meat tenderizer) or baking soda to help ease discomfort.
    - d. Consider oral antihistamines for systemic symptoms.

### **Evacuation**

1. Urgent evacuation are required for envenomations exhibiting systemic symptoms.
2. Evacuation is not required for envenomation, limited to localized symptoms, that respond to treatment.

### **Extended Care**

1. Maintain supportive and symptom-based treatment.
2. Monitor wound site for tissue necrosis and advancing infection.

---

## 2. Marine Life

### Review of Injury/Illness

Most marine bites and stings are at least transiently painful, while some involve envenomation as well. All create wounds at risk of infection with marine organisms. This section includes envenomation by animals found in the waters of the United States and the Caribbean:

- Jellyfish and Anemones
- Coral
- Sea Urchins
- Catfish
- Scorpionfish and other venomous fish
- Stingrays
- Cone Shells

### Signs and Symptoms

#### Jellyfish and Anemones (e.g., fire coral)

- \* Immediate stinging, itching, burning sensation
- \* Parasthesia
- \* Local edema and erythema, petechial hemorrhages
- \* May have a variety of other neurologic, cardiovascular, musculoskeletal, and gastrointestinal findings
- \* Anaphylactic shock is possible

#### Coral

- \* Pain, stinging, itching, redness
- \* Wounds become surrounded by reddish wheals (fades over 1-2 hours)
- \* Cellulitis and ulceration, with tissue exfoliation
- \* Lymphangitis and reactive bursitis (may or may not develop)

#### Sea Urchins

- \* Localized pain and tenderness
- \* Bluish discoloration at the entry site (may help locate the spine)
- \* Without treatment, spines can migrate into deeper tissues

#### Catfish

- \* Immediate and intense localized pain, radiates outward
- \* Pain typically lessens over 30-60 minutes (may last up to 48 hours)
- \* Localized swelling, ischemia with peripheral erythema
- \* Localized muscle spasms, fasciculations, weakness
- \* Syncope, decreased blood pressure, respiratory distress

#### Scorpionfish and other venomous fish species

- \* Immediate and intense pain, radiating outward
  - Without treatment, pain typically is most intense during the first 60-90 minutes, pain may persist for 6-12 hours

- \* **Initial localized tissue ischemia is followed by local cyanosis**
  - Accompanied by surrounding areas of redness, warmth and swelling
  - Vesicles may develop
  - Sloughing of tissue occurs within 48 hours
- \* **Neurologic symptoms may include anxiety, restlessness, delirium, headache, seizures, limb paralysis, peripheral neuropathy, tremors**
- \* **Gastrointestinal symptoms may include nausea, vomiting, diarrhea, abdominal pain**
- \* **Cardiovascular symptoms may include AV block, ventricular fibrillation, congestive heart failure**
- \* **Pulmonary symptoms may include respiratory distress, pulmonary edema**
- \* **Lymphangitis and arthralgia may also be present**

### **Stingrays**

- \* **Immediate and intense pain, radiates outward**
- \* **Localized swelling, ischemia with peripheral erythema, accompanied by rapid fat and muscle hemorrhage and necrosis**
- \* **The following symptoms may also develop:**
  - Nausea, vomiting and diarrhea
  - Headache, syncope, paralysis, fasciculations, seizures
  - Diaphoresis, vertigo, generalized swelling, weakness
  - Muscle cramps, inguinal and axillary pain
  - Tachycardia, decreased blood pressure, and dysrhythmia

### **Cone Shells**

- \* **Mild bee-like sting**
- \* **May also have localized ischemia, cyanosis, localized numbness**
- \* **Nausea, syncope, weakness, pruritus**
- \* **Aphonia, blurred vision, diplopia**
- \* **In more serious cases: localized parasthesia (may progress to circumoral parasthesia and then become generalized)**
- \* **Grave findings include disseminated intravascular coagulation (DIC), generalized muscle paralysis, cardiac and respiratory failure, and coma**

## **Management**

1. Jellyfish and Anemones
  - a. Assess and treat for anaphylaxis and respiratory distress.
  - b. Initiate 0.9% Normal Saline or LR via IV/IO at KVO or saline lock. Use warm fluids, if available.
  - c. For dermatitis:
    - Immediately apply a decontaminant for 30 minutes, or until pain is relieved.
      - 5% vinegar for box jellyfish
      - Vinegar, isopropyl alcohol, sodium bicarbonate, or diluted household ammonia (in order of preference)
      - If using papain (meat tenderizer), apply in a brief application not to exceed 15 minutes.
    - Rinse with salt water or forcibly rinse with fresh water under pressure

- 
- **DO NOT** immerse in hot water
  - After decontamination, apply shaving cream, or baking soda paste, and shave the area with a razor to remove nematocysts
  - Apply a mild topical corticosteroid (hydrocortisone cream 1%).
  - If severe, contact on-line medical direction **prior** to administering prednisone 60-100 mg QD; then taper for two additional weeks.
  - Apply dry, not moist, insulated ice packs
2. Coral
    - a. Rinse wound with a solution of 3% vinegar mixed 1:3 with Normal Saline or sterile water.
    - b. **DO NOT** close these wounds primarily
    - c. Evacuate for delayed primary repair.
  3. Sea Urchins
    - a. Immerse wound into hot water (as hot as the patient can tolerate) for 30-90 minutes, or until significant pain relief is obtained.
    - b. Remove any accessible spine fragments during the soaking period. Try not to break or crush the spines.
    - c. Treat as a puncture wound.
    - d. Use shaving cream to coat any attached pedicellariae, and then scrape away.
  4. Catfish, Scorpionfish and other venomous fish, Stingrays
    - a. Immerse wound into hot water (as hot as the patient can tolerate) for 30-90 minutes, or until significant pain relief is obtained.
    - b. Remove any accessible spine fragments during the soaking period.
    - c. Treat as a puncture wound.
    - d. Administer antibiotics (doxycycline).
    - e. Administer pain management medications (Refer to Protocol VII.A.)
  5. Cone Shell
    - a. Apply compression wrap with lymphatic occlusion. (Refer to Protocol VI.M)
    - b. **DO NOT** occlude arterial inflow. Check distal pulses and appropriate capillary refill frequently.
    - c. Immobilize affected body parts.

### **Evacuation**

1. Conduct urgent evacuation for envenomation exhibiting systemic symptoms.
2. Evacuation is not required for envenomation, limited to localized symptoms, that respond to treatment.

### **Extended Care**

1. Maintain supportive and symptom-based treatment.
2. Monitor wound site for tissue necrosis and advancing infection.

### 3. Reptiles

#### Review of Injury/Illness

Snake bites can cause damage to body tissue at the location of the bite and, if venomous, can cause both local tissue injury and systemic reactions. A snakebite, whether from a venomous or non-venomous snake, may cause severe fright reactions (e.g., nausea, tachycardia, diaphoresis), which may be difficult to distinguish from systemic manifestations of envenomation.

Non-venomous snakebites cause only local injury, usually pain and 2-4 rows of scratches from the snake's upper jaw at the bite site (horseshoe-shaped tooth marks).

Venomous snakebites cause local tissue damage and possible systemic injury. 20-30% of venomous snakebites result in no envenomation (dry bite). It is important for Austere medical providers be familiar with the identification, range, and habits of indigenous venomous reptiles.

Gila "Monster" Lizards are also known for bites with a vise-like grip that delivers poison through its saliva. It is the only venomous lizard species found in the United States (southwestern).

#### Signs and Symptoms

- \* **Characteristic fang marks often present; may be in association with other teeth marks; may appear as single puncture.**
  - "U" or horseshoe-shaped bite pattern may suggest non-venomous snake bite
- \* **Pain, tenderness, redness, swelling rapidly develop at site and may worsen progressively**
- \* **Venom may be neurotoxin, hemotoxin or both.**
  - Neurologic symptoms suggest systemic neurotoxin absorption
  - Coagulopathies indicate probable hemotoxin absorption and may be indicated by persistent bleeding from fang marks, venipuncture sites, gingival tissue, or gastrointestinal tract

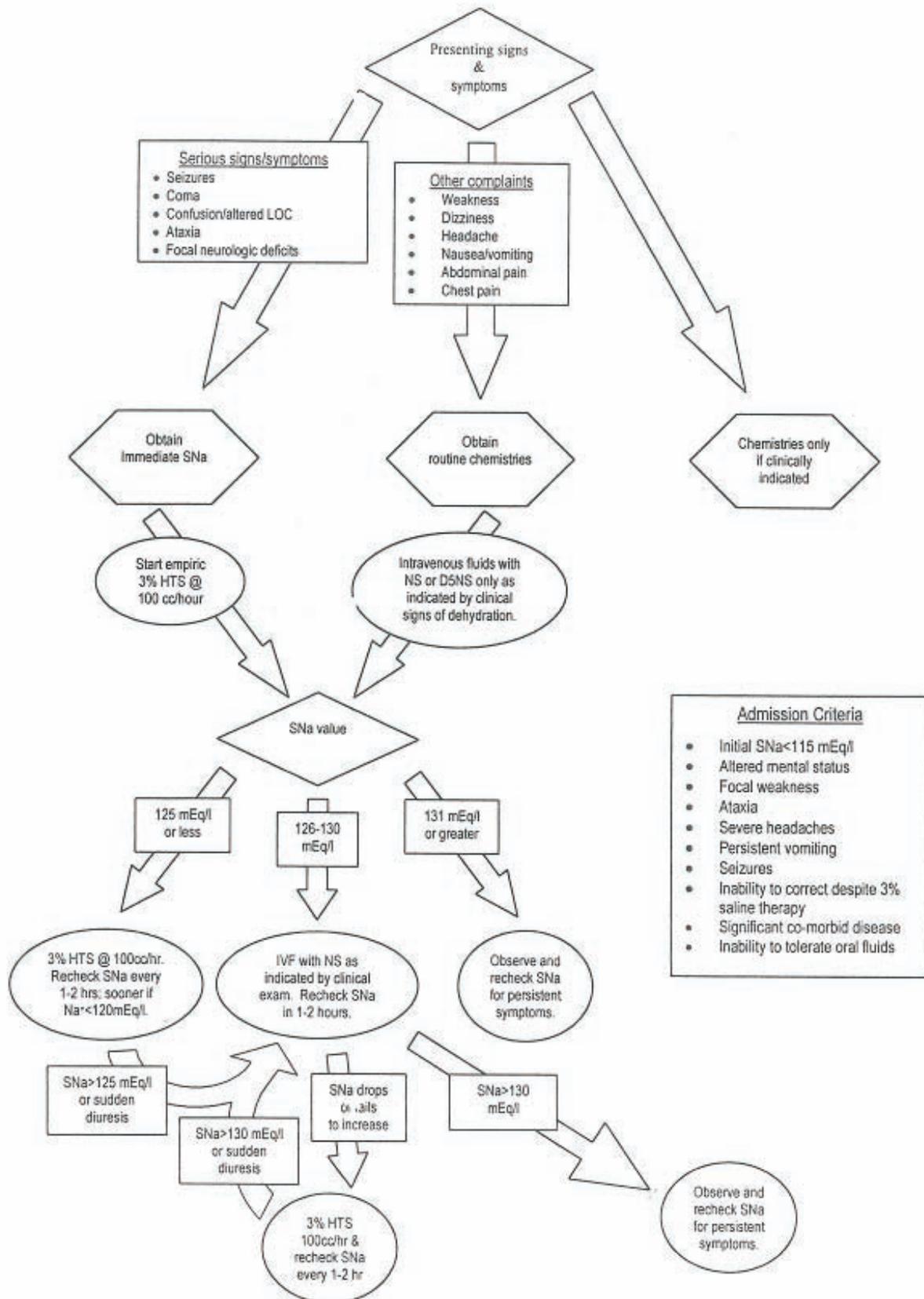
#### **Crotalid Envenomation (Rattlesnakes, Copperheads and Water Moccasins)**

- \* **Pain, tenderness, redness, swelling rapidly develop at site and progressing up the extremity within the next several hours**
- \* **Neurotoxic and hemotoxic**
  - Systemic reaction possible
  - Bleeding and ecchymosis may occur at sites distant from bite, indicating coagulopathy from hemotoxins

#### **Elapid Envenomation (Coral Snakes)**

- \* **Primarily neurotoxic**
  - Local signs of envenomation (e.g., pain, swelling, redness, ecchymosis) may be minimal
  - Onset of systemic symptoms (e.g., numbness, muscle paralysis, headache, other neurologic symptoms) may be delayed by several hours
  - The absence of immediate symptoms is NOT evidence of a harmless bite.

## Heat Emergencies and Hyponatremia



## Heloderma Envenomation (Gila “Monster” Lizards)

- \* **Neurotoxic**
- \* **Pain, tenderness (can last for weeks), redness, swelling rapidly develop at site and may worsen progressively**
- \* **Dizziness and generalized weakness**
- \* **Rarely fatal**

| Degree of Envenomation Present |   |
|--------------------------------|---|
| Envenomation                   | Characteristics   |
| None                           | Fang marks, but no local or systemic reactions  |
| Minimal                        | Fang marks, local swelling and pain, but no systemic reactions  |
| Moderate                       | Fang marks, swelling progressing beyond bite site, systemic symptoms present (e.g., nausea, vomiting, parasthesias, or hypotension) |
| Severe                         | Fang marks, marked swelling of entire extremity, subcutaneous ecchymosis, severe symptoms, coagulopathy                             |

## Management

### General

1. **DO NOT** make incisions.
2. **DO NOT** use suction by mouth or device.
3. **DO NOT** use constricting bands or tourniquets.
4. **DO NOT** apply electrical shocks.
5. **DO NOT** use cold or ice.
6. **DO NOT** use alcohol or aspirin.
7. Field use of antivenin is **NOT** currently recommended.
8. Rapid evacuation is the key to successful treatment.

### BLS

1. Assess ABCs, provide cardiopulmonary support as needed.
2. Administer supplemental oxygen, as needed. Assist ventilations with a bag valve mask (BVM), if necessary.
3. Obtain description or identification of snake or lizard, or photograph the snake or lizard using a cell phone or camera, if possible.
4. Note patient’s blood type on patient’s chart, if known.
5. Swab bite site with moistened gauze sponges or irrigate with normal saline (or clean water) to remove any venom on skin.
6. Remove any retained teeth, fangs with forceps.

7. **If elapid (Coral Snake) bite:** Apply compression bandage starting at the bite and wrapping along the length of the arm or leg and back again to the bite.
8. **DO NOT apply compression bandage for Crotalid or Heloderma species bites.**
9. Splint extremity bites and keep the extremity in a neutral position, level with the heart.
10. Evacuate by stretcher, if possible.

## **ALS**

1. If the patient is in respiratory arrest, consider advanced airway management:
  - a. Approved supraglottic device; or
  - b. Endotracheal intubation; or
  - c. Surgical cricothyroidotomy
2. Initiate 0.9% Normal Saline or LR via IV/IO at KVO or saline lock. Use warm fluids, if available.
3. If the patient is in respiratory distress from venom-induced paralysis, administer atropine 0.5-1.0 mg IV/IO.
  - a. If patient improves within 3-10 minutes, continue atropine 0.5 – 1.0 mg IV/IO q2-3h **and** neostigmine 0.5-2.0 mg by slow IV/IO, over 4 minutes. Repeat as needed, up to total maximum dose of 5.0 mg.
4. Administer antibiotics **ONLY** for extended scene care of a necrotic snakebite wound according to local protocol.

## **Evacuation**

1. Conduct urgent evacuation for any snakebite exhibiting systemic symptoms, all elapid (Coral Snake) bites, and all bites with moderate to severe envenomation.
2. Conduct priority evacuation for any snakebite exhibiting localized symptoms, and/or minor envenomation.
3. Evacuation is usually not required for snakebites, or other reptile bites, with no evidence of envenomation.

## **Extended Care**

1. Maintain supportive and symptom-based treatment.
2. Monitor wound site for tissue necrosis and advancing infection.
3. Provide anti-tetanus prophylaxis, if needed and available. (Refer to Protocol V.V.)

## **Other/Special Considerations**

1. Local medical professionals may have specialized experience with envenomation from indigenous species and can be used as a resource.
2. If stretcher evacuation is not possible, patients with Crotalid or Heloderma species bites may walk out.
3. Patients with elapid bites **must** be evacuated by stretcher.

---

## G. Heat-related Disorders

### 1. Hyperthermia

#### **Review of Injury/Illness**

“Heat exhaustion” and “heat stroke” are acute conditions in which the body produces or absorbs more heat than it can effectively dissipate into the environment, causing a dangerous increase in core body temperature. The two conditions are the most common forms of heat-related illness that require EMS treatment. These conditions may be associated with dehydration and electrolyte abnormalities. Heat stroke is a life-threatening emergency that may or may not be preceded by heat exhaustion.

Hyponatremia is a life-threatening emergency caused by increased hydration without intake of food or salt. Symptoms are caused by low serum sodium ( $\text{Na}^+$ ) levels.

#### **Anatomy and Physiology**

##### **Heat Exhaustion**

1. Inadequate hydration
2. Hot weather exertion
3. Lack of acclimatization

##### **Heat Stroke**

1. Exposure to high temperatures or vigorous exertion
2. Lack of acclimatization
3. Decreased physical fitness
4. Cardiac Hx
5. Elderly
6. Certain medications increase risk (Refer to “Other/Special Considerations.”)

##### **Hyponatremia**

1. Excessive hydration with water without eating
2. Sodium not replaced by food or inadequately replaced by electrolyte sport drinks (have insufficient  $\text{Na}^+$ )
3. Increased sweating, resulting in the loss of sodium
4. Use of NSAIDs during activity
5. Females are at a greater risk than males

## Signs and Symptoms

|                  | Heat Exhaustion  | Heat Stroke                                     | Hyponatremia                                  |
|------------------|--|---|---|
| Core Temperature | Normal to slightly   | Marked increase*                                | Normal to slightly                            |
| Heart Rate       | Often increased  | Increased                                       | Normal  |
| Respiratory Rate | Normal to increased  | Increased                                       | Varies  |
| Blood Pressure   | Normal or decreased  | Often decreased                                 | Normal to slightly                            |
| Skin             | Wet<br>Sweating  | Hot, dry and red (50%)<br>Sweating (50%)        | Normal to cool<br>May or may not be sweating  |
| Mental Status    | Awake, Normal<br>“Light-headedness”                                    | AMS<br>Confused, Agitated<br>Combative behavior | AMS<br>Slow mentation<br>Disoriented          |
| Other            | Nausea<br>Muscle cramps/spasms<br>Dark urine<br>Decreased urine output | Nausea<br>Dilated pupils<br>Seizures            | Nausea<br>Tremors<br>Near normal urine output |

\* Core temperature can reach or exceed 105° F (41° C).

## Preventive Measures

1. Heat Exhaustion and Heat Stroke:
  - a. Follow appropriate work/rest cycles based on environmental conditions (Refer to chart in “Other/Special Considerations.”)
  - b. Hydrate to replenish fluids. (Refer to chart in “Other/Special Considerations.”)
  - c. Eating is critical to maintain normal activity. Even in high temperatures, eat a normal diet to replenish essential vitamins, minerals, and sodium.
  - d. For more advanced dehydration prevention measures, refer to Protocol III.D.
2. Hyponatremia
  - a. Replace Na<sup>+</sup> by consuming high-sodium snack foods during event
  - b. One teaspoon of table salt ≈ 2.6 gm Na<sup>+</sup>
  - c. **DO NOT** administer ASA, NSAIDs, acetaminophen, diuretics, narcotics, psychotropic medications prior to and during event.

## Management

### **BLS**

1. Heat Exhaustion
  - a. Stop physical exertion.
  - b. Move the patient to a cooler, shaded location.
  - c. Remove as much clothing and equipment as possible.

- 
- d. Cool the patient with tepid or cool (not cold or iced) water and/or towels soaked with tepid water; the more skin surface actively cooled, the better.
    - Increase airflow over the moist skin to increase evaporation.
    - Avoid inducing shivering, which is one of the body's mechanisms for warming itself.
    - Monitor mental status and core body temperature (rectal) temperature to avoid over-cooling, if possible.
    - Monitor for rebound hyperthermia when measures are discontinued after initial cooling, and restart if core body temperature exceeds 101° F.
  - e. Have patient eat salty food or snack, if the patient is awake and able to swallow.
  - f. Carefully begin oral rehydration with carbohydrate/electrolyte drink mixes, if patient is awake and able to swallow.
    - Dilute carbohydrate/electrolyte drink solutions with water (50:50) to avoid an osmotic shift and diarrhea.

## 2. Heat Stroke

- a. Stop physical exertion.
- b. Move the patient to a cooler, shaded location.
- c. Remove as much clothing and equipment as possible.
- d. Aggressively cool the patient with tepid or cool (not cold or iced) water and/or towels soaked with tepid water; the more skin surface actively cooled, the better.
  - Increase airflow over the moist skin to increase evaporation.
  - Immerse the patient into a cold bath, if available.
  - Avoid inducing shivering, which is one of the body's mechanisms for warming itself.
  - Monitor mental status and core body temperature (rectal) temperature to avoid over-cooling, if possible. Stop cooling when core body temperature < 102° F, or when mental status improves.
  - Monitor for rebound hyperthermia when measures are discontinued after initial cooling, and restart if core body temperature exceeds 101° F.
- e. Carefully begin oral rehydration with carbohydrate/electrolyte drink mixes, if patient is awake and able to swallow, once the patient has been sufficiently cooled. Cooling has priority over rehydration.
  - Administer oral glucose to the patient and/or add sugar to oral rehydration solution.

## 3. Hyponatremia

- a. Stop physical exertion.
- b. Move the patient to a cooler, shaded location.
- c. Problem is a lack of salt, not a lack of water. **DO NOT** offer increased hydration with water.
- d. Have patient eat salty snack foods. (Refer to chart in “Other/Special Considerations.”)
- e. Carefully begin oral rehydration with carbohydrate/electrolyte drink mixes, if patient is awake and able to swallow. If ready-made solutions are not available, refer to “Other/Special Considerations” for an alternative solution.

---

## ALS

1. Heat Exhaustion/Heat Stroke
  - a. Administer initial 500 ml fluid bolus of D5NS (preferred), D5LR, or 0.9% Normal Saline, up to a maximum total infusion of 3,000 ml without consulting on-line medical direction. Titrate to maintain Systolic BP > 100 mm Hg.
    - Continue fluid therapy until symptoms resolve.
    - Contact on-line medical direction for additional fluid infusions.
2. Hyponatremia
  - a. Only follow the algorithm, if accurate chemistries can be obtained.
  - b. If unable to obtain accurate chemistries, follow BLS management procedures.
  - c. Initiate 0.9% Normal Saline or LR via IV/IO at KVO or saline lock.

## Evacuation

1. Conduct urgent evacuation for:
  - a. ALL heat stroke patients
  - b. Hyponatremia patients with abnormal mental status, decreasing mental status, or positive neurological signs/symptoms
  - c. Any patient that continues to deteriorate despite treatment
2. Conduct priority evacuation for:
  - a. Heat exhaustion patients
    - With no IV/IO access that can't be orally rehydrated
    - Whose urine changes from dark brown to red in color
    - Whose core body temperature is > 102° F
  - b. Suspected hyponatremia patients
3. Conduct routine evacuation required for heat exhaustion patients with a core body temperature < 102° F who do not quickly respond to treatment.
4. Evacuation is usually not required for cases of mild heat exhaustion, in otherwise healthy and fit persons, and hyponatremia patients who respond with treatment.

## Extended Care

### General

1. Observe for mental status changes.
2. Continue to monitor core body temperature.
3. Reevaluate evacuation priority if condition worsens with treatment.
4. Monitor and record patient's intake and output (I&O) of fluids and food.

- 
5. Continue to monitor improving patients for 24-48 hours.
  6. Patient who improves should avoid heat exposure/exertion for 24-48 hours.

## **BLS**

### **Heat Exhaustion**

1. Monitor urine for changes in color (dark brown or red).
2. Continue oral rehydration and salt replacement.

### **Heat Stroke**

1. Monitor for rebound hyperthermia when measures are discontinued after initial cooling, and restart if core body temperature exceeds 101° F.

## **ALS**

### **Heat Exhaustion**

1. Titrate IV/IO fluid administration to maintain urinary output 1-2 ml/kg/hr.

### **Heat Stroke**

1. Titrate IV/IO fluid administration to maintain urinary output 1-2 ml/kg/hr.
2. Perform urinary catheterization, if necessary. (Refer to Protocol VI.P)
3. If hypoglycemic (blood sugar < 60 mg/dL), administer D50W 25-50 gm IV/IO.
4. For seizures and combative behavior, consider any of the following sedatives, according to local protocols:
  - a. Lorazepam: Administer 1.0-2.0 mg IV/IO/IM; repeat every 5 minutes, up to a maximum of 10 mg.
  - b. Midazolam: Administer 2.0 mg IV/IO; repeat once, up to maximum of 4.0 mg.
  - c. Diazepam: Administer 5.0 mg IV/IO; repeat once, up to a maximum of 10 mg.

### **Follow-up**

1. All patients with a heat emergency or hyponatremia that improves with treatment should see a personal or team physician upon return from an austere environment.

### **Other/Special Considerations**

1. Certain medications can increase risk of heat stroke (e.g., alcohol [EtOH], stimulants, antihistamines, decongestants, ephedrine, some anti-hypertension medications, diuretics, psychotropic drugs).

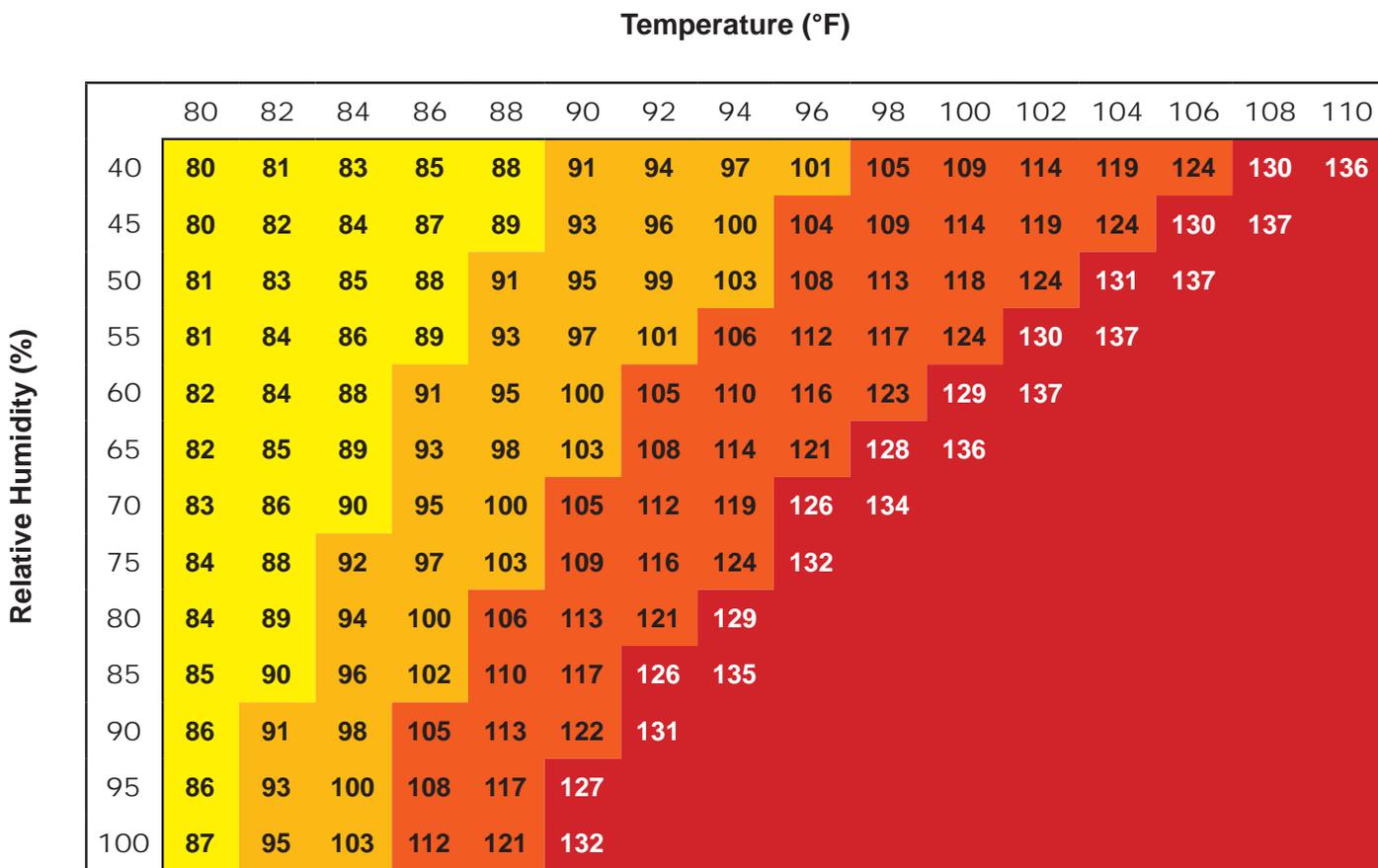
## Improvised Electrolyte Replacement Drink

- 1 ½ tablespoons sugar
- ½ tablespoon salt (1,163 mg of Na<sup>+</sup>)
- ¾ tablespoon baking soda
- ¼ tablespoon potassium based salt substitute
- 1 quart (1 liter) potable water
- Flavoring (e.g., powdered drink mix, lemon juice)\*

\* If the flavoring mix contains salt and/or sugar, adjust the formula to decrease amounts.

| Foods                      | Sodium Content<br>(mg per 100 gm or 3.5 ounces) |
|----------------------------|---|
| Table salt                 | 39,300 mg                                       |
| Chicken bouillon cubes     | 16,300 mg                                       |
| Soy sauce                  | 7,120 mg  |
| Minestrone soup, dry (pkt) | 6,400 mg  |
| Tomato soup, dry (pkt)     | 3,100 mg  |
| Bacon, back, grilled       | 2,700 mg  |
| Black bean sauce           | 2,150 mg  |
| Smoked salmon              | 1,880 mg  |
| Salami                     | 1,800 mg  |
| Pretzels                   | 1,720 mg  |
| Cornflakes                 | 1,100 mg  |
| Hard cheese                | 1,000 mg  |
| Tortilla chips             | 850 mg  |
| Potato chips               | 850 mg  |
| Margarine (average)        | 800 mg  |
| Butter regular (average)   | 750 mg  |

## General Guidelines for Routine Physical Activity in Hot Weather\*



### Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution
  Extreme Caution
  Danger
  Extreme Danger

| Heat Index (°F) | Acclimated Personnel   | Non-Acclimated Personnel  |
|-----------------|--|---|
| 82-84.9°F       | Normal Duties  | Use discretion in planning physical activity<br>Limit intensity of work and exposure to sun<br>Provide constant supervision |
| 85-87.9°F       | Use discretion in planning intense physical activity<br>Limit intensity of work and exposure to sun<br>Provide constant supervision. | Strenuous exercises such as physical training will be cancelled   |
| 88-89.9°F       | Minimize strenuous outdoor activities for all personnel with less than 12 weeks training in local or comparable weather environment  | All physical training, strenuous activities cancelled   |
| 90°F and above  | Essential Duties only  | Strenuous activities and non-essential duty cancelled   |

\* Numbers within the chart represent approximate Dry Bulb Heat Index (°F)

## Hydration and Work/Rest Cycles for Warm and Hot Weather

The following table provides information necessary to calculate recommended work/rest cycles, water requirements, maximum work times, and recovery times.

| Heat Index <sup>1</sup><br>(°F) | Easy Work                           |   | Moderate Work                       |   | Hard — Strenuous Work               |   |
|---------------------------------|-------------------------------------|---|-------------------------------------|---|-------------------------------------|---|
|                                 | Work/Rest <sup>2</sup><br>(minutes) | Water Intake <sup>3</sup><br>(Quart/Hr) | Work/Rest <sup>2</sup><br>(minutes) | Water Intake <sup>3</sup><br>(Quart/Hr) | Work/Rest <sup>2</sup><br>(minutes) | Water Intake <sup>3</sup><br>(Quart/Hr) |
| 78-81.9                         | No Limit                            | 1/2                                     | No Limit                            | 3/4                                     | 40/20                               | 3/4                                     |
| 82-84.9                         |                                     | 1/2                                     | 50/10                               |   | 30/30                               | 1                                       |
| 85-87.9                         |                                     | 3/4                                     | 40/20                               |   | 30/30                               |   |
| 88-89.9                         |                                     | 3/4                                     | 30/30                               |   | 20/40                               |   |
| 90 or more                      | 50/10                               | 1                                       | 20/40                               | 1                                       | 10/50                               |   |

- 1 Wearing body armor adds 5 degrees (F) to heat index, wearing full MOPP gear adds 10 degrees (F) to heat index.
- 2 The work/rest times and fluid replacement volumes will sustain performance and hydration for at least 4 hours in the specified heat category. Individual water needs will vary by approximately ¼ quart per hour.
- 3 Hourly fluid intake should not exceed 1-2 quarts. Daily fluid intake should not exceed 12 quarts. Remember to eat to maintain normal electrolyte (salt) levels

---

## 2. Other Conditions

### Review of Injury/Illness

Common minor heat disorders include heat rash (Miliaria Rubra or “prickly heat”), heat edema, heat cramps, and heat syncope.

### Anatomy and Physiology

#### **Heat Rash (Miliaria Rubra)**

1. Caused by blocked, inflamed, or infected sweat glands
2. Recovery of sweat gland function occurs in 7-10 days after treatment
3. Breakdown and sloughing of the epidermis may occur

#### **Heat Edema**

1. Fluid pools in extremities and skin in response to heat stress
2. Usually self-corrects in a few days as plasma volume increases to compensate for increased blood flow to skin

#### **Heat cramps**

1. Associated with dehydration and corresponding electrolyte depletion
2. Increased sweating, resulting in loss of sodium

#### **Heat Syncope**

1. Syncope occurs after a prolonged period of standing in a hot environment
2. Reduced effective blood volume rather than volume depletion
3. Decreased cerebral blood flow due to shunting of blood to skin, lower extremities

### Signs and Symptoms

#### **Heat Rash**

- \* Erythematous, papular, pruritic rash developing on actively sweating skin
- \* In hot, dry climates, rash may be confined to skin that is covered by clothing
- \* May be susceptible to secondary infection

#### **Heat Edema**

- \* Peripheral edema noted during the first few days in a hot environment

#### **Heat Cramps**

- \* Painful muscle spasms that occur in heavily worked muscles
- \* Usually involves the lower extremities and abdomen
- \* May occur during or after exercise
- \* May occur in physically fit and acclimated personnel

---

## Heat Syncope

- \* Syncope occurs after a prolonged period of standing in a hot environment
- \* May also occur with sudden standing from a sitting or prone position
- \* Brief loss of consciousness
- \* Body temperature normal (normothermic)
- \* Hypotension and bradycardia often present (vagal)
- \* May be accompanied by N/V, headache, dizziness, restlessness

## Preventive Measures

1. Proper acclimatization to a new environment
2. Daily hydration with oral electrolyte replacement
  - a. Eat salty snack foods
  - b. Drink electrolyte replacement drinks
3. For additional prevention measures, refer to Protocol III.D and III.G.

## Management

### General

1. If conditions for heat injury exist and patient does not rapidly return to consciousness, always consider the possibility of heat stroke. (Refer to Protocol III.G.)

### BLS

1. Heat Rash
  - a. Cool and dry the affected skin areas.
  - b. Advise the patient to apply talcum powder, or cornstarch, to affected areas.
  - c. Advise the use of loose fitting, lightweight clothing.
  - d. If sweating is impaired, monitor the patient for the increased risk of heat injury.
2. Heat Edema
  - a. Medical treatment not normally required, as the condition is usually self-correcting.
  - b. If the condition persists beyond 2-3 days, reevaluate for other causes of edema.
3. Heat Cramps
  - a. Move the patient to a cooler, shaded location.
  - b. Carefully begin oral rehydration with carbohydrate/electrolyte drink mixes, if patient is awake and able to swallow. (Refer to Protocol III.G.)
  - c. Advise active stretching of the affected muscles.
  - d. **DO NOT** use NSAIDs.

---

#### 4. Heat Syncope

- a. This condition is often self-correcting when patient faints, as cerebral blood flow is restored while the patient is in the supine position.
- b. Rule out and treat injuries caused by the fall, as needed.
- c. Move the patient to a cooler, shaded location.
- d. Carefully begin oral rehydration with carbohydrate/electrolyte drink mixes, if patient is awake and able to swallow. (Refer to Protocol III.G.)
- e. Rule out other causes of syncope (e.g., hypoglycemia, prior head injury, cardiac dysrhythmias).
- f. Anxiety-induced hyperventilation may occur. Calm and reassure the patient. **DO NOT** sedate.
- g. Advise the patient not to engage in vigorous activity.
- h. The patient may resume normal duties when hydration state and urine output return to normal.

### **ALS**

#### 1. Heat Rash

- a. For secondary skin infection, administer topical anti-fungal or antibiotic preparation, as needed.

#### 2. Heat Cramps

- a. Administer initial fluid bolus 0.9% Normal Saline or LR 250-500 ml, up to a maximum total infusion of 2,000 ml without consulting on-line medical direction.

#### 3. Heat Syncope

- a. Administer initial fluid bolus 0.9% Normal Saline or LR 250-500 ml, up to a maximum total infusion of 2,000 ml without consulting on-line medical direction.
- b. Obtain 12-lead ECG and monitor cardiac rhythm and treat any dysrhythmia according to current American Heart Association (AHA) ACLS guidelines.

### **Evacuation**

1. Evacuation is not usually required for heat rash, heat edema, heat cramps or heat syncope.
2. Conduct priority evacuation if the patient does not improve, or worsens, after treatment.

### **Extended Care**

1. Monitor patient status daily until condition resolves.

### **Follow-up**

1. All patients treated for minor heat-related disorders should see their team or personal physician upon return from an austere environment.

## H. Vector-borne Illnesses

### Review of Injury/Illness

This protocol concerns common vector-borne illnesses that occur in the United States.

Epidemiology of vector-borne illnesses:

| Disease                                   | Organism  | Type                    | Vector(s)  |
|---|---|-------------------------|--|
| Lyme Disease                              | Borrelia<br>Burgdorffei   | Spirochete<br>Bacteria  | Deer tick ( <i>Ixodes scapularis</i> )<br>Western black-legged tick ( <i>Ixodes pacificus</i> )  |
| Rocky Mountain<br>Spotted Fever<br>(RMSF) | Rickettsia<br>Rickettsii  | Spirochete<br>Bacteria  | Rocky Mountain wood tick ( <i>Dermacentor andersoni</i> )<br>American dog tick ( <i>Dermacentor variabilis</i> )<br>Other species have also been linked      |
| Colorado Tick<br>Fever                    | Colorado Tick Fever<br>Virus (CTFV)                                     | Virus                   | Rocky mountain wood tick ( <i>Dermacentor andersoni</i> )  |
| Tick Paralysis                            | None, only tick-borne<br>illness not caused by a<br>pathogenic organism | N/A                     | Rocky Mountain wood tick ( <i>Dermacentor andersoni</i> )<br>American dog tick ( <i>Dermacentor variabilis</i> )<br>Many other species have also been linked |
| Giardia                                   | Giardia lamblia   | Flagellate<br>Protozoan | Beavers, deer, rodents, cattle, sheep, dogs, and cats<br>Transmitted via contaminated water source   |
| West Nile Virus<br>(WNV)                  | West Nile Virus   | Flavivirus              | Mosquitoes (birds are alternate hosts)   |

### Anatomy and Physiology

#### Lyme Disease

1. Lyme Disease is a multi-stage illness.
2. The tick may have to be attached  $\geq 24$  hours before transmitting infection. The longer the tick is attached, the greater the chance of infection.
3. Onset of symptoms: Average 7-10 days after exposure (range 3-32 days).

#### Rocky Mountain Spotted Fever

1. Onset of symptoms: Average 2-14 days after exposure; the more rapid onset indicates a greater severity in illness.
2. Most common in the southeastern-south central United States

#### Colorado Tick Fever

1. Onset of symptoms: Average 3-6 days after exposure (range 0-14 days).

---

## Tick Paralysis

1. This condition is the only tick-borne illness that is not caused by a pathogenic organism.
2. Onset of symptoms: Average 5-6 days, after female tick attaches to human host.
3. Diagnosis confirmed if the patient rapidly improves after tick removal.

## Giardia

1. In the United States, this condition is most commonly transmitted to humans via contaminated water sources.
2. Onset of symptoms: Average 1-3 weeks after exposure; typical onset is sub-acute, slow and subtle, although an abrupt onset is also possible.
3. Symptoms may wax and wane over course of illness

## West Nile Virus

1. Onset of symptoms: Average 3-6 days after exposure (range 0-14 days).
2. Symptoms are typically mild and persist for a few days to several weeks.
3. WNV should always be considered in persons with unexplained encephalitis and meningitis, particularly if patient age is > 45 years.
4. Fatalities have been reported.

## Signs and Symptoms

### Lyme Disease

#### STAGE 1

- \* **Erythema migrans (bull's-eye rash) (20-50% of patients)**
  - An expanding, ring shaped, erythematous rash
  - Borders typically flat
  - Central red macule or papule, partially clearing over time
  - Outer borders remain bright red
  - Central lesion may be intensely red and indurated, vesicular or necrotic
  - Many variations to pattern, including multiple rings
  - Average Size: 6" in diameter (15 cm)
  - Average Range: 1-27" (3-68 cm)
  - Fades 28 days without treatment (range 1-14 weeks) or within a few days with antibiotic treatment
- \* **Other Symptoms (usually mild)**
  - Headache
  - Fever
  - Chills
  - Regional lymphadenopathy
  - Fatigue, malaise
  - Neck stiffness
  - Arthralgia, myalgia

## STAGE 2 (Onset a few days or weeks after bite)

- \* Multiple smaller annular lesions may develop (20-50% of patients)
  - May occur anywhere EXCEPT palms or soles
  - Less common: Malar rash
  - Rare: Urticaria
- \* Low grade, intermittent fever
- \* Tender regional adenopathy associated with erythema migrans
- \* Generalized adenopathy
- \* Splenomegaly (LUQ of ABD)
- \* Other symptoms
  - Meningeal irritation: Stiff neck with decreased flexion (difficulty touching chin to chest)
  - Mild encephalopathy (e.g., drowsiness, insomnia, memory disturbances, mood swings, dizziness, decreased balance and clumsiness)
  - Dysesthesia of the scalp
  - Musculoskeletal (e.g., arthralgia; migratory pain in tendons, bursae and bones; generalized stiffness; severe cramping pain, particularly in the calves, thighs and back)
  - Hepatitis-like symptoms with diffuse abdominal pain
  - Conjunctivitis (10-15% of patients)
  - Neurologic (e.g., headache, facial nerve palsy, stiff neck, one-sided paralysis)
  - Cardiac: AV block, complete heart block (4-10% of patients)
  - Arthritis (60% of untreated patients)

## Rocky Mountain Spotted Fever

- \* Fever > 102° F (39° C)
- \* Chills
- \* Headache
- \* Myalgia
- \* Rash (Completely absent in 10-15% of patients [“Spotless Fever”])
  - Rash often absent on initial presentation
  - Develops first on wrists, hands, ankles, and feet
  - Spreads outward to cover most of body, INCLUDING palms and soles
  - Lesions are initially small (2.0-5.0 mm) pink macules that blanch with pressure
  - After 2-3 days, lesions become fixed and darker red, papular, and ultimately petechial in appearance
  - Hemorrhagic lesions may form large areas of ecchymosis
- \* Other symptoms
  - ABD pain, nausea, vomiting, diarrhea
  - Confusion/disorientation, altered mental status, coma
  - Conjunctivitis
  - Peripheral edema
  - Seizures possible during initial phase, rarely persist
  - Cough, chest pain, dyspnea, URI-like symptoms
  - In most fulminant form, vascular collapse and death may occur within 3-6 days of onset

---

## Colorado Tick Fever

- \* Abrupt onset fever
  - Fever typically biphasic or “saddleback” (50% of patients)
  - 2-3 days of fever, followed by 1-2 days of remission, then an additional 2-3 days of fever
- \* Rash (frequently absent; macular or maculopapular rash in 5-12% of patients)
- \* Other symptoms
  - ABD pain, nausea, vomiting, diarrhea
  - Anorexia
  - Ocular pain (e.g., photophobia)

## Tick Paralysis (Rare in humans and usually occurs in children under the age of 10, mostly girls)

- \* Restlessness
- \* Irritability
- \* Neurological (progressive symptoms)
  - Loss of coordination, ataxia
  - Hand and feet paralysis
    - Ascending, symmetrical and flaccid paralysis (24-48 hours, after symptom onset)
    - Loss of deep tendon reflexes (DTR)
      - May be followed by general weakness, with bulbar and respiratory paralysis
  - Facial paralysis (associated with ticks found behind the ear)

## Giardia

- \* Fever
- \* Nausea and vomiting infrequent EXCEPT during initial onset
- \* Early satiety
- \* Stools become mushy and malodorous
- \* No blood or pus in stools
- \* Watery diarrhea, alternating with soft stools and even constipation
- \* Middle and upper ABD cramping, intense acid indigestion, sulfurous belching, malodorous flatus, bowel distention
- \* May develop into a chronic condition with malabsorption and resulting weight loss
- \* Abrupt onset form is associated with explosive, watery diarrhea, abdominal cramps, malodorous flatus, vomiting, fever and malaise for 3-4 days, then transitions to more common, sub-acute syndrome.

## West Nile Virus (WNV) (80% of patients are asymptomatic)

- \* Fever, headache, body aches (flu-like)
- \* Nausea, vomiting
- \* Lymphadenopathy
- \* Rash
  - May be maculopapular or morbilliform, involving the neck, trunk, arms, or legs
- \* Severe neuroinvasive WNV (develops in 0.5% of patients, with a median age of > 45) (Symptoms may last for weeks, and neurologic effects may be permanent.)
  - High fever

- **Headache**
- **Neck stiffness, muscle weakness, ataxia**
- **Confusion/disorientation, altered mental status, coma**
- **Convulsions**
- **Numbness, paralysis, tremors**
- **Vision loss, diplopia**

## **Management**

### **General**

#### 1. Lyme Disease

- a. Remove the tick by grasping closely to the skin surface with tweezers, forceps or hemostat and pull out with steady, gentle pressure.
  - Do not use petroleum jelly, fingernail polish, a hot match, heat, gasoline, oil, alcohol, etc., as this may force the tick to regurgitate pathogens and/or toxins into wound.
  - If the tick's head is still embedded in the skin, remove it with a needle, as you would a splinter.
- b. Watch the bite site with soap and water.
- c. Administer antibiotics according to local protocol.
- d. Consider prophylaxis following tick bite:
  - Doxycycline 200 mg PO x1 dose, following removal of the tick.

#### 2. Rocky Mountain Spotted Fever

- a. Remove the tick by grasping closely to the skin surface with tweezers, forceps or hemostat and pull out with steady, gentle pressure.
  - Do not use petroleum jelly, fingernail polish, a hot match, heat, gasoline, oil, alcohol, etc., as this may force the tick to regurgitate pathogens and/or toxins into wound.
  - If the tick's head is still embedded in the skin, remove it with a needle, as you would a splinter.
- b. Watch the bite site with soap and water.
- c. Administer antibiotics according to local protocol.
  - Continue antibiotics for 48 hours, after patient becomes afebrile.
  - The patient must have a minimum antibiotics course of 5-7 days.

#### 3. Colorado Tick Fever

- a. Remove the tick by grasping closely to the skin surface with tweezers, forceps or hemostat and pull out with steady, gentle pressure.
  - Do not use petroleum jelly, fingernail polish, a hot match, heat, gasoline, oil, alcohol, etc., as this may force the tick to regurgitate pathogens and/or toxins into wound.
  - If the tick's head is still embedded in the skin, remove it with a needle, as you would a splinter.
- b. Watch the bite site with soap and water.

---

c. No specific treatment available. Provide supportive, symptom-based treatment.

- Administer antibiotics according to local protocol.

#### 4. Tick Paralysis

a. Remove the tick by grasping closely to the skin surface with tweezers, forceps or hemostat and pull out with steady, gentle pressure.

- Do not use petroleum jelly, fingernail polish, a hot match, heat, gasoline, oil, alcohol, etc., as this may force the tick to regurgitate pathogens and/or toxins into wound.
- If the tick's head is still embedded in the skin, remove it with a needle, as you would a splinter.

b. Watch the bite site with soap and water.

c. The patient's condition should improve within a few hours following tick removal. Treatment is otherwise supportive and symptom-based.

#### 5. Giardia

a. Three classes of drugs are currently in use. (No drug is effective in all cases.)

- Nitromidazoles (metronidazole, tinidazole)
- Nitrofurans derivatives (furazolidone)
- Acridine compounds (quinacrine)

b. Treat initially with metronidazole 250 mg PO tid for 7-10 days.

- **If possible, delay treatment in pregnant females until after delivery, due to risks to the fetus associated with all three drug classes. Contact on-line medical direction for further guidance.**

#### 6. West Nile Virus

a. No specific treatment is available

b. Provide supportive, symptom-based treatment.

### **Evacuation**

1. Conduct priority evacuation required for patients with neurologic symptoms and/or suspected encephalitis.
2. Conduct routine evacuation for West Nile Virus in patients > 45 years.
3. Conduct convenience evacuation for patients with Giardia, Lyme Disease, RMSF, and Colorado Tick Fever.
4. Evacuation is usually not necessary for mild cases of West Nile Virus or Tick Paralysis that resolves with treatment.

### **Extended Care**

1. Continue antibiotics as directed.
2. Monitor for worsening symptoms.

### **Follow-up**

1. All patients that are not evacuated should see their team or personal physician upon return from an austere environment.

---

## **Other/Special Considerations**

### **Mosquitoes (bite prevention)**

1. Clothing
  - a. Long shirts, pants, and socks; tuck pants in socks or boots.
  - b. Tightly woven fabrics are best (e.g., nylon)
  - c. Looser fitting clothing makes it difficult for mosquitoes to bite through the clothing to the skin
  - d. Meshed screen hats (covers face and neck) and gloves are useful in areas with significant mosquito populations.
  - e. Exposed skin should be protected by insect repellent.
    - DEET is the primary insect repellent used in the United States.
      - Concentrations vary from 5-35%.
      - 20% DEET is generally effective for most areas.
      - Use 30-35% DEET for adults in areas with malaria risk.
      - For children, use a concentration of 10% or less.
      - Avoid DEET-containing repellents for infants < 6 months.
      - DO NOT use sunscreens containing DEET.
        - » Sunscreens need to be applied more frequently than DEET.
        - » When using both a sunscreen and DEET, first apply the sunscreen, then wait 30 minutes before applying DEET.
    - Other repellents for use on exposed skin may be effective in repelling mosquitoes, but do not afford a similar duration of protection
  - f. Permethrin is a natural compound with insect repellent properties that may last for weeks with proper application. It is used to treat clothing, bedding, and mosquito netting. It has **NOT** been approved for direct use on skin.

### **Chiggers (*Eutrombicula alfreddugesi*)**

1. Although they do not carry vector-borne disease, its bites may be extensive in number and induce an allergic reaction.
  - a. Symptoms include:
    - Pruritus, often highly intense
    - Small, hemorrhagic petechiae, usually accompanied by intense erythema, within 24 hours after onset
    - May develop blisters, purplish skin discoloration, swelling of feet and ankles
  - b. Treatment is symptom-based.
    - Topical antipruritic agents, such as 1% phenol in calamine lotion
    - Topical corticosteroid cream (hydrocortisone 1%)
    - Oral antihistamines
  - c. Evacuation is usually not required.

---

## I. Lightning Injuries

### Review of Injury/Illness

Lightning injuries range from minor wounds to serious traumatic injuries that can result in death. Direct strike lightning injuries account for only 3-5% of all lightning-related injuries. Compared to high-voltage electrical injuries, lightning injuries have much higher voltage (30 million volts/250,000 amps), but shorter exposure times (1-100 milliseconds).

Many lightning injuries have little or no external evidence of burns because of flashover effect; most of the current “flashes” over the skin leave minimal damage. Severe tissue damage is most likely at the entry and exit points. Primary or secondary cardiac arrest (due to VF) and asystole are the most common cardiac injuries.

Lightning strike victims are safe to touch. Complete undressing of the patient is necessary to facilitate thorough examination.

### Signs and Symptoms

#### Minor

- \* **Feeling of strange sensation in extremity**
- \* **Amnesia, confusion**
- \* **Temporary unconsciousness**
- \* **Deafness and/or TM rupture**
- \* **Blindness**

#### Moderate

- \* **Disoriented**
- \* **Combative paralysis**
- \* **Fractures, blunt trauma**
- \* **Absent pulses in lower extremities**
- \* **Spinal/neurogenic shock**
- \* **Seizures**
- \* **Temporary cardiorespiratory arrest**
- \* **Comatose**

#### Severe

- \* **Symptoms similar to “Minor” and “Moderate”**
- \* **Discharge from the ear canal**
- \* **Cardiac VF or asystole**

### Preventive Measures

1. Avoid metal conductors and/or tall objects. Do not stand, hug, or huddle near tall trees; if in a forest, stay in thick bush or among low trees.
2. Avoid open fields or areas near pipelines, power lines, and ski lifts.
3. Avoid open shelters because of side flash potential. Tents offer little, if any, protection.
4. Seek out hardtop vehicles or stone/brick buildings.
5. Seek out large caves; stay away from opening and side walls.

6. Seek out ditches, unless there is contact with water.
7. Seek shore immediately if on water. Avoid swimming, boating, or being the tallest object on the water.
8. When no immediate shelter is available, all persons should spread out 100 ft apart.
9. Keep the smallest contact with ground, as possible - “Lightning Position” requires squatting, feet together, ears covered with hands, and squatting on some insulation material (ground pad) to keep the ground current from passing through the body.

## **Management**

### **BLS**

1. Initiate ABCs. If there are multiple casualties, refer to Protocol II.C.
2. For cardiac arrest, initiate CPR according to current American Heart Association (AHA) guidelines.
  - a. If victim has not regained pulse after 30 minutes of CPR, resuscitation efforts can be halted.
3. Administer supplemental oxygen, as needed. Assist ventilations with a bag valve mask (BVM), if necessary.
4. Immobilize spine and/or splint fractures, if necessary.
5. Treat and dress superficial external burns. (Refer to Protocol IV.B.)
6. Assess and treat for hypothermia, as needed. (Refer to Protocol III.C.)
7. Administer oral fluids, if patient is awake and able to swallow.
8. Consider pain management medications. (Refer to Protocol VII.A.)

### **ALS**

1. If respiratory arrest, consider advanced airway management:
  - a. Approved supraglottic device; or
  - b. Endotracheal intubation; or
  - c. Surgical cricothyroidotomy (Refer to Protocol VI.D.)
2. Administer initial fluid bolus 0.9% Normal Saline or LR 250 ml, up to a maximum total infusion of 2,000 ml without consulting on-line medical direction. Titrate to maintain Systolic BP > 90 mm Hg.
3. Start CPR according to current American Heart Association (AHA) guidelines, as needed.
4. Obtain 12-lead ECG and monitor cardiac rhythm and treat any dysrhythmia according to current American Heart Association (AHA) ACLS guidelines.
5. Monitor extremities for swelling and loss of peripheral pulses, indicating compartment syndrome.

## **Evacuation**

1. Conduct urgent evacuation for any cardiac issues or suspected compartment syndrome.
2. Conduct priority evacuation for any direct lightning injury or loss of consciousness.
3. Conduct routine evacuation for indirect exposure to lightning.

---

### **Extended Care**

1. Monitor cardiac rhythms for 6 hours after lightning injury, if available.
2. Assess and treat for hypothermia, as needed. (Refer to Protocol III.C.)

### **Follow-up**

1. All patients with a lightning injury should see a personal or team physician upon return from an austere environment.

---

## J. Motion Sickness (Sea Sickness)

### Review of Injury/Illness

Motion sickness is caused by distortion of sensory signals to the brain, a conflict between the visual signals of movement and the sensation of movement perceived by the inner ear (e.g., By being below decks, the eyes see no motion, but the ears continue to feel motion). Motion sickness occurs in vehicles, aircraft, and watercraft.

Also known as “Mal de Mer,” sea sickness is capable of incapacitating persons not acclimated to the ocean. Most cases of sea sickness will improve or resolve within 72 hours as patient acclimatizes to the sea environment. Individuals susceptible to motion sickness may develop symptoms in calm seas, or even in port. Even the most seasoned crew member can get sea sick in rough seas.

Individuals susceptible to motion sickness can be treated with prophylactic medications and other measures. Traditional anti-emetics (e.g., metoclopramide, prochlorperazine) are usually ineffective.

### Signs and Symptoms

- \* **Mild nausea progresses to vomiting/retching**
- \* **Anorexia**
- \* **Headache**
- \* **Frequent yawning (may or may not occur)**
- \* **Cold sweats and/or “flushing” (skin warmth, redness, hot sweats)**
- \* **Hypotension**
- \* **Increased respiratory rate**
- \* **General fatigue, malaise**

### Preventive Measures

1. Avoid large meals, alcohol, and recreational drugs.
2. Sleep on board the night prior to departure, if possible.
3. While initially underway, keep mentally occupied. Avoid reading, chart work, cooking, and similar attention-focused activities until acclimated.
4. Sit in most stable part of vessel or vehicle.
  - a. Vessels: Interior center of vessel, amidships
  - b. Aircraft: Forward of the wing, near a window
  - c. Vehicles: Driver seat or front passenger seat
5. Remain above deck, if possible. Gaze on a fixed distal point to provide a stable sensory reference point (e.g., horizon, distant shore, clouds, stars).
6. Maintain good hydration with small sips of water or sports drinks.

## Management

### General

1. Prophylaxis is the primary treatment.
2. All anti-motion sickness medications can impair alertness.
  - a. Medications must be used with caution by persons operating vessels, vehicles, or heavy machinery or engaging in underwater activities.
  - b. The use of alcohol or other CNS depressants increases the sedative effects of anti-motion sickness medications and should be avoided.
3. The use of the medications listed should be avoided by persons with narrow-angle glaucoma, gastrointestinal obstruction, or urinary retention (e.g., prostatic hypertrophy) and should be used with caution by persons with cardiovascular, pulmonary, liver, or kidney disease. Consult on-line medical direction for further guidance.

| Medications for Adult Anti-Motion Sickness Prophylaxis |                    |                                   |                            |  |
|--|--------------------|-----------------------------------|----------------------------|--|
| Drug   | Route              | Dose                              | Administer prior to travel | Notes  |
| Scopolamine  | Patch <sup>3</sup> | Transdermal Patch<br>Replace q72h | 4-8 hours                  | Least sedating of the agents<br>Wash hands after application     |
|  | PO <sup>4</sup>    | 0.4-0.8 mg PO q8h                 | 1 hour                     |  |
| Meclizine  | PO                 | 25-50 mg PO qd                    | 1 hour                     | Less sedating than other antihistamine agents                    |
| Diphenhydramine <sup>1</sup>                           | PO                 | 25-50 mg PO q6h                   | 30 minutes                 | Maximum of 400 mg/day  |
| Promethazine   | PO                 | 25 mg PO q8-12h <sup>2</sup>      | 30 minutes                 | Most sedating of the agents, but also most effective anti-emetic |
| Cyclizine  | PO                 | 50 mg q4-6h                       | 1 hour                     | Maximum of 200 mg/day  |
| Dimenhydrinate <sup>1</sup>                            | PO                 | 50-100 mg PO q4-6h                | 30 minutes                 | Maximum of 400 mg/day  |
| Ginger   | PO                 | Varies, 500 mg PO<br>q4h          | Varies                     | Clinical investigation results vary,<br>but promising            |

- 1 Only dimenhydrinate and diphenhydramine are recommended for use in children. Other medications may cause paradoxical excitation and should **NOT** be used in children < 2 years.
- 2 CDC recommendation, Briggs and MacKenzie recommend promethazine at 25 mg PO q6-8h.
- 3 Transdermal scopolamine is associated with fewer side effects than oral scopolamine. It is applied as a transdermal patch on hairless skin on the skull behind the ear.
- 4 Oral scopolamine may be given as additional prophylaxis following the initial patch application.

| Anti-Motion Sickness Medications Comparisons  |   |
|---|---|
| BLS Level Medications   | ALS Level Medications   |
| Meclizine, OTC forms only<br>• Dramamine II, <sup>®</sup> Bonine <sup>®</sup><br>Diphenhydramine<br>Cyclizine<br>Dimenhydrinate<br>Ginger | Scopolamine<br>Meclizine, including Rx forms:<br>• Antivert, <sup>®</sup> Medivert, <sup>®</sup> Meclicot <sup>®</sup><br>Diphenhydramine<br>Promethazine<br>Dimenhydrinate |

### **Evacuation**

1. Conduct convenience evacuation if the patient does not improve, or worsens, after treatment (over 72-96 hours).
2. Evacuation is usually not required.

### **Extended Care**

#### **BLS**

##### **General**

1. Encourage rehydration.
2. Consider administering a different anti-motion sickness medication, if possible.
3. BLS providers may give oral diphenhydramine for dystonic reaction, as needed. Consult on-line medical direction for further guidance. (Refer to “Dystonic Reaction.”)

#### **ALS**

##### **General**

1. If the patient is still symptomatic after 24-72 hours, consider IM injections for motion sickness.
  - a. Factor in oral doses that may have been taken to avoid exceeding maximum 24-hour dose.
  - b. Medications that may be considered for IM injection:
    - Scopolamine: Administer 0.3-0.6 mg IM, every 6-8 hours.
    - Diphenhydramine: Administer 25 mg IM; may increase dosage up to 50 mg, every 2-3 hours, up to a maximum of 400 mg/day.
    - Dimenhydrinate: Administer 50-100 mg IM, every 4-6 hours, up to a maximum of 400 mg/day.

##### **Dehydration (Refer to Protocol III.D.)**

1. If risk of dehydration is present due to severe vomiting:
  - a. Administer initial fluid bolus 0.9% Normal Saline or LR 250-500 ml, up to a maximum total infusion of 2,000 ml without consulting on-line medical direction.
  - b. After administering fluid boluses, adjust IV infusion rate to maintain a urine output of 1.0-2.0 ml/kg/hr.

---

### **Dystonic Reaction**

This condition is a potentially dramatic, but rare, side effect related to the use of phenothiazines (e.g., promethazine). Mild symptoms include restlessness, difficulty controlling eyes, and/or tongue rolling. Severe dystonia (Oculogyric Crisis) is marked by body spasms with arched neck and back, tongue protruding, eyes rolled back, and the patient barely able to speak. It is impressive, but not immediately dangerous.

1. Discontinue promethazine.
2. Administer diphenhydramine 50 mg IV/IO/IM.
  - a. IV route will resolve the dystonia in seconds; IM route may take 5-15 minutes; PO route may take 30-90 minutes.
  - b. Administer PO diphenhydramine, if IV/IO/IM not possible. If an ALS provider is unavailable, a BLS provider may administer the medication after consulting on-line medical direction.
  - c. Repeat diphenhydramine 25-50 mg every 4-6 hours, if symptoms reoccur (may reoccur over the next several days).

### **Other/Special Considerations**

1. Non-sick crew members should perform attention-focused tasks that may worsen the illness in the affected group (e.g., chart reading, navigation tasks, cooking, foredeck and below deck work).
2. Assign ill crew members non-essential tasks, preferably above deck and/or outdoors in order to help reduce severity of symptoms.

---

## **IV. Trauma Protocols**

- A. Advanced Hemostasis**
- B. Burns**
- C. Epistaxis**
- D. Field Dentistry**
  - 1. General Dental Care**
  - 2. Alveolar Ridge Fracture**
  - 3. Avulsed Tooth**
  - 4. Dislocated Tooth**
- E. Fluid Resuscitation**
- F. Management of Major Trauma**
- G. Orthopedic Injuries**
- H. Specific Orthopedic Injuries**
  - 1. Facial Fractures**
  - 2. Hand Disorders**
  - 3. Hand Injuries**

---

## A. Advanced Hemostasis

### Review of Injury/Illness

“Hemorrhaging” is the loss of blood internally or externally. Severe hemorrhaging can quickly lead to shock and death. Small penetrating injuries may be associated with serious internal damage. Pelvic fractures can cause significant—even fatal—internal blood loss.

### Signs and Symptoms

- \* Hypotension
- \* Rapid, weak pulse
- \* Restlessness, anxiety
- \* Tachypnea
- \* Diaphoresis
- \* Cyanosis

### Management

#### **BLS**

1. Secure and maintain airway and place patient in recovery position.
  - a. Chin lift or jaw thrust maneuver
  - b. NP or OP airway
2. Administer supplemental oxygen, as needed. Assist ventilations with a bag valve mask (BVM), if necessary.
3. Direct pressure and elevation should be first method of hemorrhage control followed by:
  - a. Bandages
  - b. Wound packing
  - c. Hemostatic agents
4. If direct pressure is not adequate to control the exsanguinating hemorrhage, apply a tourniquet.
5. Minimize patient movement that could dislodge any clots or worsen internal hemorrhaging.
6. Consider pelvic stabilization with a pelvic sling, if indicated.
  - a. To improvise, wrap a sheet, jacket, or material around the pelvis and tie an overhand knot. Place tent pole/post/stick on the knot, then tie another overhand knot. Twist the pole/post/stick until the sling is tight.
7. All limb injuries should be splinted to promote clot formation.
8. Assess and treat for hypothermia. (Refer to Protocol III.C.)
9. If prolonged evacuation, administer oral fluids, if patient is awake and able swallow.
10. Consider pain management medications after consulting on-line medical direction. (Refer to Protocol VIII.A.)
  - a. If a CNS or TBI injury is suspected, perform a full neurological assessment before administering any medication. (Refer to Protocol VII.B and Protocol VII.C.)

---

## ALS

1. If respiratory arrest, consider advanced airway management:
  - a. Approved supraglottic device; or
  - b. Endotracheal intubation; or
  - c. Surgical cricothyroidotomy (Refer to Protocol VI.D.)
2. Administer initial fluid bolus 0.9% Normal Saline, LR, or Hextend® 250 ml IV/IO, up to a maximum total infusion of 2,000 ml NS or LR or 1,000 ml Hextend.® Titrate to maintain Systolic BP > 90 mm Hg. Contact on-line medical direction for additional fluid infusions.
3. Administer antibiotics for any open wound according to local protocol.

## Evacuation

1. Conduct urgent evacuation for massive blood loss, shock, amputation proximal to wrists or ankles, arterial bleeding, internal bleeding, and pelvic and femur fractures.
2. Conduct priority evacuation for any major traumatic injury where bleeding is controlled, as rebleeding may occur.

## Extended Care

1. Minimize movement to any injury in order to avoid rebleeding.
2. Conduct continuous distal pulse checks on any limb with a tourniquet applied. If a distal pulse is present, tighten the existing tourniquet or apply a second tourniquet, proximal to the first.
3. Expose and clearly mark all tourniquet sites with the time of application.
4. Spinal immobilization is unnecessary for patients with penetrating trauma, unless indicated.

## Other/Special Considerations

### **Hemostatic Agents (can be applied by BLS level and above)**

1. Considerations for use:
  - a. When direct pressure and elevation do not stop heavy bleeding after 90 seconds
  - b. In abdominal cavity, if wound is non-compressible
  - c. For deep penetrating injuries and arterial bleeding
  - d. As adjunct to tourniquet removal
  - e. Allergies to shellfish are **NOT** a contraindication for using chitosan-based agents
2. Use **ONLY** approved hemostatic agents. Follow product-specific instructions for application.

### **Bandages & Dressings**

1. Ensure the dressing is tight enough to provide even pressure over the entire wound.
2. Leave fingers and toes exposed.

3. Continually re-check distal circulation using PMS.
4. If hemorrhaging continues, **DO NOT** remove the first dressing. Apply additional dressings **OVER** the first.

### Wound Packing

1. Pack wound with rolled gauze until unable to force any additional gauze into the wound.
2. After full packing, apply direct, firm pressure over the wound.
3. Apply a snug, elastic bandage wrap over the packing to secure the dressing.

### Tourniquet

1. If bleeding **CANNOT** be controlled by direct pressure:
  - a. Apply a tourniquet proximal to the wound.
    - Use a commercially available tourniquet, a BP cuff, or improvised “Spanish Windlass,” 2-4 inches proximal to the wound.
    - Use wider materials that will not cut into the flesh (1-2 inches minimum).
      - There is an inverse relationship between the width of a tourniquet and the pressure that is required to occlude arterial inflow. Narrower bands are prone to damaging arteries and nerves.
  - b. If necessary, apply the tourniquet just proximal to the joint above the wound. **DO NOT apply tourniquet directly over a joint.**
  - c. Tighten the tourniquet just enough to control/stop the bleeding, then secure in place with an appropriate knot (square) or mechanical device such as a buckle on a belt. This is generally tight enough so that pulses distal to the tourniquet are not palpable.
  - d. Use tape or a marker to form a large T on the forehead of the patient. Document the time that the tourniquet was applied to the patient. **NEVER skip these steps when a tourniquet is in place.**
  - e. Always leave the wound and tourniquet sites uncovered so that any additional bleeding can be observed and treated accordingly.
2. The transition from a tourniquet to another hemorrhage control method should be accomplished by the following procedure:
  - a. Apply a pressure dressing or hemostatic agent.
  - b. Loosen the tourniquet slowly.
  - c. Monitor for bleeding.
    - If bleeding is **NOT** controllable, retighten tourniquet.
    - If bleeding is controlled, fully remove the tourniquet
  - d. Do not transition from tourniquet if one of the following occurs:
    - If the patient is in severe shock
    - If a complete amputation has occurred
    - If no provider is available to monitor for rebleeding
    - If the tourniquet has been in place > than 6 hours

---

## B. Burns

### Review of Injury/Illness

A burn injury can result from direct or indirect contact with any heat source, including a flame, electrical, chemical, lightning, flammable liquid, flashes, radiation, or scalding liquids. Injuries can range from minor (1st and 2nd degree) to life-threatening (3rd and 4th degree burns). (Also refer to Lightning Injuries in Protocol III.I.)

Smoke inhalation injuries are often seen when there is closed space exposure to fire. Smoke inhalation injuries require significantly more fluid than other burn casualties. It may also require hyperbaric oxygen therapy. Also consider airway burns, carbon monoxide (CO) poisoning, or other toxic inhalation (cyanide).

### Signs and Symptoms

#### **Inhalation (airway burns)**

- \* **Difficulty breathing and/or swallowing**
- \* **Hoarseness**
- \* **Stridor**
- \* **Wheezing**
- \* **Soot/singed hairs**
- \* **May or may not exhibit facial burns**

#### **First degree (superficial thickness burn to skin)**

- \* **Redness**
- \* **Pain**
- \* **Swelling**

#### **Second degree (partial thickness burn to skin)**

- \* **Redness**
- \* **Pain**
- \* **Swelling**
- \* **Blistering**

#### **Third degree (full thickness burn to skin)**

- \* **May be white, leathery or charred appearance**
- \* **Swelling**
- \* **Underlying tissue is damaged**
- \* **May or may not have pain**

#### **Fourth degree (full thickness burn to skin; not universally used term)**

- \* **Burns extend through skin and muscle, sometimes into bone**

---

## **Management**

### **BLS**

1. The highest priority is to stop the burn process.
2. Remove jewelry and any clothing that is not stuck to the wound.
3. Secure and maintain airway and place patient in recovery position.
  - a. Chin lift or jaw thrust maneuver
  - b. NP or OP airway
4. Provision of supplemental oxygen is crucial to patients with smoke inhalation due to possible carbon monoxide poisoning. Start with 100% O<sub>2</sub> by non-rebreathing mask (NRBM) if patient has altered mental status. Assist ventilations with a bag valve mask (BVM), if necessary.
5. Cool burned skin with room temperature saline, do not apply ice to burned tissues.
6. Cover burns with dry, sterile dressing, if irrigation is discontinued.
7. Elevate burned extremities.
8. Assess and treat for hypothermia. (Refer to Protocol III.C.)
9. If prolonged evacuation, administer oral fluids, if patient is awake and able to swallow.
10. Administer pain management medications. (Refer to Protocol VII.A.)

### **ALS**

1. If airway obstruction, or impending airway obstruction, and other measures are unsuccessful, consider advanced airway management:
  - a. Approved supraglottic device; or
  - b. Endotracheal intubation; or
  - c. Surgical cricothyroidotomy (Refer to Protocol VI.D.)
2. Facial burns can present special problems in securing an advanced airway device such as an endotracheal tube.
  - a. If there is no appropriate clean, undamaged skin available to secure tape to, then consider tying the endotracheal tube to a tooth
    - Select a stable, undamaged, posterior molar.
    - Tie a heavy braided suture such as 0 silk to the tooth with several knots.
    - Tie an additional knot 2.0 cm from the tooth. Then tie the endotracheal tube to this knot.
3. Start with 100% O<sub>2</sub> by non-rebreathing mask (NRBM) if patient has altered mental status. Assist ventilations with a bag valve mask (BVM), if necessary.
4. Administer initial fluid bolus LR (preferred) or 0.9% Normal Saline 250 ml IV/IO. Titrate to maintain Systolic BP > 90 mm Hg.
  - a. For more serious burns, consider two IVs.
  - b. Avoid placement of catheter adjacent to burn if feasible – if necessary, suture in place.

- 
- c. Use the Modified Parkland Formula to calculate fluid therapy rates.
    - NS or LR solution in first 24 hours after injury = 4 ml x % BSA (2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> degree burns only) x body weight (kg).
    - Give half of the total fluid within the first 8 hours (from time of injury) and the second half over the next 16 hours
  5. For smoke inhalation:
    - a. Administer Albuterol 2-4 puffs, by metered dose inhaler (MDI) or nebulizer, if available, every 15 minutes; may repeat 3x. Repeat 2-4 puffs every 2 hours, as indicated.
    - b. Administer Dexamethasone (Decadron®) 8.0 mg IV/IO/IM, once a day for 2 days.
    - c. If cyanide poisoning is suspected, use Cyanide Antidote Kit.
  6. Administer antibiotics according to local protocol.

### **Evacuation**

1. Conduct urgent evacuation for burns that could compromise the airway or cause respiratory distress.
2. Conduct urgent evacuation if deep burns to the hands, feet, genitals, eyes, mucous membranes, or are circumferential.
3. Conduct priority evacuation if there is significant smoke inhalation.

### **Extended Care**

1. If unable to get to a definitive care center within 24 hours:
  - a. Gently clean and apply a topical antibiotic ointment and a fresh dressing every 12-24 hours.
  - b. When removing old dressings, soak dressings with clean water before removing.
2. Administer pain management medications. (Refer to Protocol VII.A.)

### **Other/Special Considerations**

#### **Eye Burns (Refer to Protocol V.P.3.)**

1. For a chemical burn to the eye, irrigate with the following guidelines (with Morgan Lens, if available.):
  - a. Acid burn (crusty appearance): 30 minutes minimum, or until pain subsides
  - b. Alkali burn (soapy appearance): 60 minutes minimum, or until pain subsides

#### **Electrical Burns**

1. Treat the entrance and exit wounds.
2. Internal injuries are often severe and must be treated appropriately. (Refer to Protocol IV.A and Protocol IV.B.)
3. Obtain 12-lead ECG and monitor cardiac rhythm and treat any dysrhythmia according to current American Heart Association (AHA) ACLS guidelines.
4. Assess and treat fractures of bones and/or spine. (Refer to Protocol IV.G.)

---

## Electro-muscular Disruption (Taser™)

1. Confirm that the device has been turned off and that the barb cartridge has been disconnected.
2. Obtain 12-lead ECG and monitor cardiac rhythm and treat any dysrhythmia according to current American Heart Association (AHA) ACLS guidelines.
3. Barbs can be removed by stabilizing the skin surrounding the barb and extracting with one smooth jerk. Once extracted, visually inspect barb to make sure it is intact and that no fragments remain in the wound site.
  - a. If barbs are lodged in the following locations, **DO NOT** remove. Evacuate the patient to a medical facility for definitive care:
    - Eyes, ears, nose, mouth, face, or neck
    - Genitals
    - Spine
    - Hands, feet, or joints
4. After barb removal, clean and irrigate the wound and cover them with dry, sterile dressing.
5. Obtain tetanus status. The patient will need tetanus immunization, if he has not received one in last 5 years.

## Circumferential Burns

1. Burns can constrict the chest and restrict respiratory efforts.
2. Burns can constrict the limbs and impair peripheral circulation.
  - a. Continually re-check distal circulation using PMS.
3. If chest constriction or impaired peripheral circulation occur, consider escharotomy after consulting on-line medical direction. (Refer to Protocol VI.H.)

## Sunburns

The most common symptom of sunburn is painful erythema of skin. Severe cases may have blistering, low grade fever, chills, nausea, vomiting, and diarrhea.

1. Prevention
  - a. Avoid the mid-day sun and use natural shade.
  - b. Protect your skin by wearing hats and sufficient clothing.
  - c. Apply sunscreen that protects against UVA and UVB liberally and often. Ensure the sunscreen is water and sweat resistant and has a sun protection factor (SPF)  $\geq 30$ .
2. Treatment
  - a. Soak skin in cool water or with compresses.
  - b. **DO NOT** drain blisters, unless they are very large. Cover any open blisters with dry, sterile dressing.
  - c. Apply a bland ointment or moisturizing cream (aloe vera).
  - d. Administer NSAIDs for pain relief and an anti-inflammatory effect.
  - e. Topical or systemic steroids may be administered by an ALS provider in more severe cases, after consulting on-line medical direction.

## C. Epistaxis

### Review of Injury/Illness

Common causes of epistaxis are nasal and/or facial trauma, nose picking, spontaneous nosebleed, and drying of nasal mucosa from environmental causes (such as arid conditions at high altitude and desert locations).

Uncontrolled epistaxis may cause significant bleeding and airway obstruction. Anterior epistaxis is much more common than posterior epistaxis, originating from the posterior nasopharynx and can be particularly dangerous.

Bleeding can be significant in patients who are taking anti-coagulant medications, including aspirin.

### Anatomy and Physiology

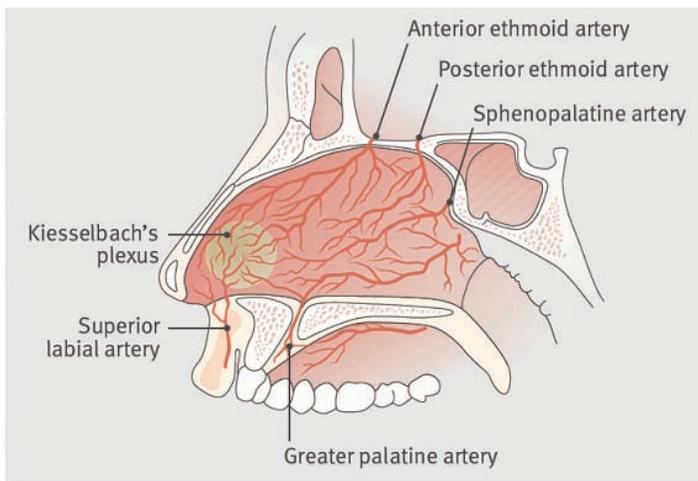


Fig 1 Vascular anatomy of nasal septal blood supply

### Signs and Symptoms

- \* **Bleeding from one or both nares**
- \* **May have nasal deformity, if associated with trauma**
- \* **Presence or absence of septal hematoma (documentation necessary)**

### Management

#### **BLS**

1. Have patient sit and lean forward to allow blood to drain outward from nose and not down the throat.
2. Evaluate patient for current level of bleeding.
  - a. If the bleeding has stopped:
    - **DO NOT** clear any clot.
    - Monitor for rebleed.
  - b. If the patient is bleeding:
    - Have the patient clear out any clots by blowing his/her nose.

- Have the patient pinch his/her nostrils together firmly and continuously for 15 minutes.
  - In some instances, the provider must perform this maneuver for the patient.
  - Consider applying two spray doses of OTC oxymetazalone (Afrin®) nasal decongestant in each nostril, prior to applying pressure.
  - Consider applying a cold pack to the bridge of the nose to assist in slowing the bleeding.
- c. If the patient continues to bleed after 15 minutes of continuous pressure:
  - Apply anterior nasal packing. (Refer to Protocol VI.K.1.)
  - Perform neurological exam, if the patient suffered blunt trauma. (Refer to Protocol VII.B and Protocol VII.C.)

## **ALS**

1. If bleeding appears to be significant, begin IV fluid resuscitation. (Refer to Protocol IV.E.)
2. If blood causes obstruction or induces choking, secure and maintain airway. Provide advanced airway support, if necessary.
3. If bleeding has not been controlled with the properly applied BLS recommendations:
  - a. Apply posterior nasal packing. (Refer to Protocol VI.K.2.)
  - b. If posterior nasal packing is used, administer levofloxacin (Levaquin®) 500 mg PO QD until definitive care is reached.

## **Evacuation**

1. Conduct urgent evacuation for uncontrolled epistaxis or an airway compromise.
2. Conduct priority evacuation for posterior epistaxis that is controlled with posterior nasal packing using a Foley catheter balloon.
3. Conduct routine evacuation for posterior epistaxis that is controlled with posterior nasal packing using a nasal balloon or any controlled epistaxis in a patient taking anti-coagulant medication.
4. Evacuation is usually not required for anterior epistaxis controlled with direct pressure or anterior packing.

## **Extended Care**

1. May attempt to carefully remove anterior nasal packing after 4 hours.
2. May attempt to carefully deflate and remove nasal balloon or Foley catheter balloon after 72 hours.
3. Monitor for development of fever.
4. If anterior epistaxis was related to arid or high altitude conditions, apply neomycin-free antibiotic ointment or nasal saline spray for prophylaxis.

## **Management of Complications**

1. If patient develops temperature > 100° F, administer levofloxacin (Levaquin®) 500 mg PO QD until definitive care is reached. Contact on-line medical direction for further guidance.

---

## **Other/Special Considerations**

1. Consult on-line medical direction if:
  - a. Significant nasal or facial trauma is present
  - b. Systolic BP > 140 mm Hg and/or Diastolic BP > 90 mm Hg
  - c. Unexplained tachycardia is present
  - d. Bleeding cannot be controlled
  - e. The provider is uncertain or uncomfortable with the management or procedure
  - f. The patient develops temperature > 100° F
  - g. A pattern of recurrent nosebleeds develops

---

## D. Field Dentistry

### 1. General Dental Care

#### **Review of Injury/Illness**

Common dental injuries include fractured, dislocated, and avulsed teeth. Toothaches are also a commonly encountered disorder, and may be caused by pulpitis (dental caries), lost dental fillings, periodontal and apical abscesses, etc.

Dental injuries suggest significant blunt force trauma to the head. In case of dental trauma, evaluate patient for associated serious injury. Rule out:

- Head injury, inquire for LOC (Refer to Protocol V.F.)
- Spinal injury, clear C-spine (Refer to Protocol VI.C.)
- Associated facial injuries (e.g., mandible fracture, alveolar ridge fracture, orbital fracture, zygomatic fracture) (Refer to Protocol IV.H.)

Blood draining into throat may obstruct airway or induce choking. Swallowing blood may result in nausea and/or vomiting. Always be prepared to protect the patient's airway.

Field suction is ideal, if available. Early advanced airway management may be necessary in severe maxillofacial trauma. If bleeding is present or anticipated with procedure and suction is unavailable, have the patient sit with head forward to prevent blood from draining into throat.

#### **Management**

##### **ALS**

##### 1. Antibiotics

- a. For all dental cases, administer clindamycin (Cleocin<sup>®</sup>) 450 mg PO q8h preferred, until definitive care is reached.
- b. For severe periodontal or apical abscess, administer clindamycin (Cleocin<sup>®</sup>) 300 mg PO q8h, unless patient size or other medical condition dictates a decreased dose of 150 mg q8h, after initial dose. Continue until definitive care is reached.
- c. For SBE antibiotic prophylaxis in at-risk individuals, administer clindamycin 600 mg prior to beginning procedure (ideally 1-2 hours).
- d. For antibiotic prophylaxis of a procedure with high risk for local infection, administer clindamycin 300 mg PO, followed by clindamycin 150-300 mg q8h.

---

## 2. Alveolar Ridge Fracture

### **Review of Injury/Illness**

This condition is a traumatic fracture of the alveolar ridge of the maxilla or mandible. It often involves multiple teeth.

If fracture is not grossly obvious, check for stability by rocking the alveolar ridge anteriorly and posteriorly. Any movement indicates fracture.

### **Signs and Symptoms**

- \* **Movement of the alveolar ridge, anteriorly or posteriorly**
- \* **Tooth dislocation or avulsion**

### **Management**

#### **BLS**

1. Administer pain management medications. (Refer to Protocol VII.A.)

#### **ALS**

1. For severe pain, consider dental anesthesia. (Refer to Protocol VI.E.)
2. Administer antibiotics for all dental cases: Clindamycin (Cleocin<sup>®</sup>) 450 mg PO q8h preferred (until definitive care)

### **Evacuation**

1. Conduct priority evacuation for a fracture not stabilized in the field.
2. Conduct routine evacuation for a fracture stabilized in the field.

### **Extended Care**

1. If evacuation is delayed, or if patient must walk out, stabilize the fracture. (Refer to Protocol IV.G and Protocol VI.M.)

### **Follow-up**

1. Dental evaluation is required as soon as possible upon return from an austere environment.

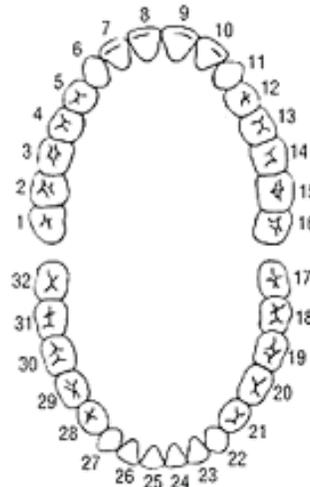
## Dental Enumeration Illustration

**Note:** When looking at the tooth chart, it illustrates a patient's mouth with the jaws open. The upper right jaw will be on the left of this image.

1. 3rd Molar (wisdom tooth)
2. 2nd Molar (12-yr molar)
3. 1st Molar (6-yr molar)
4. 2nd Bicuspid (2nd premolar)
5. 1st Bicuspid (1st premolar)
6. Cuspid (canine/eye tooth)
7. Lateral incisor
8. Central incisor
9. Central incisor
10. Lateral incisor
11. Cuspid (canine/eye tooth)
12. 1st Bicuspid (1st premolar)
13. 2nd Bicuspid (2nd premolar)
14. 1st Molar (6-yr molar)
15. 2nd Molar (12-yr molar)
16. 3rd Molar (wisdom tooth)
17. 3rd Molar (wisdom tooth)
18. 2nd Molar (12-yr molar)
19. 1st Molar (6-yr molar)
20. 2nd Bicuspid (2nd premolar)
21. 1st Bicuspid (1st premolar)
22. Cuspid (canine/eye tooth)
23. Lateral incisor
24. Central incisor
25. Central incisor
26. Lateral incisor
27. Cuspid (canine/eye tooth)
28. 1st Bicuspid (1st premolar)
29. 2nd Bicuspid (2nd premolar)
30. 1st Molar (6-yr molar)
31. 2nd Molar (12-yr molar)
32. 3rd Molar (wisdom tooth)

**Maxillary  
Upper Arch**

**Mandibular  
Lower Arch**



### Surfaces

- B-Buccal
- D-Distal
- F-Facial or Labial
- I-Incisal
- L-Lingual
- M-Mesial
- O-Occlusal

### Quadrants

- Quad 1 – Upper Right 01xx08
- Quad 2 - Upper Left 09xx16
- Quad 3 - Lower Left 17xx24
- Quad 4- Lower Right 25xx32

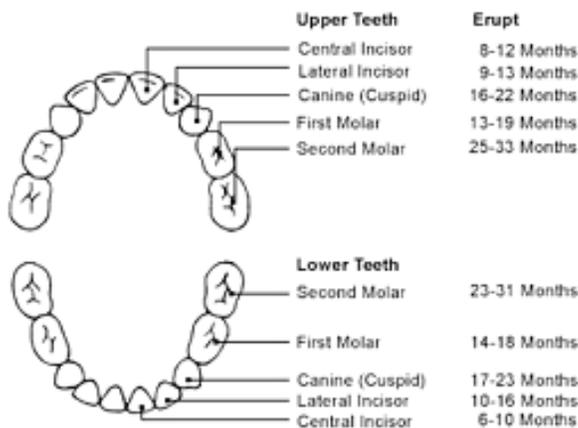
### Anterior Teeth

- 6,7,8,9,10,11
- 22,23,24,25,26,27

### Posterior Teeth

- 1,2,3,4,5,12,13,14,15,16
- 17,18,19,20,21,28,29,30,31,32

## Primary Teeth Eruption Chart

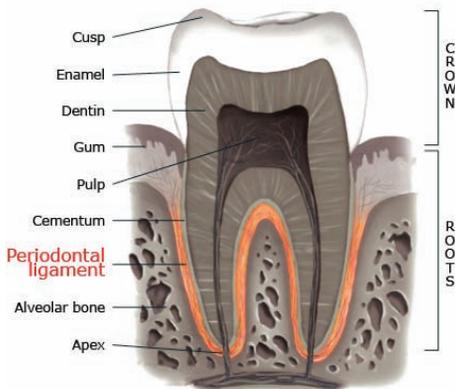


### 3. Avulsed Tooth

#### Review of Injury/Illness

This condition is a result from direct trauma causing detachment of the tooth from the bone. The best chance of tooth survival is replacement within one hour. If the tooth is not replaced within 1 hour of injury, then the chances for tooth survival are very poor.

#### Anatomy and Physiology



(Note location of periodontal ligaments. Careful handling of tooth helps preserve these ligaments. **DO NOT** scrub, rub, scale or otherwise roughly handle tooth prior to replacement. Handle tooth **ONLY** by the crown.)

#### Signs and Symptoms

- \* **Tooth completely detached from other structures**
- \* **Empty socket**
- \* **Can indicate a severe impact to the head**
  - **Head injury, inquire for LOC (Refer to Protocol V.F.)**
  - **Spinal injury, clear C-spine (Refer to Protocol VI.D.)**

#### Management

##### **BLS**

1. Assess and treat associated facial injuries (e.g., mandible fracture, alveolar ridge fracture, orbital fracture, zygomatic fracture). (Refer to Protocol IV.H.)
2. Administer pain management medications. (Refer to Protocol VII.A.)

##### **ALS**

1. For severe pain, consider dental anesthesia. (Refer to Protocol VI.E.)
2. Administer antibiotics for all dental cases: Clindamycin (Cleocin<sup>®</sup>) 450 mg PO q8h preferred (until definitive care)

- 
3. Replace the tooth:
    - a. Handle the tooth **ONLY** by the crown. **DO NOT** scrub, rub, or remove any tissue from the tooth.
    - b. Gently rinse the tooth with normal saline or potable water.
    - c. Place the tooth in normal saline, milk, or saliva prior to procedure.
    - d. Gently irrigate the empty socket with normal saline or potable water.
    - e. Use slow, steady pressure to reposition the tooth into the socket.
    - f. Have the patient stabilize the tooth by gently biting down on a gauze pad.
    - g. Secure the tooth. (Refer to Protocol VI.F.)

### **Evacuation**

1. Evacuation is usually not required.

### **Extended Care**

1. Continue antibiotics for 5 days.
2. Maintain a soft diet until a definitive dental evaluation is received.
3. **DO NOT** brush the injured tooth for 5 days.
4. Use warm water or saline gargle every 2-4 hours.

### **Follow-up**

1. Dental evaluation is required as soon as possible upon return from an austere environment.

---

## 4. Dislocated Tooth

### Review of Injury/Illness

This condition is caused by trauma to the mouth that results in the tooth being moved from its normal position, without complete avulsion. It is also known as a “luxated tooth” or “partial avulsion.”



### Signs and Symptoms

- \* Tooth is obviously dislocated from normal position
- \* Tooth is loose and mobile
- \* Can indicate a severe impact to the head
  - Head injury, inquire for LOC (Refer to Protocol V.F.)
  - Spinal injury, clear C-spine (Refer to Protocol VI.D.)

### Management

#### **BLS**

1. Assess and treat associated facial injuries (e.g., mandible fracture, alveolar ridge fracture, orbital fracture, zygomatic fracture). (Refer to Protocol IV.H.)
2. Administer pain management medications. (Refer to Protocol VII.A.)

#### **ALS**

1. For severe pain, consider dental anesthesia. (Refer to Protocol VI.E.)
2. Administer antibiotics for all dental cases: Clindamycin (Cleocin®) 450 mg PO q8h preferred (until definitive care)
3. Manually reposition tooth:
  - a. Use a finger to gently guide the tooth down and back while simultaneously repositioning the crown with another finger.
  - b. Have the patient stabilize the tooth by gently biting down on a gauze pad.
  - c. Secure the tooth. (Refer to Protocol VI.F.)

---

### **Evacuation**

1. Conduct priority evacuation if the tooth cannot be repositioned in the field.
2. Conduct routine evacuation if the tooth has been repositioned and stabilized.

### **Extended Care**

1. Continue antibiotics for 5 days.
2. Maintain a soft diet until a definitive dental evaluation is received.
3. **DO NOT** brush the injured tooth for 5 days.
4. Use warm water or saline gargle every 2-4 hours.

### **Follow-up**

1. Dental evaluation is required as soon as possible upon return from an austere environment.

---

## E. Fluid Resuscitation

### Review of Injury/Illness

Four different fluids are commonly used for fluid therapy:

- Normal Saline (NS) is 0.9% sodium chloride solution that acts as a volume expander
- Lactated Ringer's Solution (LR) contains specific amounts of sodium, potassium, calcium, chloride, and lactate ions. Its composition is most similar to the electrolyte composition of blood
- Hextend<sup>®</sup> is a plasma volume expander derived from natural sources of starch. It acts as an oncotic agent to permit retention of intravascular fluid until the hetastarch is replaced by blood proteins
- Dextrose 5% Normal Saline (D5NS) is commonly used to provide sugar and fluid to a patient who is unable to tolerate PO intake

### Anatomy and Physiology

1. Monitoring urine output can help guide the need for additional fluid therapy.
  - a. The most accurate and preferred method for urine collection is via catheterization. (Refer to Protocol VI.P)
  - b. If unable to use catheter, collect urine in a device that allows for measurement. Be sure to consider inherent inaccuracies when using this method
2. If urine outputs are below following guidelines, increase volume infusion.
  - a. 0.5 ml/kg/hr for adults
  - b. 1.0 ml/kg/hr for pediatrics

---

For a specific injury/condition, refer to fluid resuscitation management. If the initial fluid resuscitation for an acute condition has been administered, the patient is unable to tolerate oral fluids, the patient is stable, and urine output is greater than the listed limits, consider switching to maintenance fluid guidelines below.

---

### Management

#### **BLS**

1. Carefully begin oral rehydration with water or carbohydrate/electrolyte drink mixes, if patient is awake and able to swallow. (Refer to Protocol III.D and Protocol III.G.)
  - a. Advise the patient to hydrate enough to keep urine clear to light yellow.
  - b. If suspected hyponatremia, **ONLY** give improvised electrolyte hydration drink. (Refer to "Other/Special Considerations" in Protocol III.D and Protocol III.G.)

---

## ALS

1. General Trauma
  - a. Administer initial fluid bolus 0.9% Normal Saline, LR, or Hextend® 250 ml IV/IO, up to a maximum total infusion of 2,000 ml NS or LR or 1,000 ml Hextend.® Titrate to maintain Systolic BP > 90 mm Hg. Contact on-line medical direction for additional fluid infusions. (Refer to Protocol IV.E.)
    - Special Considerations:
      - Any IV fluid given to a shock casualty should be warm, not room temperature or cold, as administering cold fluids for an extended period of time increases the risk of hypothermia.
      - If pulmonary injury or traumatic brain injury is suspected, be cautious not to overload with fluids.
2. Hyperglycemia
  - a. Initiate 1.0 L 0.9% Normal Saline or LR via IV/IO, over 30-60 minutes, followed by Normal Saline or LR at a rate of 150 ml/hr.
  - b. Check glucose levels with a glucometer every 30 minutes, if available.
3. Burns (Refer to Protocol IV.B.)
4. Hypothermia (Refer to Protocol III.C.)
5. Heat Exhaustion (Refer to Protocol III.G.)
6. Heat Stroke (Refer to Protocol III.G.)
7. Hyponatremia (Refer to Protocol III.G.)

### **Fluid Maintenance Management**

1. To calculate maintenance fluids, use the following formulas:
  - a. First 10 kg, give 4.0 ml/kg/hr
  - b. Second 10 kg, give 2.0 ml/kg/hr
  - c. Then 1.0 ml/kg/hr
  - d. EXAMPLE: An 80 kg man would receive 40 ml + 20 ml + 60 ml = 120 ml/hr.
2. Dextrose solutions (e.g., D5W, D5NS, D5LR) should be used with caution in patients with a history of diabetes. Check glucose levels with a glucometer, if available.

### **Extended Care**

1. Monitor vital signs.
2. Rotate IV sites after 48 hours, for prolonged care.

---

## F. Management of Major Trauma

### Review of Injury/Illness

Management of a major trauma requires the rescuer to consider many factors at once. Initial response and patient assessment are as follows:

- Scene Safety
- Triage
- Airway
- Breathing
- Circulation
- Cervical spine immobilization
- Environmental control
- Comprehensive patient survey
- Evacuation
- Continuing care

### Management

#### Scene Safety

1. Ensure safety of rescuers, non-injured members, and casualties.
2. Assess scene for potential hazards (e.g., avalanches, falling rocks, dangerous animals).
3. **DO NOT** let sense of urgency create an unsafe environment.

#### Triage

1. Refer to Protocol II.C.

#### Airway

1. If patient is unresponsive, determine if patient is breathing by looking, listening, and feeling for air movement near mouth
2. Examine airway for obstruction. Use finger sweep or suction to remove obvious obstructions.
3. If the patient is conscious, place him/her in the recovery position.
4. If patient is unconscious, maintain an open airway by:
  - a. Perform chin lift; or jaw thrust if C-spine injury is suspected
  - b. Use nasopharyngeal (NP) or oropharyngeal (OP) airways
    - Lubricate the NP airway and insert with bevel toward the septum
    - Contraindicated if CSF fluid is coming from nose or ears
5. If there is an ALS provider and there is an airway obstruction or impending airway obstruction, consider advanced airway management:
  - a. Approved supraglottic device; or

- 
- b. Endotracheal intubation; or
  - c. Surgical cricothyroidotomy (Refer to Protocol VI.D.)

## **Breathing**

1. If patient is not breathing, initiate ventilation through mouth to mouth, bag valve mask (BVM), or advanced airway. Administer supplemental oxygen, as needed.
2. All open and/or sucking chest wounds should be treated by immediately applying an occlusive dressing to cover the defect.
  - a. Monitor for development of tension pneumothorax. Treat as needed. (Refer to Protocol VI.L.)
  - b. In a patient with progressive respiratory distress after chest trauma:
    - Release the dressing in an open and/or sucking chest wound.
    - Decompress with needle thorocostomy. (Refer to Protocol VI.L.)
    - Suspect needle clotting, if air is not expelled under pressure.
    - Be prepared to perform multiple needle decompression to resolve tension pneumothorax.

## **Circulation**

1. Control all sources of hemorrhaging. (Refer to Protocol IV.A.)
2. Administer initial fluid bolus 0.9% Normal Saline or LR 250 ml IV/IO, up to a maximum total infusion of 2,000 ml. Titrate to maintain Systolic BP > 90 mm Hg. (Refer to Protocol IV.E.)

## **Cervical Spine Immobilization**

1. Suspect C-spine injury if the MOI exerts a great force on the on the body or if there is soft-tissue damage to the head, neck, or face area due to trauma.
  - a. Patient needs to be immobilized using a backboard, c-collar, and/or other stabilization devices
  - b. If necessary because of austere environment transportation, refer to Protocol VI.C. to see if it is safe to no longer immobilize patient.

## **Environmental Control**

1. Patients who suffer a traumatic injury are extremely susceptible to hypothermia, especially when blood is lost. Hypothermia prevention should be a top priority. (Refer to Protocol III.C.)

## **Comprehensive patient survey**

1. Perform a GCS evaluation (Refer to Protocol VII.B.)
2. Assess for neurologic abnormalities.
3. Palpate scalp very closely for tenderness, depressions, and lacerations
  - a. Conduct urgent evacuation for any suspected skull injury.
4. Thoroughly evaluate of the body – Remove clothes, but be sensitive to environment.
  - a. Palpate entire body, assessing for injury.
  - b. Check skin color, sweating, and perfusion.

- 
- c. Examine respiratory efforts.
  - d. Obtain vital signs and pulse oximetry, if available.
  - e. Measure core body temperature.

### **Evacuation**

1. Determine need for evacuation level as soon as possible.
2. Consider transport to the nearest Trauma Center, as available.

### **Continuing Care**

1. Regularly assess patient condition and monitor for trends.
2. Administer pain management medications. (Refer to Protocol VII.A.)
3. Administer antibiotics for any open wound per local protocol.
4. Consider patient's personal needs and hygiene (e.g., urethral catheter, eating, oral care)
5. Rotate immobilized patient every 2 hours to avoid pressure sores, if possible. (Refer to Protocol VI.)
6. Provide psychological support for the casualty.

### **Other/Special Considerations**

#### **Hypothermia Prevention after Traumatic Injury**

1. Hypothermia often complicates the management of a patient with a traumatic injury, leading to decreased survival rates. Aggressive hypothermia prevention should be performed when **any** of the following conditions exist:
  - a. A patient suffers a traumatic injury
  - b. Ambient temperature
  - c. Any time Aeromedical evacuation is used
2. Prevention Measures
  - a. Control bleeding as soon as possible.
  - b. Minimize exposure to the elements.
  - c. Keep clothes and gear on or with patient, if possible.
    - Only strip clothes and protective gear from patient when necessary and for a minimal amount of time.
    - Replace wet clothing with dry as soon as possible.
  - d. Keep the patient warm.
    - Actively and often dry any fluids from patient (e.g., blood, IV fluid, sweat, rain).
    - Wrap patient in rescue blanket, if available.
    - Put hypothermia prevention cap on patient's head to prevent heat loss, if available.

- 
- For fluid resuscitation, use fluid warming devices or pre-warmed fluids, if available.
  - If core body temperature drops below the patient's normal body temperature, initiate active re-warming measures.
  - Wrap patient in multiple blankets with heat sources placed at the neck, armpits, groin, and at the palms of the hands. Always have clothing or material between the heat source and the skin, as hypothermic skin burns easily at low temperatures.
- e. For more active rewarming measures, refer to Protocol III.C.

---

## G. Orthopedic Injuries

### Review of Injury/Illness

Often orthopedic injuries are not life threatening and focus of the care provider should be to identify any life-threatening injuries. They generally result from traumatic direct or twisting force.

Pelvic and femur fractures can cause severe internal and external hemorrhaging that can quickly lead to death.

### Signs and Symptoms

- \* Pain/tenderness, swelling, and/or bruising near injury
- \* Loss of use
- \* Grating sensation
- \* Deformity
- \* Open wound (may or may not be present)

### Management

#### **BLS**

1. Secure and maintain airway and place patient in recovery position.
  - a. Chin lift or jaw thrust maneuver
  - b. NP or OP airway
2. If patient is not breathing, initiate ventilation through mouth to mouth, bag valve mask (BVM), or advanced airway. Administer supplemental oxygen, as needed.
3. Control all sources of hemorrhaging with bandages, wound packing, and/or hemostatic agents. (Refer to Protocol IV.A.)
4. Immobilize spine, if indicated.
5. Assess joint function.
  - a. Palpate bones and check for crepitus.
  - b. Assess Range of Motion (ROM).
6. Splint fractures and dislocations. (Refer to injury-specific management in “Other/Special Considerations.”)
  - a. Splint the joints above and below the fracture site.
  - b. If fracture/dislocation is open (compound), cover the open area with sterile dressing.
  - c. If bone ends are protruding, **DO NOT** push them back in.
  - d. If fracture is angulated and pulseless, attempt to realign to natural position using mild traction. If significant resistance is met, stop immediately and splint in position found.
  - e. If fracture/dislocation is angulated with pulse, splint in position found
  - f. Reassess PMS before **and** after splinting.
7. Assess color and temperature of skin.

- 
8. Perform hypothermia prevention measures. (Refer to Protocol III.C.)
  9. Administer pain management medications. (Refer to Protocol VII.A.)
    - a. If suspected CNS injury, perform full neurological assessment **prior** to administering medication. (Refer to Protocol VII.B and Protocol VII.C.)
  10. If prolonged evacuation, administer oral fluids, if patient is awake and able swallow.

### **ALS**

1. If open fracture or sign of shock, administer initial fluid bolus 0.9% Normal Saline, LR, or Hextend<sup>®</sup> 250 ml IV/IO, up to a maximum total infusion of 2,000 ml NS or LR or 1,000 ml Hextend<sup>®</sup>. Titrate to maintain Systolic BP > 90 mm Hg. Contact on-line medical direction for additional fluid infusions. (Refer to Protocol IV.E.)
2. Administer antibiotics for any open wound according to local protocol.

### **Evacuation**

1. Conduct urgent evacuation for any spinal injuries, pelvic and/or femur fractures, and injuries that cause vascular and/or neural compromise.
2. Conduct priority for open fractures, open joint injuries, injuries with corrected vascular compromise, or injuries with suspected compartment syndrome.

### **Extended Care**

1. If definitive care is not possible for more than 6 hours, consider definitive debridement of any open fracture or dislocation to prevent infection.
2. Continue immobilization until definitive care is reached.
  - a. Transport any victim with an unstable extremity fracture or dislocation with the affected limb elevated.
3. If open injury:
  - a. Change dressing twice daily and as needed, if dirty or wet.
  - b. Continue antibiotics until definitive care is reached.
  - c. Monitor wound for signs and symptoms of infection/cellulitis.
4. Continue ice packs for 12-24 hours, and elevation for 48 hours or more, and as needed for pain and swelling.

### **Follow-up**

1. All patients with an orthopedic injury should follow-up with a physician upon return from an austere environment.

---

## **Other/Special Considerations**

1. Facial fracture (Refer to Protocol IV.H.)
2. Cervical injury
  - a. Apply cervical collar and backboard.
  - b. Continually reassess PMS.
  - c. If C-spine clearance is needed, refer to Protocol VI.C.
3. Clavicle
  - a. Check for bilateral breath sounds.
    - Assess for potential pneumothorax.
  - b. Check for neurovascular function adjacent to the extremity.
  - c. Immobilize using “sling and swathe.”
  - d. Apply cold/ice packs to area.
4. Pelvic injury
  - a. Consider pelvic stabilization with a pelvic sling, if indicated.
    - To improvise, wrap a sheet, jacket, or material around the pelvis and tie an overhand knot. Place tent pole/post/stick on the knot, then tie another overhand knot. Twist the pole/post/stick until the sling is tight.
  - b. Backboard immediately.
  - c. Consider urethral catheterization. (Refer to Protocol VI.P.)
5. Hip injury
  - a. Realign limb, if possible.
  - b. Consider light traction with a splint for transportation.
    - If traction is not available, splint legs together with padding between legs and backboard patient.
    - Traction splint is contraindicated if a pelvic fracture, femoral neck (hip) fracture, avulsion or amputation of the foot, or fractures distal to knee is suspected.
6. Femur fracture
  - a. Apply traction splint, if available.
    - Traction splint is contraindicated if a pelvic fracture, femoral neck (hip) fracture, avulsion or amputation of the foot, or fractures distal to knee is suspected.
7. Knee Injury
  - a. A knee dislocation is a true emergency; conduct urgent evacuation.
  - b. Continually reassess PMS in the affected extremity.
  - c. Apply linear traction to lower part of the leg.
  - d. Use a posterior splint and transport on a backboard, if possible.

---

## 8. Ankle Injury

- a. Inspect for open wounds.
- b. Continually reassess PMS in the affected extremity.
- c. If a rotational injury is present, realign ankle with gentle traction before applying a posterior splint with the ankle in the neutral position
- d. Form a U-shaped splint using a blanket roll, pillow, or SAM splint.

## 9. Dislocation

- a. Digit (Refer to Protocol VI.G.1.)
- b. Mandible (Refer to Protocol VI.G.2.)
- c. Patella (Refer to Protocol VI.G.3.)
- d. Shoulder (Refer to Protocol VI.G.4.)

## H. Specific Orthopedic Injuries

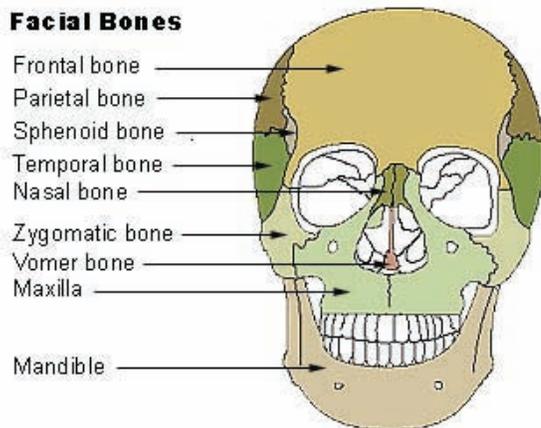
### 1. Facial Fractures

#### Review of Injury/Illness

Facial fractures most frequently occur as a result of blunt force impact or penetrating trauma. Because of the mechanism of injury, all victims of face and head injuries should be assumed to have a brain or spinal injury, until proven otherwise.

#### Anatomy and Physiology

##### **Facial Bones**



#### Signs and Symptoms

##### **Orbital fracture**

- \* Pain, tenderness, swelling, and bruising
- \* Peri-orbital (usually infraorbital) ecchymosis
- \* Extraocular motion (EOM) (may or may not be impaired, particularly with upward gaze)
- \* Impaired facial sensation, parasthesia/anesthesia to the orbit, cheek, maxilla and teeth (if nerve entrapment is present)
- \* Eye may extrude forward due to swelling of surrounding orbital tissue
- \* Hyphema

##### **Nasal fracture**

- \* Pain, tenderness, swelling, and bruising
- \* Bilateral infraorbital ecchymosis
- \* Nose may appear deformed or shifted to one side (not present in many nasal fractures)

##### **Zygoma (cheekbone) fracture**

- \* Pain, tenderness, swelling, and bruising
- \* Depression or dimpling deformity

---

## Maxilla fracture

- \* Pain, tenderness, and bruising
- \* Infraorbital ecchymosis (may or may not be present)
- \* Maxilla is often mobile upon examination (Le Forte Type I, II, III fractures may or may not be present)

## Mandible fracture

- \* Often obvious
- \* Malocclusion of teeth (may suggest fracture)
- \* Epicondyle fracture
  - Bleeding from ear canal and/or behind the tympanic membrane
  - Ecchymosis of the ventral floor of the ear canal

## Management

### BLS

1. Secure and maintain airway.
  - a. Chin lift or jaw thrust maneuver
  - b. NP or OP airway
2. Immobilize spine, if indicated.
  - a. If spinal injury is not suspected, have the patient sit up in a comfortable position so that his/her head is elevated at least 30-45 degrees.
3. Apply cold/ice pack.
4. Perform injury-specific exams.
  - a. Orbital:
    - Examine for hyphema, or blood in the anterior chamber, of the eye.
    - Evaluate and document visual acuity using small eye (Snelling) chart.
    - Perform exam for EOM:
      - Have patient follow movement of finger while tracing an “H” in front of patient’s field of view.
      - Observe the bilateral movement of the eyes. Document any lag in the affected eye.
      - A lag in motion, particularly with upward gaze, may indicate an entrapped extraocular ligament.
      - If eye movements are symmetrical bilaterally, the exam is normal; document as EOMI (extraocular movement intact).
    - Test for bilateral facial sensation.
      - Facial sensation may be impaired if nerve entrapment is present. This may include paresthesia or anesthesia to the orbit, cheek, maxilla, and teeth.
        - » Significant swelling without fracture may also cause decreased or loss of sensation.
        - » Check the maxilla and teeth to confirm anesthesia or paresthesia. These structures are more resistant to decreased sensation due to swelling.
  - b. Nasal: Inspect for septal hematoma.

- 
- c. Zygoma:
    - Palpate zygomatic region for depression and/or deformities.
    - Test for bilateral facial sensation.
  - d. Maxilla:
    - When fractured, the maxilla is often mobile on exam.
      - If front teeth are intact and not loose, grasp and try to move maxilla forward. If no movement, significant fracture may not be present
      - If front teeth move with alveolar ridge, it is probably a Le Forte Type I fracture.
      - If front teeth move with anterior maxilla and nose, it is probably a Le Forte Type II fracture.
      - If entire face below the eyebrows moves forward, it is probably a Le Forte Type III fracture.
  - e. Mandible:
    - Check teeth for normal occlusion (bite); malocclusion suggests fracture.
    - If teeth are intact and not loose, perform tongue blade test:
      - Have patient bite a tongue blade on left and the right side of mandible.
      - If patient can break or leave teeth marks on tongue blade, the mandible is probably intact.
    - Examine the external ear canal and the tympanic membrane for bleeding.
      - A fracture to the epicondyle of the mandible should be suspected if:
        - » Bleeding is present in the ear canal
        - » Blood is seen behind the tympanic membrane (may also indicate a basilar skull fracture)
        - » Ecchymosis of the ventral floor of the ear canal is present
      - A small wound on the ventral floor of the ear canal indicates a possible open fracture. Administer antibiotics per local protocol.
5. Perform injury-specific procedures:
    - a. Orbital/Zygoma:
      - Keep head elevated.
      - Use cold/ice packs for pain and swelling, as needed.
    - b. Nasal: For active bleeding, refer to Protocol IV.C.
    - c. Maxilla: Monitor and maintain airway. Assist ventilations with a bag valve mask (BVM), if necessary.
    - d. Mandible: Stabilize fracture with a Barton's Dressing. Dressing **must** be quick-release.
  6. Administer pain management medication. (Refer to Protocol VII.A.)

## ALS

1. If there is an airway obstruction or impending airway obstruction, consider advanced airway management:
  - a. Approved supraglottic device; or
  - b. Endotracheal intubation; or
  - c. Surgical cricothyroidotomy (Refer to Protocol VI.D.)

- 
2. Administer antibiotics per local protocol if:
    - a. An open wound is present
    - b. A maxilla or mandible fracture is present
  3. For alveolar ridge fractures, refer to Protocol IVD.2.

### **Evacuation**

1. Conduct urgent evacuation for any patient with neurologic symptoms, airway compromise, or impaired vision.
2. Conduct priority evacuation for mandible fractures, Le Forte Type III fractures, and forward extrusion or hyphema of the eye is present.
3. Conduct routine evacuation for Le Forte Type I and II fractures, orbital fractures with evidence of nerve or ligament entrapment, unstabilized alveolar ridge fractures.
4. Conduct convenience evacuation for minor fractures without deformity, no ligament or nerve entrapment, or stabilized alveolar ridge fractures.

---

## 2. Hand Disorders

### Review of Injury/Illness

Several common hand disorders may be encountered in the field are paronychia, felon, and herpetic whitlow.

### Anatomy and Physiology

1. Paronychia is an inflammation of the skin surrounding the eponychium, or tissue fold, of the nailplate.
2. Felon is an inflammation of the distal fat pad, located on the volar (or palmar) aspect of the digits.
3. Herpetic Whitlow (digital herpes simplex, herpes of the finger or hand) is a contagious herpes simplex virus infection.

### Signs and Symptoms

#### Paronychia

- \* Erythema and swelling (typically on the side margins of the nailfold)
- \* Pain and tenderness
- \* Yellowish, pus-filled blister, with surrounding inflammation (advanced cases)
- \* Purulent drainage, if paronychia opens spontaneously

#### Felon

- \* Pain, tenderness, and mild swelling of the distal fat pad
- \* Erythema
- \* May form into an abscess (a pus-filled blister)

#### Herpetic Whitlow

- \* Pain and tenderness
- \* Localized erythema and itching (pruritus)
- \* Fluid or pus-filled blisters, usually occurring in groups or clusters
- \* May occur anywhere on the digit, not limited to nail fold area

### Management

#### BLS

1. Paronychia and Felon
  - a. Soak in warm water for 20 minutes, 4-5 times a day.
  - b. Elevate extremity for pain or swelling, as needed.
2. Herpetic Whitlow
  - a. This condition is usually self-limiting, resolving in 1-3 weeks.
  - b. It is often recurrent; first occurrence is usually the worst.
  - c. Avoid touching or scratching, as it is **highly** contagious to self and others. It easily spreads to other parts of the fingers, hand, eyes and body.

- 
- d. Cover lesions or affected areas with dry, sterile dressing or bandages.
  - e. Wash hands thoroughly after touching any lesions or affected areas.

## **ALS**

1. Paronychia
  - a. If well-formed, swollen and fluctuant:
    - Gently separate and lift nailfold from nailplate.
    - In advanced cases, lifting the nailfold will allow the evacuation of pus.
    - The procedure may need to be performed under digital nerve block anesthesia. (Refer to Protocol VI.J.2.)
    - After drainage, continue warm water soaks for 20 minutes, 4-5 times a day.
    - Cover affected areas with dry, sterile dressing or bandages.
  - b. If abscessed:
    - Gently “un-roof” pus-filled blister, or make small incision through the epidermis, and evacuate the pus.
      - Avoid other incisions, unless otherwise instructed by on-line medical direction.
    - After drainage, continue warm water soaks for 20 minutes, 4-5 times a day.
    - Cover affected areas with dry, sterile dressing or bandages.
  - c. Antibiotics are usually not required if inflammation is localized, without cellulitis or lymphangitis.
2. Felon
  - a. Consider administering antibiotics per local protocol.

## **Evacuation**

1. Conduct routine evacuation for any condition accompanied by quickly spreading cellulitis, lymphangitis, or fever.
2. Conduct convenience evacuation for moderate to large felons, paronychias that do not respond to treatment, and widespread herpetic whitlow outbreak.
3. Evacuation is usually not required for localized herpetic whitlow, paronychias, and minor felons that respond to treatment.

## **Extended Care**

1. Paronychia
  - a. Continue warm soaks and elevation until condition improves.
  - b. Continue dressing changes until drainage ceases.
  - c. Monitor for spreading cellulitis, lymphangitis, or fever.

---

## 2. Felon

- a. Continue warm soaks and elevation until condition improves.
- b. Continue antibiotics until definitive care is reached.
- c. Monitor for spreading cellulitis, lymphangitis, or fever.
- d. If evacuation is delayed and an abscess develops:
  - Gently “un-roof” pus-filled blister, or make small incision through the epidermis, and evacuate the pus.
    - Avoid other incisions, unless otherwise instructed by on-line medical direction.
  - After drainage, continue warm water soaks for 20 minutes, 4-5 times a day.
  - Cover affected areas with dry, sterile dressing or bandages.

### **Management of Complications**

#### 1. Paronychia

- a. If accompanied by spreading cellulitis, lymphangitis, or fever, consider administering antibiotics according to local protocol.

#### 2. Herpetic Whitlow

- a. Secondary infection may develop. (Refer to Protocol V.T.)

### **Follow-up**

#### 1. Paronychia

- a. Follow-up is usually not required for paronychias that respond well to treatment, unless antibiotics were administered.

#### 2. Felons

- a. Follow up with team or personal physician upon return from an austere environment:
  - If not evacuated and still symptomatic
  - If the felon reoccurs after antibiotics treatment, suspect a retained foreign body. (particularly if a felon develops secondary to a puncture wound)

#### 3. Herpes Whitlow

- a. Follow-up is usually not required for isolated, self-limiting lesions.
- b. If still symptomatic, follow-up with team or personal physician upon return from an austere environment.

### **Other/Special Considerations**

1. If patient presents with felon-like lesion and had been working with a high-pressure line (e.g., grease gun, grease line, hydraulic line) suspect injection of substance into digit.
  - a. May cause widespread injection of substance into digit and hand
  - b. This is a surgical emergency that needs debridement and open irrigation in an operating room.
  - c. Priority evacuation is required to avoid loss of digit or hand.

### 3. Hand Injuries

#### Review of Injury/Illness

When examining any hand injury, always examine uninjured hand/digit and compare findings with injured hand or digit.

Mallet Finger is an avulsion of the extensor digitorum communis (EDC) tendon of the distal phalanx (DP), caused by blunt impact or sharp trauma.

Collateral Ligament Injury (“Game Keeper’s Thumb” or “Skier’s Thumb”) is a torn collateral ligament, usually the ulnar collateral ligament (UCL) of the thumb, due to hyperextension of the digit.

Tendon lacerations are usually caused by penetrating trauma where the patient is unable to flex or extend the digit or wrist. A laceration may be visible when the hand is examined in the position it was held at time of injury.

Muscle tears and lacerations are usually caused by penetrating trauma, infrequently by blunt trauma. Thenar and hypothenar muscle lacerations are most significant

#### Anatomy and Physiology

#### Common Hand Injuries



---

## **Signs and Symptoms**

### **Mallet Finger**

- \* Presents with DP in flexion
- \* Patient cannot extend DP

### **Collateral Ligament Injury (“Game keeper’s thumb”)**

- \* HX consistent with injury: hyperextension of digit
- \* Pain, swelling, ecchymosis on injured side

### **Tendon Laceration**

- \* Associated with an open wound
- \* Increased pain on extension/flexion
- \* Absent or decreased extension/flexion in extensor/flexor tendons
- \* Decreased strength on extension/flexion (partial laceration)

### **Muscle Tear or Laceration (Thenar muscle group)**

- \* Muscle tear or laceration visible in wound
- \* Cannot oppose thumb or decreased opposition strength in thumb
- \* Increased pain on opposition of thumb
- \* Significant bleeding or ecchymosis

### **Muscle Tear or Laceration (Hypothenar muscle group)**

- \* Muscle tear or laceration visible in wound
- \* Cannot adduct small finger
- \* Increased pain on adduction of small finger
- \* Significant bleeding or ecchymosis

## **Management**

### **BLS**

1. Perform focused exam, including neurosensory, motor and vascular functions on all hand injuries, and then splint according to injury.
  - a. Mallet Finger
    - Splint with DP in extension, applied from just distal of proximal interphalangeal joint (PIPJ).
  - b. Collateral Ligament Injury
    - Focused exam:
      - Thumb:
        - » Exam with thumb completely flexed. Look for increased laxity of joint on injured side
        - » Have patient push against your hand with thumb flexed. Look for increased pain on injured side

- Digit:
  - » Have patient push against hand with injured digit. Look for increased pain and laxity of joint on injured side.
- Splint thumb in a spica cast where thumb is immobilized by a splint running the length of the forearm. (Refer to Protocol VI.M.)

c. Tendon Laceration

- Splint extensor injuries in extension.
  - Finger: Splint all fingers and wrist in extension.
  - Thumb: Splint thumb in extension and wrist neutral.
- Splint flexor injuries in flexion.
  - Finger: Splint all fingers in flexion.
  - Thumb: Splint thumb in flexion and wrist neutral.

2. Administer pain management medication. (Refer to Protocol VII.A.)

## ALS

1. Administer antibiotics for all open wounds according to local protocol.

2. Tendon Lacerations:

a. If evacuation is to be delayed > 6 hours:

- Have the patient demonstrate ROM while examining wound under local anesthesia.
- If skin is lacerated, close with sutures. **DO NOT** suture tendons or muscles. (Refer to Protocol VI.Q.)
- Splint the injury.

3. Muscle Tears and Lacerations

a. If evacuation is to be delayed > 6 hours:

- Hypothenar: Apply volar splint to the wrist with small finger buddy-taped to ring finger.
- Thenar: Apply Triple S splint (e.g., modified thumb spica, volar hybrid splint) according to Protocol VI.X.
- If skin is lacerated, close with sutures. **DO NOT** suture tendons or muscles. (Refer to Protocol VI.Q.)
- Splint the injury.

## Evacuation

1. Conduct urgent evacuation for any hand injury accompanied by uncorrected neurovascular compromise.
2. Conduct priority evacuation for open fractures or open joint injuries accompanied by corrected neurovascular compromise.
3. Conduct routine evacuation for all tendon lacerations.
4. Conduct convenience evacuation for closed collateral ligament tears, closed scaphoid fracture, and muscle tears or lacerations.
5. Evacuation is usually not required for uncomplicated mallet finger.

---

## **Extended Care**

1. Continue ice packs for 12-24 hours, and elevation for 48 hours or more, and as needed for pain and swelling.
2. Definitive care is to continue splints as follows:
  - a. Mallet finger for 6 weeks
  - b. Collateral ligament injuries or tendon lacerations for 4-6 weeks
  - c. Significant muscle tears for 2 weeks
  - d. Minor muscular tears for 7-10 days
3. If an open injury:
  - a. Change dressing twice daily and as needed, if dirty or wet.
  - b. Continue antibiotics until definitive care is reached.
  - c. Monitor wound for signs and symptoms of infection (e.g., fever, cellulitis, lymphangitis, increased pain, purulent discharge on dressing).

## **Management of Complications**

1. Loss of function occurs when a near complete tendon laceration ruptures during exam. Inform the patient of findings and splint the injury.

## **Follow-up**

1. Patients with mallet finger injury should follow up with team or personal physician upon return from an austere environment.

## **Other/Special Considerations**

1. Once an injury has been established, it is unnecessary to reevaluate motor function until it is time to discontinue the splint.

---

## V. Force Health Protection Protocols

- A. Field Sanitation
- B. Emergency Medical Evacuation from Operational Sites
- C. Occupational Health Considerations
- D. Sick Call Medicine
- E. Acute Abdomen
- F. Altered Mental Status
- G. Cardiac Disorders
- H. Deep Vein Thrombosis
- I. Extended Patient Care
- J. Foot Care
- K. Gastrointestinal Disorders
- L. Genitourinary Disorders
  - 1. Kidney Stones
  - 2. Urinary Tract Infection
- M. Gynecologic Disorders
- N. Pregnancy Related Disorders
- O. Head, Eyes, Ears, Nose and Throat
  - 1. Headache
  - 2. Eye Care
  - 3. Ear Infections and Disorders
  - 4. Upper Respiratory Infections
- P. Pulmonary Embolus
- Q. Respiratory Disorders
- R. Rhabdomyolysis
- S. Skin Disorders
- T. Subcutaneous Abscesses
- U. Fever without Known Cause
- V. Vaccinations
- W. Water-related Exposures

---

## A. Field Sanitation

### Review

Proper field sanitation is vital to prevent the spread of enteric and other communicable diseases and to maintain environmental protection. Field sanitation includes food safety, water disinfection and waste management. Supervision of field sanitation is a preventative health function of tactical medical personnel.

### Food Safety

---

These guidelines are designed to assist with food procurement, food handling, and limiting food borne illnesses. However, situations may arise in which there are no food sources that are 100% safe. In these situations, personnel should use these guidelines to make the best choices possible. For more information on food safety, refer to the USDA website: [www.fsis.usda.gov](http://www.fsis.usda.gov).

---

1. Potentially hazardous foods (PHF) include, but are not limited to: milk and milk products, fish and shellfish, meat, and poultry.
2. The absence of odor is not a reliable indicator of safe food.
3. Basic sanitation:
  - a. Everything that touches food during preparation and serving must be clean.
  - b. Food workers **must** practice excellent personal hygiene and hand washing.
  - c. Sanitize cutting boards with diluted (100 ppm) chlorine bleach solution (one tablespoon [Tbsp] of household bleach per one gallon of potable water).
  - d. Avoid cross-contaminating other foods (e.g., fruits, vegetables) with PHF.
    - Use separate knives, cutting boards, and utensils during preparation.
    - Wash hands after handling PHF prior to handling other foods.
  - e. Avoid preparation of PHF 24 hours or more before serving.
4. The danger zone for serving/storing PHF is 41-145° F.
  - a. Cold foods must be served/stored at internal temperatures < 40° F.
  - b. Hot foods must be served/stored at internal temperatures > 145° F.
5. High cooking temperatures (165-212° F) will kill most enteric pathogens.
6. Discard any PHF that has been left unrefrigerated for more than 2 hours (1 hour if ambient temperature > 90° F).
7. Cook or freeze:
  - a. Poultry, fish, ground meats and variety meats within 2 days of purchase.
  - b. Other beef, veal, lamb or pork meats within 3-5 days of purchase.
  - c. Use cooked leftovers in 3-4 days.

- 
8. Thawing foods in refrigerator is best.
    - a. Thawing food in water is also acceptable.
      - Place food in watertight container (plastic bag), place in cold water.
      - Change cold water every 30 minutes until thawed.
      - Cook immediately after thawing.
    - b. Microwave thawing is acceptable, but cook food **immediately** after thawing.

### **Food Storage**

1. Promptly refrigerate PHF at  $\leq 40^{\circ}$  F, using containers  $< 2$  inches deep.
2. Freezing at  $\leq 0^{\circ}$  F stops bacterial growth, but will not kill pathogens already present.
3. Thorough reheating to an internal temperature of  $\geq 165^{\circ}$  F will kill pathogens that may have grown even with proper storage techniques.
  - a. Reheating is not a substitute for proper food storage.
4. **DO NOT** store acidic food or beverages (e.g., tomatoes, citrus drinks) in galvanized metal containers in order to prevent zinc poisoning.

### **Guidelines for Food Procured from Unapproved Sources**

1. Avoid local street vendors.
2. All ice (unless obtained from a filtered water source) is considered contaminated.
  - a. Anything in contact with unfiltered water ice is considered contaminated.
  - b. Alcohol beverages mixed with unfiltered water or ice are not safe.
3. Canned and dried products are relatively safe.
  - a. Do not eat from swollen, leaking, or rusty cans of food
4. Wash raw fruits and vegetables in potable water and disinfect with one of the following methods:
  - a. Place small amounts of produce in a net bag and completely submerge in boiling water for 15 seconds (not recommended for leafy vegetables)
  - b. Immerse leafy vegetables for 15 minutes in a diluted (100 ppm) chlorine bleach solution (one Tbsp of household bleach per one gallon of potable water).
    - Break apart “head” vegetables (e.g., lettuce, cabbage, celery) before disinfection
    - Rinse produce thoroughly with potable water after disinfecting and prior to storing
5. Maintain geographic awareness as to where toxins (e.g., Ciguatera) occur in seafood.
  - a. Avoid specific local species known to carry toxins.
  - b. Species and toxins vary from one location to another.
  - c. Test kits for specific toxins (e.g., Ciguatera) are available.

---

## **Water Disinfection**

1. The best method for disinfecting water in the field is through the use of a portable filter, available in individual, small group and large group sizes.
2. To be effective, the filter must possess the following:
  - a. An activated charcoal unit (binds chemicals such as pesticides, herbicides, industrial waste, radioactive particles)
  - b. A microporous filter element with maximum pore size < 0.2 microns (removes bacteria and protozoans)
  - c. An iodine resin element (kills most viruses)
    - If the filter does not have iodine resin element:
      - Treat water with iodine tablets **prior** to filtration.
      - Boil water for  $\geq 2$  minutes **after** filtering.
3. Place water to be filtered in a container that will **NOT** be used for drinking.
  - a. Allow sediments to settle for  $\geq 1$  hour before filtering.
  - b. Use a pre-filter attachment for a portable filter to remove larger particles, prevent the filter from clogging, and prolong the life of filter elements.
    - Alternatively, pour settled water into another container using a cloth for a pre-filter.
  - c. Water filters are typically ineffective when used at sub-freezing temperatures due to the freezing of filter elements. Cold weather may crack and ruin the filter.
  - d. For saltwater use, a reverse osmosis filter is used. They can be expensive, but are readily available and should be standard issue on every lifeboat.
  - e. Follow the manufacturer's instructions regarding use of an individual filter.

## **Alternative or Emergency Methods of Water Disinfection**

1. Boiling Water
  - a. Destroys almost all pathogens, including viruses but **DOES NOT** remove chemicals or radioactive particles.
  - b. Boil water for 5 minutes. (Higher altitude has no practical effect on boiling disinfection. Even at 19,000 feet, water boils at 178° F. This is sufficient for disinfection.)
  - c. If fuel conservation is required, shorten boiling time to 2 minutes.
2. Halogens
  - a. Iodine and chlorine tablets are widely available in outfitter stores.
  - b. Halogens kill most pathogens but not Cryptosporidium cysts.
  - c. Use of halogens is dependent upon concentration and contact time.
    - Required contact time increases with cold temperatures.
    - Follow the manufacturer's instructions with iodine or chlorine-based tablets for dosing and contact times.

---

### 3. Iodine

- a. Use 4 ppm concentrations for clear, warm water or 8 ppm concentrations for cloudy, cold water.
  - Minimum contact time is 30 minutes for clear, warm water or 60 minutes for cloudy, cold water.
- b. The taste of Iodine can be improved by adding a flavored drink mix to water.
- c. Tablets
  - 1 tablet/2 L = 4 ppm; 1 tablet/1 L = 8 ppm
  - If tablets are not available:
    - Povidine-iodine (**NOT** Povidine Scrub) solution may be used. Use 8-16 drops per liter (4-8 ppm).
    - A tincture (2% solution) of iodine may be used. Use 5-10 drops per liter of water (4-8 ppm).
    - Household bleach may also be used, but it is more sensitive to water pH and the presence of nitrogenous wastes in water
      - » Treat water with 2 drops (4 ppm) or 4 drops (8 ppm) per liter.
      - » Use 4 ppm concentrations for clear, warm water; 8 ppm concentrations for cloudy, cold water.
- d. Contraindications
  - Prolonged use of iodine (more than a few months) should be avoided.
  - Pregnant women should not use iodine products for > 1-3 weeks during pregnancy.
  - Persons with known iodine allergies or unstable thyroid disease should **NOT** use iodine-based disinfection.

### Waste Management

1. Includes the management of urinary and fecal wastes, wastewater, trash, and garbage.
2. Bodily functions
  - a. Bodily functions should be eliminated away from trails and at least 100 ft from any water source or camp.
  - b. If toilet facilities are not available in a field situation, a specific location should be designated for this need. All personnel should be advised of its location.
    - Dig a cat hole (a small hole) in the ground.
      - Eliminate in the cat hole. (A cat hole is not necessary for urination.)
      - Cover cat hole with dirt.
      - Burn or pack out toilet paper in a plastic bag.
    - If a prolonged encampment is likely, construct a trench latrine or pit toilet.
  - c. Encourage proper hand washing, following bowel movements (a minimum of 20 seconds of thorough washing with soap and water).
    - An alcohol-based “waterless” hand sanitizer can be used if water is limited.
3. Wastewater
  - a. Water from bathing, brushing teeth, washing dishes, etc., should be eliminated away from trails and at least 100 ft from any water source or camp.
  - b. If a prolonged encampment is likely, construct a drainage pit for showers and a dishwashing station.

---

#### 4. Trash and garbage

- a. The best course is to pack out all trash and garbage. Avoid storing trash and garbage in camp overnight to avoid attracting wildlife.
- b. Burning
  - If necessary, paper trash and food garbage can be burned in a campfire. **DO NOT** burn metal cans, glass, or plastics.
  - Designate a burn site downwind and at least 1,000 feet from the campsite, a building, or any other occupied structure.
    - Burning should be conducted in the morning hours, if possible. Avoid burning during dry or windy conditions to help prevent the development of a forest fire.
    - Check and ensure that fire has extinguished prior to nightfall. Avoid travel to burn pit at night.
    - In an area with dangerous, predatory wildlife, personnel should approach the burn pit with a minimum of two people.

---

## B. Emergency Medical Evacuation from Operational Sites

### Review

Field evacuation is the evacuation of the sick and injured from a remote location to an evacuation collection point. It is often a ground, foot-based (carry-out) operation and may take several hours to days to complete. The evacuation collection point may be a fixed field facility (base or aid station), a location to meet an emergency vehicle, a helicopter landing zone, or a shoreline landing to meet a boat/ship.

### General Considerations

1. Maintain continuous contact with the patient during evacuation.
  - a. A change in mental status is a key indicator for a significant change in condition en route to the collection point
2. Field evacuation of a stretcher patient is an arduous labor- and time-intensive task.
  - a. It is potentially dangerous to both patient and rescuers.
  - b. Every attempt should be made to medically clear the patient for accompanied ambulatory self-rescue (walk-out), as consistent with sound clinical judgment.
3. Patients often experience anxiety during stretcher evacuation.
  - a. Keep the patient informed.
  - b. Maintain reassuring voice contact with patient.
  - c. Leave the patient's face exposed so patient can observe what is occurring.

### Patient Packaging for Evacuation

1. Hypothermia wrap
  - a. Use during all cold and cool weather evacuations.
  - b. Also used in many fair weather evacuations for specific conditions such as:
    - Trauma patients
    - Exposure and immersion injuries
    - Aeromedical evacuations
2. Stabilization
  - a. Stabilize patient on the scene prior to an extended walkout (e.g, splint fractures, dress wounds, establish IV access, administer medications).
  - b. Consider urethral catheterization, Texas catheter (males), or diapers, unless monitoring I&Os during extended evacuation in a non-ambulatory patient. (Refer to protocol VI.P)
  - c. Immobilization
  - d. Patient should be immobilized to prevent unnecessary movement during evacuation.

- 
- e. Padding the patient for an extended stretcher evacuation requires extra care.
    - Provide padding to bottom of stretcher (camp pad is ideal).
    - Pad knees, ankles, small of back and back of head.
    - Pad between the patient's head and the end of the stretcher.
    - Pad between the patient's feet and the end of the stretcher.
  3. Sphygmomanometer placement
    - a. Place BP cuff around patient's arm and place arm inside the blanket or wrap.
    - b. Position pump bulb and pressure gauge on top of patient, outside of the blanket or hypothermia wrap for quick access, without disturbing the patient's covering or padding.
  4. Gather and pack the patient's equipment.

### **IV Access**

1. IV access via a saline lock is often preferred to a continuous IV drip infusion during field evacuation.
  - a. It avoids the tangling of IV lines and inadvertent loss of IV access.
  - b. The weight of several IV bags is easier to transport when distributed among rescuers.
2. Fluid therapy may be given as periodic boluses and may be timed to coincide with rest periods on prolonged evacuations. It can be managed in a manner in which patient receives the same hourly IV infusion with boluses that he/she would receive with continuous infusion.
3. Package patient to allow rapid access to IV site.

### **General Field Evacuation**

#### **Review**

Field evacuation of a stretcher patient is an arduous, labor- and time-intensive effort. Every attempt should be made to clear the patient for accompanied ambulatory self-rescue (walk-out), as consistent with sound medical judgment. Due to the difficulty and time constraints of field evacuation, helicopter evacuation indications are generally more liberal than in traditional EMS.

#### **Stretcher Bearing (Carrying)**

1. It takes a minimum of 6 rescuers to carry a stretcher bound patient  $\frac{1}{4}$  mile or less.
  - a. 4 rescuers carry the stretcher; 2 front/2 rear
  - b. 2 rescuers clear obstacles from the path ahead, act as relief stretcher bearers and assist as needed
  - c. For heavier patients or in adverse terrain, all 6 rescuers are needed to carry the stretcher.
  - d. Rotate team between positions.
  - e. If longer distances are involved, many more rescuers are required
    - Use a minimum of 8-10 rescuers

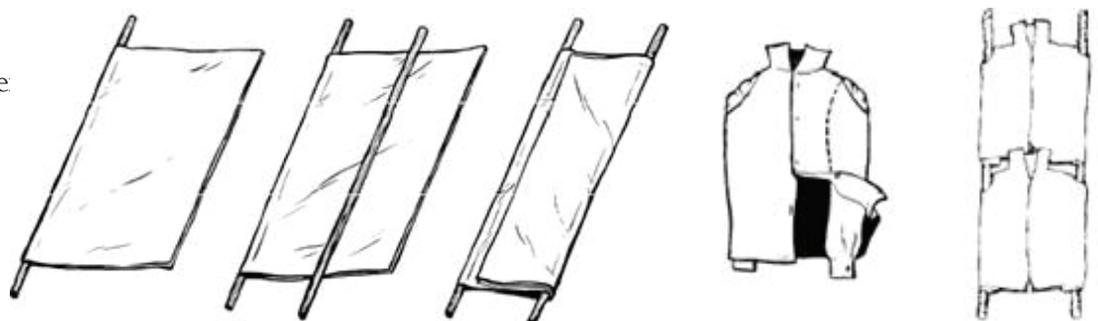
2. Webbing in a loop can be tied to the stretcher, with the loop across the rescuer's opposite shoulder to distribute weight.
3. Jackets, heavy sweatshirts, or a blanket can be used to support the poles of an improvised stretcher or military field stretcher between front and rear rescuers.
4. All commands are on the count of three (e.g., 1-2-3-lift).
5. The patient is generally carried feet first.
6. Ascending/descending slopes < 60 degrees
  - a. Carry patient head first (head up-hill) on ascent
  - b. Feet first (head up-hill) on descent
  - c. Stretcher should be belayed with rope when ascending or descending slopes of < 60 degrees°
7. Ascending/descending slopes > 60 degrees
  - a. Patient is generally carried level and horizontal on a rope hoist
  - b. If prohibited by terrain, patient may be raised / lowered vertically with head up
  - c. Ascending/descending slopes > 60 degrees constitutes high angle evacuation and requires specialized training in technical rope rescue (NFPA –TRR)
8. Use the caterpillar walk to move over small banks or ledges.
  - a. Two relief bearers position themselves forward of stretcher movement.
  - b. Stretcher is passed forward to the relief bearers; all other bearers remain in position, holding stretcher.
  - c. Stretcher is passed forward.
  - d. Rear bearers are now no longer engaged and move forward of the stretcher and the process repeats itself until the obstacle is cleared.
9. Caterpillar walk may also be used to change/rotate stretcher-bearers.

## Types of Commercial Stretchers

1. Basket (e.g., Stokes stretchers)
2. Flexible (e.g. Reeves, ultra light quick-extraction stretchers)
3. Specialty (e.g. wheeled mountain rescue and snow toboggan stretchers)

## Improvised stretchers

1. Blanket stretcher
2. Rope stretcher
3. Handled soft stretche
4. Mummy litter
5. Coiled rope handles



---

## **Patient Carries**

1. Web sling
2. One rescuer split coil
3. Two rescuer split coil
4. 4-handed seat

## **Weather Considerations**

1. Weather conditions may delay ground, air, and water transport, thereby delaying the field evacuation
2. Be prepared to render extended patient care en route to and/or at the evacuation collection point.

## **Aircraft Evacuation**

1. MEDEVAC relates to short range evacuation, typically using helicopters.
  - a. Helicopter evacuation is typically considered when:
    - It improves the patient's chances for recovery.
    - It avoids an extended, difficult, or dangerous ground evacuation.
    - The number of ground personnel is limited in a field evacuation.
    - Aircraft safety is not compromised by surrounding conditions.
2. AEROVAC relates to long range evacuation, typically using fixed wing aircraft.
3. Most larger AEROVAC and commercial aircraft maintain a cabin pressure altitude of 6,000-8,000 ft.
4. Unique stresses associated with evacuation via aircraft:
  - a. Flight safety
  - b. Flight noise and vibration
  - c. Temperature extremes
  - d. Reduced air pressure
  - e. Relative hypoxia
  - f. Third spacing/fluid shifts
  - g. Low cabin humidity (< 25%)

## **Anatomy and Physiology**

1. Physiologic effects of altitude (noted in both un-pressurized and pressurized aircraft)
  - a. Reduced air pressure (P) results in expansion of gases (Boyle's Law)
  - b. As the overall P of the gas (air) decreases, the partial pressure (pp) of each constituent gas decreases (Dalton's Law)
  - c. As pp of oxygen decreases, a lower P gradient develops
    - Results in less P to push O<sub>2</sub> molecules across the alveolar membranes in the lungs
    - Results in less oxygenation of the blood (lower O<sub>2</sub> saturation)

- d. Third spacing due to reduced ambient P from leakage of fluid from intravascular goes into the extravascular space
  - Reduced P results in decreased ambient moisture and humidity which results in the drying of mucous membranes, skin, eyes, and broncho-pulmonary surfaces
2. Relative hypoxia occurs due to decreased pp of O<sub>2</sub>.
  - a. Typical oxygen saturation (PaO<sub>2</sub>) is 90% at 8,000 ft (non-smoker).
  - b. Most healthy individuals can compensate.
  - c. Affects those with illnesses or injuries.
3. Supplemental oxygen must be humidified.
4. Replace air-filled cuffs and balloons (e.g., ET tubes) with a sterile fluid (e.g., Normal Saline, LR) and carefully monitor in-flight.

### Relative Contraindications to Evacuation by Air

| Description                                     |   |   |
|---|---|---|
| Severe Anemia:<br>Hgb < 7 gm/dL, Hct < 21 gm/dL | Myocardial infarct in past 10 days, or complications in past 5 days | Beyond 34th week of pregnancy unless absolutely medically necessary |
| Recent Acute Blood Loss:<br>Hct < 30 gm/dL      | Infectious stage of serious communicable disease                    | Fever of unknown origin > 102° F                                    |
| Sickle Cell Disease                             | Infectious stage of serious communicable disease                    | Unlikely to survive the flight due to terminal illness or injury    |
| Active Hematemesis                              | CVA within 7 days   |   |
| General surgery within 5 days                   | Intracranial air  |   |

### Relative Contraindications to Evacuation by Air with Mitigating Interventions

| Condition                      | Intervention  |
|--------------------------------|---|
| Pneumothorax within 72 hrs     | Chest tube or Heimlich Valve in place, monitor tubing for occlusion or kinking  |
| Tracheostomy                   | Humidified O <sub>2</sub> must be available and in place  |
| Pacemaker                      | Must be prepared to adjust en route   |
| Eye surgery or trauma          | Must keep altitude < 1,500 ft   |
| Spinal injury                  | For AEROVAC: Stryker frame must be utilized<br>For MEDEVAC: Full C-spine immobilization in place  |
| Upper/lower jaw immobilization | Must have quick release available (wire cutters)  |
| Circumferential casts          | Casts must be bivalved; check sensory, motor and vascular status frequently during flight (particularly if patient is unconscious or sedated); recheck status after repositioning patient to prevent damage incurred from kinked structures.<br><br>If air splints have been used, partially deflate prior to flight or vent in flight as needed. Re-inflate as P decreases on descent or landing |

---

## **Other/Special Considerations**

1. Oxygen administration at altitude
  - a. The oxygen concentration ( $\text{FiO}_2$ ) delivered to the patient needs to be adjusted for altitude to compensate for reduced pressure. In pressurized aircraft, adjust  $\text{FiO}_2$  to pressure altitude of cabin, not actual altitude.
  - b. At sea level, a nasal cannula at 1 L/minute delivers an  $\text{FiO}_2$  of 24%.
    - Each increase of 1 L of  $\text{O}_2$  typically represents a 4% increase in  $\text{FiO}_2$ .
    - Maximum  $\text{FiO}_2$  possible via nasal cannula is 44% (6 L).
  - c. A face mask with a non re-breathing reservoir bag provides 90-100% oxygen.
  - d. With a standard  $\text{O}_2$  face mask, attach a calibrated Venturi device to manage the  $\text{FiO}_2$  (at sea level 15 L/min delivers 60%  $\text{FiO}_2$ ).
  - e. If patient on a mechanical ventilator, use ventilator's adjustment settings.

### **$\text{O}_2$ Adjustment formula:**

$$\frac{\text{P at original facility} \times \text{the required } \text{FiO}_2}{\text{New P altitude}} = \text{Required } \text{FiO}_2 \text{ at new altitude}$$

P = Pressure (atmospheric) in mm Hg

- f. Use the  $\text{O}_2$  Adjustment Formula to calculate the  $\text{FiO}_2$  at a given altitude.
  - Example: Patient transport at 4,000 feet altitude, original facility at sea level
    - P at original facility: 760 mm Hg (sea level P)
    - P at 4,000 ft = 656 mm Hg (pressure altitude)
    - Patient receiving 2 L/minute  $\text{O}_2$ ,  $\text{FiO}_2$  is 28%
    - $0.28 \times 760/656 = 0.32$  or 32%
    - $\text{FiO}_2$  needs adjustment to 32% to receive same relative  $\text{FiO}_2$  concentration at 4,000 ft.
- g. 8,000 ft is the maximum allowable flight altitude without oxygen for passengers and crew.

## Standard Pressures at Altitude

| Altitude (ft) | Pressure (mm Hg) | Altitude (ft) | Pressure (mm Hg) | Altitude (ft) | Pressure (mm Hg) |
|---------------|------------------|---------------|------------------|---------------|------------------|
| 0 (Sea Level) | 760.00           | 6,000         | 609.09           | 12,000        | 483.36           |
| 500           | 746.51           | 6,500         | 597.66           | 12,500        | 473.96           |
| 1,000         | 733.04           | 7,000         | 586.49           | 13,000        | 464.82           |
| 1,500         | 719.84           | 7,500         | 575.56           | 13,500        | 455.68           |
| 2,000         | 706.63           | 8,000         | 564.64           | 14,000        | 446.53           |
| 2,500         | 693.93           | 8,500         | 553.97           | 14,500        | 437.90           |
| 3,000         | 681.23           | 9,000         | 543.31           | 15,000        | 429.01           |
| 3,500         | 668.78           | 9,500         | 532.89           | 15,500        | 420.62           |
| 4,000         | 656.34           | 10,000        | 522.73           | 16,000        | 411.99           |
| 4,500         | 644.40           | 10,500        | 512.83           | 16,500        | 403.86           |
| 5,000         | 632.46           | 11,000        | 502.92           | 17,000        | 395.73           |
| 5,500         | 620.78           | 11,500        | 493.01           | 17,500        | 387.60           |

Source: NOAA

## Management of Complications

1. Minor barotraumas (e.g., barotitis media, barosinusitis, barodontalgia) can occur during flight ascent/descent. (Refer to Protocol III.E.5 and Protocol III.E.6.)
2. Distention of gas in stomach or bowel can occur during flight ascent/descent.
  - a. Consider placing a nasogastric (NG) tube for patients who are unconscious or have had recent GI surgery or trauma.
3. Tension pneumothorax in trauma patients can occur during flight ascent/descent.
  - a. This condition can be catastrophic if the aircraft accidentally depressurizes in-flight. Perform a needle decompression. (Refer to Protocol VI.L.)

---

## C. Occupational Health Considerations

### **Hearing Protection**

1. 110 decibel (dB) exposure for more than 1 minute risks permanent hearing loss.
2. Prolonged exposure to any noise  $\geq 85$  decibels can cause gradual hearing loss.
3. Wear earplugs, earmuffs, or other hearing protection devices when indicated.
4. Typical decibel (dB) ratings:
  - a. 140-170 dB – Firearms discharge
  - b. 150 dB – Firecracker
  - c. 120 dB – Ambulance siren
  - d. 110 dB – Chain saw, rock concert (110 dB+)
  - e. 100 dB – Snowmobile
  - f. 95 dB – Motor cycle
  - g. 85 dB – Heavy city traffic
  - h. 60 dB – Normal conversation

### **Eye Protection**

1. Safety goggles, or other appropriate eye protection, is indicated for:
  - a. Protection from projectile fragments when working with power tools or on firing range.
  - b. Ultraviolet and infrared protection when working on the water, snow, other intense light conditions, or while at high altitude.

### **Immersion Protection**

1. Wear waterproof gloves and hip waders, chest waders, or a dry suit when working in contaminated or toxic water, which is particularly important near flooded industrial sites, following river and/or storm flooding.

### **Solar Protection**

1. Use appropriate sunscreens (SPF 30+); reapply often.
2. Cover exposed skin as much as possible.
3. Special attention is required at high altitudes or polar latitudes.

---

## **Influenza Precautions**

1. In the presence of an outbreak or pandemic, follow respiratory precautions:
  - a. Use a proper fitting mask, as advised by Centers for Disease Control and Prevention (CDC).
  - b. Wash hands frequently.
  - c. Avoid contact with others, if febrile or sick.
  - d. Consider oral anti-viral prophylaxis medication; start within 48 hours of exposure to virus for maximal effect.

## **Immunizations**

1. Maintain up-to-date recommended immunizations specific to operating area.
2. Maintain up-to-date tetanus immunizations.
3. Obtain annual influenza immunization.
4. Consider obtaining hepatitis A and B immunizations.
5. Consider annual TB testing.

---

## D. Sick Call Medicine

### Review

Sick call medicine is the evaluation of common medical complaints that may be encountered in an austere setting.

A key role of the AEMS provider is to differentiate minor illness and injury from their more severe forms that may require evacuation. Key indicators are signs, symptoms, and pertinent examination findings that assist in differentiating minor from more severe conditions. In many cases, the key indicators act as “red flags.”

### Basic Tools

1. Stethoscope
2. BP cuff
3. Otoscope
4. Thermometer (oral and rectal)
5. Glucometer,
6. Urine dip stick
7. Urine specimen container or cup

### Key Indicators

#### **Bleeding**

1. Posterior epistaxis
2. Bloody stools (hematochezia)
3. Dark, tarry stools (melena)
4. Vomiting blood (hematemesis)
5. Coughing blood (hemoptysis)
6. Patients taking anticoagulant medications

#### **Chest Pain**

1. New onset or change in quality/pattern of angina
2. Chest pain with dyspnea
3. Chest pain with new ECG changes
4. Chest pain in a drug user
5. HR >100 bpm or < 50 bpm
6. Systolic BP > 160 mm Hg or < 90 mm Hg, Diastolic BP > 115 mm Hg
7. Systolic BP > 20 mm Hg difference between left and right arms

---

## Eyes

1. Abrupt loss or significant change in vision (greater than one line change in visual acuity)
2. Transient loss of vision, abrupt flashes of light, halos or “waving curtains”
3. Eye pain around globe or orbital area
4. New onset diplopia
5. Facial herpes or orbital cellulitis
6. Blood in anterior chamber (hyphema)
7. Photophobia
8. Lag in upward gaze when evaluating extra ocular motion (EOM)
9. Infraorbital anesthesia or parasthesia following orbital injury

## Fever

1. Fever in a suspected IV drug abuser
2. Fever accompanied by altered mental status
3. Fever associated with any airway complications
4. Fever associated signs of meningitis
5. Fever > 101° F

## Headache (HA)

1. Acute onset of “worst headache of my life”
2. Headache accompanied by persistent vomiting or projectile vomiting
3. Headache with a fever
4. Headache associated with photophobia
5. Headache accompanied by neck pain with movement or stiff neck
6. New type of severe headache in patients with Hx of migraines
7. Headache accompanied by Diastolic BP > 110 mm Hg
8. Headache accompanied by visual changes
9. Headache associated with syncope or recent head injury

## Abscesses

1. Abscesses accompanied by cellulitis or lymphadenopathy
2. Abscesses accompanied by fever, general malaise, weakness
3. Abscesses in an immunocompromised patient
4. Abscesses in a patient with chronic steroid usage

---

## Neurologic

1. Altered or unusual mental status findings
2. Paralysis
3. Parasthesia
4. Unilateral decrease in hand grasp strength
5. Unilateral decrease in plantar flexion strength
6. Positive pronator drift
7. Ataxia
8. Slurred speech or difficulty speaking

## Ob-Gyn

1. Rape or sexual assault
2. Non-pregnancy related bleeding with orthostatic changes or tachycardia
3. Vaginal bleeding in pregnancy
4. Ectopic pregnancy
5. BP >140/90 mm Hg or a 20 mm Hg rise from patient's baseline BP (toxemia)
6. Proteinuria with headache or ABD pain (toxemia)

## Pain

1. ABD pain
2. ABD pain associated with a mass, especially if pulsatile
3. Intractable, severe pain
4. Pain associated with deep venous thrombosis

## Respiratory

1. Shortness of breath with RR > 24 rpm
2. Shortness of breath with Systolic BP < 90 mm Hg or Diastolic BP > 115 mm Hg
3. Shortness of breath with HR < 50 bpm or > 120 bpm
4. Cyanosis
5. Dyspnea related to foreign body ingestion or aspiration
6. Hx of choking on a foreign body
7. Associated ECG changes or chest pain
8. Tachypnea associated with blood sugar level > 240 dL/mg
9. Urticaria with wheezing and/or oral or facial swelling

---

## Genitourinary (GU)

1. Inability to urinate
2. Hematuria
3. Extreme flank, abdominal, or genital pain
4. Fever, general malaise, weakness
5. Fever > 101° F with pyuria (pus in urine, cloudy urine)
6. Pyuria in patients > 55 years or with complex medical Hx (may be a sign of UTI, sepsis, or pneumonia)

## Vomiting

1. LOC, altered mental status, head injury
2. Projectile vomiting
3. Hematemesis
4. Systolic BP < 90 mm Hg
5. Orthostatic HR increase of > 20 bpm or drop in Systolic BP > 10 mm Hg
6. Associated signs of acute abdomen
7. Cancer patients
8. Suspected drug toxicity

## Seizures

1. New onset
2. Change in normal seizure pattern
3. Altered mental status
4. Associated head or spinal injury

## Syncope

1. No obvious vasovagal cause
2. Associated head injury
3. Secondary to heat injury
4. Syncope with positive neurological symptoms or physical findings
5. Orthostatic HR increase of > 20 bpm or drop in Systolic BP > 10 mm Hg

---

## E. Acute Abdomen

### Review of Injury/Illness

Determining the exact cause of acute abdominal pain is less important than determining if the patient requires urgent surgery. Common causes of abdominal pain include acute appendicitis, acute colocolitis, and perforated viscous which require surgical evaluation. Severe abdominal pain can also be caused by many conditions that are not directly related to the gastrointestinal tract, such as cardiac ischemia, pneumonia, urinary tract infection, and gynecologic conditions.

Small bowel obstruction (SBO) can lead to an acute abdomen but often presents before this stage:

- Small bowel obstruction is a mechanical obstruction of the intestine.
- It initially presents with sudden onset of severe, sharp waves of colicky pain involving the entire abdomen.
- As the condition progresses, gastric contents and gas build up proximal to the obstruction. This causes distension, constant diffuse pain, nausea, and bilious vomiting.
- Without surgery, the bowel wall will become ischemic from a lack of blood supply. Eventually it will rupture, leading to peritonitis. It is imperative that a SBO is quickly identified and treated prior to this occurring.

### Signs and Symptoms

#### Acute Abdomen

- \* **Sever, persistent or worsening abdominal pain**
- \* **Signs of peritoneal inflammation**
  - **Tenderness with guarding**
  - **Rebound/percussive tenderness**
  - **“Rigid” abdomen**
  - **Patient lying perfectly still (movement causes severe pain)**
- \* **Fever**
- \* **Anorexia**
- \* **Nausea, vomiting**
- \* **Mild diarrhea**

#### Small Bowel Obstruction

- \* **Early**
  - **Waves of severe colicky pain involving the entire abdomen, progressing to constant diffuse pain**
  - **Nausea**
  - **Vomiting, classically bilious (green)**
  - **Distended abdomen**
  - **Lack of bowel movement and flatus**
  - **Tinkling, high-pitched bowel sounds**
  - **Non-reducible abdominal hernia (groin or ventral)**
- \* **Late**
  - **Peritonitis**
  - **Fever**
  - **Distended, tympanic abdomen**
  - **Silent abdomen (no bowel sounds heard in all four quadrants, over 2 minutes each)**

---

## **Management**

### **BLS**

1. Keep patient NPO, except for sips of water with medications.
2. Assess and treat for bleeding and/or shock, if indicated.
3. Administer pain management medications after consulting on-line medical direction. (Refer to Protocol VII.A.)

### **ALS**

1. Administer initial fluid bolus 0.9% Normal Saline or LR 250 ml IV/IO, up to a maximum total infusion of 2,000 ml. Titrate to maintain Systolic BP > 90 mm Hg.
2. Administer **both** antibiotics after consulting on-line medical direction. Continue administering antibiotics until definitive care is reached.
  - a. Levofloxacin (Levaquin®) 750 mg IV QD
  - b. Metronidazole (Flagyl®) 500 mg IV q6h
3. Place nasogastric (NG) tube, if available.
  - a. Confirm location by aspiration of gastric contents or auscultation of gastric air on insufflations.
  - b. Aspirate all initial contents. Continue attempts to aspirate gastric contents every 15-30 minutes.
4. For nausea or vomiting, administer appropriate antiemetic medication. (Refer to Protocol V.K.)

### **Evacuation**

1. Urgent evacuation is required for acute abdomen and small bowel obstruction. Evacuation to surgery is lifesaving treatment.

### **Extended Care**

1. Maintain NG tube and aspirate gastric contents every 15-30 minutes.
2. Continue IV/IO hydration, pain control, and antibiotics, as indicated.
3. Be prepared for patient to become severely ill and progressively more unstable.

## F. Altered Mental Status

### Review of Injury/Illness

Acute behavioral changes can result from traumatic head injury, metabolic and endocrine disease processes, seizures, stress disorders, and poisoning. For acute combativeness, agitation, or violent behavior where the patient needs to be controlled for the safety of the group, ALS-trained personnel should consider sedation.

### Signs and Symptoms

| Diabetic Episode  | Seizures  | Combative Patient                                |
|---|---|--|
| History of Diabetes<br>Hypoglycemia (blood glucose < 70 dL/mg)<br>Hyperglycemia (blood glucose > 400 dL/mg) | Witnessed seizure<br>History of seizures<br>Recent head trauma<br>Evidence of CNS infection | Confusion /disorientation<br>Aggressive Behavior |

### Management

#### **BLS**

1. Conduct a complete physical exam including:
  - a. Assess for signs of external head injury.
  - b. Check GCS score. (Refer to Protocol VII.B.)
  - c. Check pupillary responses.
  - d. Check core body temperature.
  - e. Check blood glucose levels with a glucometer, if available.
  - f. Assess for alcohol or drug use.
2. Secure and maintain airway and place patient in recovery position.
  - a. Chin lift or jaw thrust maneuver
  - b. NP or OP airway
3. Administer supplemental oxygen, as needed. Assist ventilations with a bag valve mask (BVM), if necessary.
4. Control all sources of hemorrhaging that could have been sustained during AMS episode. (Refer to Protocol IV.A.)
5. Treat any traumatic injuries that could have been sustained during AMS episode. (Refer to Protocol IV.F.)
6. Assess and treat for hypothermia. (Refer to Protocol III.C.)
7. If hypoglycemic:
  - a. If patient is awake and able to swallow, give patient something to eat or drink that contains sugar (e.g., fruit juice, fruit, candy, non-diet soda) until AMS is resolved.
  - b. If patient cannot protect airway, place small amounts of sugar or glucose paste (10-15 gm) between the cheek and teeth until AMS is resolved.

8. If hyperglycemic, administer oral fluids, if patient is awake and able to swallow.
9. If the patient is experiencing seizures or is postictal:
  - a. Avoid trauma to the patient during seizures.
  - b. If possible, place the patient on his/her side to avoid aspiration of vomitus.
  - c. If seizures are accompanied by fever, consider meningitis and urgent evacuation.
  - d. If patient cannot protect airway, place small amounts of sugar or glucose paste (10-15 gm) between the cheek and teeth to treat for possible hypoglycemia.

## ALS

1. If respiratory arrest, consider advanced airway management:
  - a. Approved supraglottic device; or
  - b. Endotracheal intubation; or
  - c. Surgical cricothyroidotomy (Refer to Protocol VI.D.)
2. If hypoglycemic:
  - a. Initiate 0.9% Normal Saline or LR via IV/IO at KVO or saline lock.
  - b. Administer Dextrose 50% (D50W) 25 gm IV/IO; may repeat x1 in 5 minutes, if no response.
  - c. If IV/IO access cannot be obtained, administer Glucagon 1 mg IM; may repeat x1 in 5 minutes, if no response.
3. If hyperglycemic, administer initial fluid bolus 0.9% Normal Saline or LR 1,000 ml IV/IO, over 30-60 minutes, followed by Normal Saline or LR at 150 ml/hr.
4. For seizures lasting more than 10 minutes or without recovery of consciousness:
  - a. Administer diazepam (Valium®) 5.0 mg IV/IO slow; may repeat every 5 minutes, up to a maximum total dose of 20 mg.
  - b. If IV/IO access cannot be obtained, administer one of the following:
    - Diazepam (Valium®) 5.0 mg IM; may repeat x1 in 5 minutes, if no response.
    - Midazolam (Versed®) 5 mg IM; may repeat x1 in 5 minutes, if no response.
5. For a combative patient that is a danger to oneself or others, consider **one** of the following:
  - a. Lorazepam (Ativan®) 1.0-2.0 mg IV/IO; may repeat x1 in 5 minutes, if no response.
  - b. Diazepam (Valium®) 5.0 mg IV/IO; may repeat x1 in 5 minutes, if no response.
  - c. Haloperidol (Haldol®) 5.0 mg IV/IO; may repeat x1 in 5 minutes, if no response. Patient **must** be monitored if administered this medication.

## Evacuation

1. Conduct urgent evacuation for all acute behavioral changes, except for mild hypoglycemia that responds to treatment.
2. Conduct urgent evacuation for all acute behavioral changes in patients taking oral hyperglycemic medications.
3. Limited supplies for treating diabetic patients (e.g., IV fluids, glucose paste) increases evacuation priority.

---

### **Extended Care**

1. **DO NOT** leave any patient alone, even after an AMS episode has been resolved.
2. Monitor blood glucose levels hourly after any diabetic emergency.
3. Avoid alcohol and recreational drugs after any episode of AMS.

### **Follow Up**

1. Any patient who experiences an unexplained acute behavioral change should follow up with a personal or team physician upon returning from an austere environment.

### **Other/Special Considerations**

1. Consider that AMS may result from chemical or nerve agents.
2. Consider that AMS may result of fever. (Refer to Protocol V.U.)

---

## G. Cardiac Disorders

### Review of Injury/Illness

Acute Coronary Syndrome (ACS), including myocardial infarction (MI) and unstable angina, is an umbrella term that covers any group of clinical symptoms compatible with acute myocardial ischemia. Acute myocardial ischemia is chest pain due to insufficient blood supply to the heart muscle. It most commonly results from coronary artery disease. Congestive heart failure (CHF) is a condition in which the heart can't pump enough blood to the body's other organs, usually resulting in fluid build-up in the lungs and/or lower extremities. Immediate evacuation is vital to successful treatment.

### Signs and Symptoms

#### Acute Coronary Syndrome

- \* Chest pain that often feels “crushing” or “squeezing”
- \* Pain may radiate to arm or jaw
- \* Pain often exacerbated by physical exertion
- \* Diaphoresis
- \* Nausea, vomiting
- \* Anxiety
- \* Dyspnea

#### Congestive Heart Failure (CHF)

- \* Dyspnea
- \* Tachycardia, tachypnea
- \* Fatigue
- \* Jugular vein distension
- \* Pulmonary rales and/or wheezes
- \* Cyanosis
- \* Diaphoresis
- \* Peripheral edema
- \* Paroxysmal nocturnal dyspnea

## **Management**

1. If the patient is pulseless and non-breathing, initiate CPR according to current American Heart Association (AHA) guidelines.

| <b>Acute Coronary Syndrome</b>  | <b>Congestive Heart Failure</b>  |
|---|--|
| <p><b>BLS</b></p> <p>Have patient discontinue all exertion and place into position of comfort.</p> <p>Administer oxygen, if available. Assist with bag valve mask (BVM), if necessary.</p> <p>Administer aspirin 81-325 mg, if the victim has no allergies to ASA and history of significant GI bleeding.</p> <p>Administer 0.4 mg nitroglycerin sublingual every 5 minutes, up to 3 doses, until pain is relieved.</p> <ul style="list-style-type: none"><li>• Contraindicated if Systolic BP &lt; 100 mm Hg<ul style="list-style-type: none"><li>▫ In the absence of a BP cuff, the inability to palpate a radial pulse in the wrist indicates hypotension.</li></ul></li></ul> | <p><b>BLS</b></p> <p>Place patient into position of comfort (sitting upright preferred).</p> <p>Administer oxygen, if available. Assist with bag valve mask (BVM), if necessary.</p> <p>Administer 0.4 mg nitroglycerin sublingual every 5 minutes, up to 3 doses, until pain is relieved.</p> <ul style="list-style-type: none"><li>• Contraindicated if Systolic BP &lt; 120 mm Hg</li></ul> <p>If the patient is wheezing, and has a prescribed metered dose inhaler (MDI), assistance may be offered for administration.</p> |
| <p><b>ALS</b></p> <p>Consider giving a beta-blocker such as metoprolol 5 mg IV/IO, over 1-2 minutes; may repeat every 5 minutes, up to a maximum of 3 doses.</p> <ul style="list-style-type: none"><li>• Contraindicated if Systolic BP &lt; 100 mm Hg, HR &lt; 60 bpm, or if there is Hx of heart block, asthma, COPD, or CHF.</li></ul>   | <p><b>ALS</b></p> <p>Consider administering furosemide 20-40 mg IV/IO/IM/PO (or twice the patient's prescribed dosage).</p> <p>If patient is wheezing, administer Albuterol 2.5 mg in 3 ml Normal Saline via nebulizer, every 5 minutes, if available.</p>   |

## **Evacuation**

1. Conduct urgent evacuation for all cardiac disorders.

## **Extended Care**

1. Obtain 12-lead ECG and monitor cardiac rhythm and treat any dysrhythmia. Repeat 12-lead ECG every 6 hours, or if any changes in chest pain occur.
2. Minimize exertion and/or activities for patient.

## **Other/Special Considerations**

1. Many signs and symptoms of CHF parallel those of high-altitude pulmonary edema (HAPE). Patients with HAPE do not usually have jugular venous distension and difficulty breathing when lying flat. (Refer to Protocol III.A.)

---

## H. Deep Vein Thrombosis (DVT)

### Review of Injury/Illness

A thrombus (clot) develops in a vein, resulting in occlusion. Clots can dislodge and flow through the blood stream to lodge in another part of the body, most commonly the lungs.

- Clots are commonly found in the lower extremities, but may occur in any deep vein.
- Thrombus often lead to pulmonary embolus (PE). (Refer to Protocol V.P.)
- They can also be mistaken for cellulitis or Baker's Cyst (non-tender, benign cyst that causes swelling behind the knee)

### Risk Factors

1. Recent air flight (due to cramped, prolonged sitting in-flight and dehydration)
2. Recent lower extremity injury or surgery
3. Oral contraceptive use
4. Recent prolonged inactivity or bed confinement
5. Obesity, advanced age
6. CHF, recent MI, cancer
7. Prior history of DVT
8. Dehydration
9. Smoking

### Signs and Symptoms

- \* **Swelling**
- \* **Calf pain, tenderness**
- \* **Erythema**
- \* **Palpable vein(s)**

**Be alert for development of PE. (Refer to Protocol V.P.)**

### Management

#### **BLS**

1. Monitor pulse oximetry, if available. A sudden decrease in SpO<sub>2</sub> suggests PE.
2. Administer Aspirin 325-650 mg PO.
3. Immobilize the affected extremity.

#### **ALS**

1. Administer supplemental oxygen, if necessary.
2. Initiate 0.9% Normal Saline or LR via IV/IO at KVO or saline lock.

- 
3. Obtain 12-lead ECG and monitor cardiac rhythm and treat any dysrhythmia according to current American Heart Association (AHA) ACLS guidelines.
  4. Assess and treat for symptomatic PE. (Refer to Protocol V.P.)

### **Evacuation**

1. Conduct urgent evacuation for DVT with respiratory distress.
2. Conduct priority evacuation for DVT without respiratory distress.

### **Extended Care**

#### **General**

1. Treat supportively and symptomatically.
2. Continuously monitor cardiac rhythm and pulse oximetry.

#### **ALS**

1. If evacuation is delayed, administer a low molecular weight heparin (e.g., enoxaparin) 1 mg/kg sq q12h.
  - a. **DO NOT** administer enoxaparin via IV/IO/IM.
  - b. Avoid further use of aspirin and NSAIDs, if enoxaparin started.
  - c. Monitor for bleeding.
  - d. Enoxaparin may be stored at room temperature (best between 59-86° F).
  - e. Contraindicated for patients allergic to heparin and/or pork products, or those actively bleeding.

### **Other/Special Considerations**

1. No further definitive field treatment is available without lab testing (e.g., PTT, INR).

## I. Extended Patient Care

### Review

On long or delayed evacuations, patient care needs must be addressed. This is particularly important if evacuation will be delayed more than 24 hours.

### Maintain Privacy

1. Perform medical evaluation or history/medical questioning away from others. Others may also be requested to leave the area during the interview and/or examination.
2. If in an open area, drape the exam area with tarps during the examination, if possible.

### Oxygen Therapy

1. To determine remaining oxygen supply in a standard medical oxygen tank:
  - a. Subtract the safe residual pressure (rP) of 200 psi from the current tank pressure (Tp), then multiply by the cylinder factor constant (Cf), then divide by the flow rate in liters per minute = time remaining at current flow rate.
  - b. Use the following formula:

$$\text{Time remaining} = \frac{(T_p - rP) Cf}{\text{Flow rate in LPM}} \quad \text{or} \quad [(T_p - rP) Cf ]/LPM$$

Where:

Tp = Current tank pressure in psi

rP = Safe residual pressure (200 psi)

Cf = Cylinder factor constant for tank in use

LPM = Flow rate in liters per minute

### **Oxygen Tank Volumes and Cylinder Factor Constants**

| Tank Type | Volume (Liters) | Cylinder Factor Constant (Cf) |
|-----------|-----------------|-------------------------------|
| D         | 350             | 0.16                          |
| Super D   | 500             | --                            |
| E         | 625             | 0.28                          |
| M         | 3,000           | 1.56                          |
| G         | 5,300           | 2.41                          |
| H         | 6,900           | 3.14                          |
| K         | 6,900           | 3.14                          |

2. Oxygen supply may be extended in the field through the use of re-breather technology (e.g., CO<sub>2</sub> scrubbers, O<sub>2</sub> scavengers devices, REMO-2 (DAN), Wenoll, Circulox, Oxi-Saver).
  - a. This technology extends standard tank O<sub>2</sub> supply by up to 8 hours.
  - b. Re-breather technology can maintain an oxygen concentration (FiO<sub>2</sub>) of at least 93%, with a mean FiO<sub>2</sub> of 95% in experimental studies.
  - c. Use only with conscious and responsive patients as CO<sub>2</sub> poisoning may occur, secondary to equipment malfunction.
  - d. It cannot be used with BVM or NRBM, as it may not generate sufficient pressure to inflate bags adequately.

## **IV Maintenance**

1. Rotate IV sites after 48 hours, for prolonged care.
  - a. Monitor IV site for infiltration, phlebitis.
  - b. Ensure the removal of all air when changing tubing.
2. If the initial IV catheter was inserted under emergency conditions, replace it with a new catheter using aseptic technique, when possible.
  - a. Secure a new IV site before removing the old IV catheter.
3. Observe patient for signs of fluid overload:
  - a. Shortness of breath, increased respiratory rate, increased BP
  - b. Excessive cough
  - c. Jugular vein distension (JVD)
  - d. If overload is suspected:
    - Slow IV to KVO rate or saline lock.
    - Administer O<sub>2</sub> via NRBM at 15 L/minute.
    - Position the patient for easiest breathing and comfort.
4. If using saline lock:
  - a. Flush with 3.0-5.0 ml of sterile normal saline or water q8h, unless previously flushed during medication administration.

### **Calculating IV Flow Rate**

$$\text{gtts/min} = \frac{\text{volume to be infused} \times \text{gtt/min of administration set}}{\text{Time of infusion (in minutes)}}$$

{gtts/min = drops/min}

- b. Example: IV infusion at 100 ml/hr using a macrodrip set (10 gtts/min):

$$\text{gtts/min} = \frac{100 \times 10}{60} = \frac{1000}{60} = 17 \text{ gtts/min}$$

- 
5. Drip rates of IV administration sets:
    - a. Microdrip = 60 gtts/min
    - b. Macro drip = 10 or 15 gtts/min

### **Intake and Output (I&O)**

1. I&O is used to monitor IV therapy, hydration, fluid loss.
2. Measure (in ml) and record all intake: PO, IV/IO, NGT.
3. Measure (in ml) and record all output: urine, emesis, and drainage from NGT and/or surgical drain.
4. Record sub-total I&O every 8 hours and total I&O every 24 hours.
5. For critical and seriously ill patients on IV fluids, record IV fluid input and urine output hourly.
6. Urine output < 30 ml/hr may indicate decreased renal function.

### **Nutrition**

1. Patients have varying dietary concerns based on religion, culture, and other medical conditions.
  - a. If patient is conscious and able to eat, discuss any dietary concerns the patient may have.
  - b. Food is a major morale issue. Make every reasonable effort to accommodate the patient's dietary preferences.
2. Normal daily adult calorie requirement:
  - a. Generally 2,000 calories
  - b. 2,500 calories for active adult males < 45 years
3. Diet for gastroenteritis patients:
  - a. Start with a clear or full liquid diet.
  - b. Advance the diet, as tolerated.
  - c. If symptoms reoccur, or worsen, return to a clear or full liquid diet.
  - d. Clear liquid diet includes:
    - Flavored drink mixes (e.g., Kool-Aid), fruit punch, clear, flat carbonated beverages (e.g., ginger ale), electrolyte (sports) drinks, tea
    - Clear bouillon
    - Gelatin (e.g., Jell-O), popsicles, fruit ice
    - **NO** coffee or carbonated drinks
  - e. Full liquid diet includes:
    - Cocoa
    - Fruit juices (e.g., apple, grape, cranberry)
    - Vegetable juices
    - Strained soups
    - Cream of wheat/rice hot cereal

- 
- f. Soft food diet includes:
    - White bread or toast
    - Cooked/ready-to-eat cereal (**NO** bran)
    - Mild cheese, cottage cheese
    - Pasta, rice, boiled/mashed potatoes
    - Graham crackers, saltines
    - Apple sauce, bananas, seedless melons
    - Cooked/canned fruits
  - g. Soft food diet plus includes:
    - Eggs (e.g., soft-cooked, poached, hard-boiled, scrambled)
    - Tender meat, fish or poultry
    - Soft cake or cookies (**NO** nuts or raisins)
    - Butter, cream, margarine, jelly

### **Feeding via Nasogastric Tube (NGT)**

1. Nutrition may be given via NGT if:
  - a. GI tract functions are normal
  - b. The patient is unconscious or otherwise incapable of eating
  - c. A significant delay in evacuation has occurred
  - d. Evacuation delay continues
  - e. Feeding will not complicate, or worsen, the condition
2. If prepared gastric feeding supplements are not available, reconstituted soup bouillon, soup stock, protein drinks, apple sauce, etc. may be used.
3. Technique:
  - a. Check for abdominal distention and bowel sounds.
    - Delay NGT feeding if distention is present or bowel sounds are absent.
  - b. Check for residual gastric contents by aspirating NGT.
    - If > 50-100 ml, delay NGT feeding until residual gastric contents diminish.
  - c. Place patient on his/her right side in High Fowler's (sitting) position.
  - d. Fill a 30-60 ml catheter tip syringe with gastric supplement.
  - e. Infuse slowly via the NGT.
  - f. Finish administration by flushing NGT with 30-60 ml of water or normal saline.

---

## **Daily Care**

1. Daily care maintains general health and prevents complications of bed confinement.
2. All daily care depends on weather and exposure.
3. Patients should be ambulatory, if possible.
  - a. Patients may need assistance walking
  - b. Escort patient to continue monitoring, as needed.
  - c. Check patency and positioning of all tubes, making sure nothing is pulling against any of the tubes.
4. Care Routine:
  - a. Patient care area
    - Adjust and straighten the patient's bedding.
    - Clean and straighten up the immediate patient area.
    - Check integrity of the patient shelter.
  - b. Opportunity to void
    - Patients should be ambulatory, if possible.
      - Assist the patient, if bedridden. Use or improvise a bedpan or urinal.
  - c. Bathing
    - Patients should be ambulatory, if possible.
      - Assist the patient, if bedridden or unconscious.
    - Opportunity to wash face and hands, brush teeth
    - Full bath (if possible)
    - Lotion for dry skin
    - Powder for moist skin (hot and humid conditions)

## **Oral Hygiene**

1. Perform in the morning, after every meal, and before bedtime.
2. Assist patient, if needed, using:
  - a. Soft toothbrush
  - b. Gauze sponge wrapped around tongue blade
  - c. Commercially-prepared oral hygiene swab
  - d. Avoid lemon/glycerin oral swabs or mouthwash containing alcohol.
  - e. An unconscious patient should be positioned laying on his/her side during oral care, if possible.
3. Oral hygiene is particularly important for patients who are receiving O<sub>2</sub>, have NGT, or are NPO.
4. A moisturizer (e.g., Vaseline, cocoa butter, ChapStick) may be applied to lips to prevent dryness and cracking.

---

## **Elimination**

1. Monitor patient for voiding or defecating in bed, as urine and feces are very irritating to the skin and can lead to pressure sores.
2. Waste must be washed away completely. Dry the skin and provide new bedding, if possible.
3. In unconscious patients or patients in a hypothermia wrap, “chucks” or other absorbent towels or adult diapers should be used.
4. Consider urethral catheterization, Texas catheter (males), or diapers, for unconscious or bedridden patients. (Refer to protocol VI.P)

## **Prevention of Pressure Sores**

1. Use a padded mattress or camp pad for bedding.
2. Pad all patient contact points including:
  - a. Contacts between parts of the body (e.g., head, elbows, hips and buttocks, heels)
  - b. Contacts between the patient and stretcher, wall, bed rails, etc.
3. Change the patient’s position every 2 hours, and re-pad contacts.
4. Keep the patient’s bedding smooth and free of folds and/or wrinkles.
5. Inspect the patient for pressure sores during daily care.
6. Apply lotion and extra padding to areas showing redness and/or irritation from body positioning.

## **Decrease DVT risk in bedridden patients**

1. Use thigh-high compression stockings, if available.
2. Encourage isometric exercise of lower extremities.
3. Keep legs slightly elevated, if possible.

---

## J. Foot Care

### Review of Injury/Illness

Good foot care is essential to maintaining team mobility. It helps to avoid debilitating injuries and complications.

Blisters result from friction from new or poorly-fitted footwear.

Ingrown toenails occur from improper nail cutting and wearing improperly fitted (tight) footwear. It most commonly occurs in the Great Toe.

Immersion foot or “Trench Foot” is caused by the breakdown of skin exposed to colder water temperatures (above freezing) for prolonged periods. It may occur from standing in water or from continued wearing of saturated footwear. It is most often associated with colder water temperatures, although can occur in warmer water exposures.

Stress fractures occur from repeated stress due to overuse and over training. They usually involves the 2nd or 3rd metatarsal (march fractures). Stress fractures begin as a small, non-displaced break, and worsens, if stress continues. They may also be caused by worn-out or poorly-fitted footwear.

### Signs and Symptoms

#### **Blisters (partial thickness lesions)**

- \* **Generally filled with clear fluid**
- \* **May contain blood (“blood blister”)**
- \* **If infected, fluid may fill with purulent fluid (pus) and develop other symptoms of infection**
  - **Increasing pain and tenderness**
  - **Cellulitis**
  - **Lymphangitis**
  - **Fever**

#### **Ingrown Toenail**

- \* **Redness, edema and tenderness (lateral or medial paronychia nailplate)**
- \* **If infected, may have associated purulent drainage and develop other symptoms of infection**
  - **Fever**
  - **Cellulitis**
  - **Lymphangitis**

#### **Immersion Foot (“Trench Foot”)**

- \* **Initial**
  - **Begins with erythema secondary to hyperemia**
  - **Mild swelling**
  - **Diffuse discoloration and mottling of foot**
  - **Numbness and painful parasthesias**
- \* **Advanced (after 2-7 days)**
  - **Marked increase in hyperemia**
  - **Regional variation in skin temperature**
  - **Marked edema**

- 
- **Blisters and ulceration develop**
  - **Tissue may slough over time**

### **Stress Fractures**

- \* **Patient often has no recollection of injury**
- \* **Dull ache, soreness, point tenderness**
- \* **Swelling, particularly around 2nd and 3rd metatarsals (worsens with time and ambulation)**

### **Preventive Measures**

1. Assess tetanus immunization status prior to deployment to operational areas. (Refer to Protocol V.C and Protocol V.V.)
2. Blisters
  - a. Always wear proper-fitting footwear.
  - b. Break in new boots prior to use in operational areas.
  - c. Pad suspected pressure points early with moleskin and secure with tape.
3. Ingrown Toenails
  - a. Always wear proper-fitting footwear.
  - b. Trim nails in a straight, horizontal line.
  - c. Avoid trimming nails close to lateral and medial skin folds.
4. Immersion Foot
  - a. Keep feet clean and dry.
  - b. Apply foot powder to reduce moisture and fungal infections, if available.
  - c. Change wet socks frequently, as needed.
  - d. Avoid prolonged immersion in water, including saturation of neoprene boots that remain open at the top (e.g., river boots, hip waders).

### **Management**

#### **General**

#### **Blisters**

1. Clean blister site with soap and water and irrigate.
2. Apply antiseptic solution to blister site.
3. Leave smaller blisters intact for as long as possible.
  - a. If blister has naturally ruptured, debride/remove epidermal roof
4. Drain fluid via a small incision into epidermal roof of the blister. Leave the roof of the blister intact.
5. Apply topical antibiotic ointment.
6. Apply sterile, dry dressing, moleskin, or other padding doughnut over blister and surrounding skin. Tape in securely in place.

- 
7. Another option is injecting tincture of benzoin between epidermal roof of blister and underlying skin with a syringe and small gauge needle (25 or 27 ga).
    - a. Apply gentle, but firm pressure to ensure contact between skin layers and benzoin.
    - b. Express and remove excess benzoin.
    - c. Application of benzoin into an open wound is painful.
    - d. Liquid bandage products (less painful) may be used instead of benzoin, but may not bond to skin as well.
    - e. Wound glue or toothache pain gels may also be used by applying a drop of the glue or gel to the opening created for drainage, followed by gentle, but firm, pressure to facilitate spread
  8. Warm soaks may help with blisters not treated with benzoin, liquid bandage, glue, gel.
  9. Monitor for signs of developing infection, particularly if the blister is filled with blood.

### **Ingrown Toenail**

1. Wash site with soap and water, irrigate to remove soap.
2. Apply antiseptic solution to the entire toe.
3. Local anesthesia via toe block may be necessary for debridement. (Refer to Protocol VI.J.2.)
4. Carefully resect lateral or medial nail plate, as indicated by location, using a small probe or hemostat.
  - a. Place probe or hemostat between nail plate and underlying nail bed to undermine nail plate and remove the section of nail.
  - b. Be careful not to damage nail bed.
  - c. A digital tourniquet may be utilized to improve visualization (use a small penrose drain secured with a hemostat).
5. Apply topical antibiotic ointment, an adaptic or other non-adherent dressing, and a bulky dry, sterile dressing.
6. Warm soaks for 20 minutes qid may help with ingrown toenails.
7. Elevate affected foot and limit weight bearing activity for 12-24 hours.

### **Immersion Foot**

1. Remove feet from wet environment, if possible. Dry feet thoroughly.
  - a. Rapid re-warming (as with frostbite) is not necessary.
2. Elevate feet, if possible.
3. Aspirate fluid from larger blisters and bullae aseptically with a needle and syringe.
4. Debride any sloughing, or loosely attached, skin.
5. Apply 1% topical hydrocortisone cream to affected areas, if available. Otherwise, use a topical antimicrobial ointment.
6. Apply a loose dry, sterile dressing and gauze wrap.
7. Elevate affected foot/feet and limit weight bearing activity for 24-36 hours or until definitive care is reached.
8. Administer pain management medication. (Refer to Protocol VII.A.)
9. **DO NOT** use warm soaks with immersion foot.

---

### **Stress Fractures**

1. Apply a bulky compression wrap.
2. For severely painful cases, apply a posterior splint. (Refer to Protocol VI.M.)
3. Elevate affected foot/feet and limit weight bearing activity until definitive care is reached.
4. Administer pain management medication. (Refer to Protocol VII.A.)

### **Evacuation**

1. Conduct priority evacuation for any immersion foot or wounds with signs of systemic septicemia.
2. Conduct routine evacuation for any blister or ingrown toenail with signs of infection.
3. Conduct convenience evacuation for ingrown toenails requiring resection, debilitating blisters, stress fractures, or any minor injury not improving with treatment.
4. Evacuation is usually not required for minor blisters and ingrown nails that respond to treatment.

### **Extended Care**

1. Change dressing twice daily and as needed, if dirty or wet.
2. Continue compression wrap and/or splint to treat stress fractures.
3. Administer antibiotics according to local protocol for blisters or ingrown toenails with advancing erythema, cellulitis, lymphangitis, or fever.
4. Trench foot
  - a. Apply 1% silver sulfadiazine cream instead of topical antimicrobial ointment according to local protocol, if available.
    - Apply cream thinly to a piece of gauze with a tongue blade. Use a new tongue blade for each application.
    - Apply gauze to wound with the cream side against the skin.
    - Apply an adaptic or other non-adherent dressing and a bulky dry, sterile dressing.
  - b. Administer antibiotics according to local protocol for blisters or ingrown toenails with advancing erythema, cellulitis, lymphangitis, or fever.

### **Follow-up**

1. All cases of trench foot, infected blisters, or ingrown toenails should be evaluated team or personal physician upon return from an austere environment.

---

## K. Gastrointestinal Disorders

### Review of Injury/Illness

Complaints of nausea, vomiting, and diarrhea are extremely common. They represent a wide range of underlying conditions that often can be treated effectively in the field and do not require evacuation.

Acute onset of vomiting and/or diarrhea is most often a viral infection of the GI tract, but bacteria and parasitic infections are common in austere environments

The acute (surgical) abdomen can indicate a number of different conditions that all require urgent evacuation for immediate surgical intervention. (Refer to Protocol V.E.)

### Signs and Symptoms

- \* **Nausea, vomiting, diarrhea**
  - **Constant or waves of nausea**
  - **Loose or watery BMs**
  - **Blood or mucous (may or may not be present)**
  - **Abdominal cramping**
  - **Dehydration**
- \* **Fever (may or may not be present)**
- \* **Abdomen may be diffusely tender**
- \* **Evaluate for peritoneal inflammation indicating development of acute abdomen (Refer to Protocol V.E.)**

### Management

#### **BLS**

1. Maintain good hydration with small sips of water or sports drinks, as tolerated. (Refer to Protocol III.D and Protocol III.G.)

#### **ALS**

1. Initiate IV hydration, if indicated. (Refer to Protocol IV.E.)
2. For nausea and/or vomiting, administer one of the following, as needed:
  - a. Ondansetron (Zofran<sup>®</sup>) 4.0 mg IV/IO, over 2-5 minutes, or IM q12h
  - b. Promethazine (Phenergan<sup>®</sup>) 12.5-25 mg IV/IO/IM/PO/PR q6h
  - c. Prochlorperazine (Compazine<sup>®</sup>) 10 mg IV/IO/IM/PO q8h
  - d. Prochlorperazine (Compazine<sup>®</sup>) 25 mg PR q12h
3. For diarrhea:
  - a. Administer loperamide (Imodium<sup>®</sup>) 4.0 mg PO initially, then 2.0 mg PO after every loose BM, up to a maximum of 16 mg/day.

- 
- b. If diarrhea persists > 24 hours or is accompanied by blood or mucous, fever, and/or abdominal pain, administer one of the following:
    - Levofloxacin (Levaquin<sup>®</sup>) 500 mg PO QD for 3 days
    - Azithromycin (Zithromax<sup>®</sup>) 500 mg PO x1 day, then 250 mg PO QD days 2-5
  - c. If diarrhea persists > 3 days, treat as Giardia or Amebiasis with metronidazole (Flagyl<sup>®</sup>) 500 mg PO BID for 5 days

### **Evacuation**

1. Conduct urgent evacuation if:
  - a. Dehydration persists despite treatment
  - b. Grossly bloody emesis
  - c. Diarrhea accompanied by blood or mucous, fever, and/or abdominal pain
  - d. Suspected acute abdomen
2. Evacuation is usually not required for vomiting and/or diarrhea that responds to treatment and for patients that can maintain hydration.

### **Extended Care**

1. Maintain good hydration with small sips of water or sports drinks. (Refer to Protocol III.D and Protocol III.G.)
2. Continue antibiotics, as indicated.

### **Follow-up**

1. Follow-up is not required for patients whose symptoms have resolved.
2. Follow-up with a personal or team physician for any persistent or recurrent condition upon return from an austere environment.

---

## L. Genitourinary Disorders

### 1. Kidney Stones

#### Review of Injury/Illness

Kidney stones may cause severe pain and can strike at any time. They are one of the most common causes of sudden and severe flank abdominal pain. They are most common in men > 40 years. Dehydration may exacerbate the condition.

#### Signs and Symptoms

- \* Severe flank pain (may radiate to groin)
- \* “Writhing” in pain
- \* Nausea, vomiting (may or may not be present)
- \* Urinary frequency, urgency, dysuria
- \* Hematuria (may or may not be present)
- \* Fever (indicates progression to infection)

#### Management

##### **BLS**

1. Maintain good hydration with small sips of water or sports drinks. (Refer to Protocol III.D and III.G.)
2. Monitor for progression to sepsis.
3. Strain all urine for stones. Retain any stones found for analysis.
4. Administer pain management medication according to local protocol. (Refer to Protocol VII.A.)
  - a. Anti-inflammatory medications are most effective.
  - b. Narcotics may be necessary to control pain.

##### **ALS**

1. Initiate IV fluid therapy with Normal Saline or LR at 150 ml/hour.
2. Strain all urine for stones. Retain any stones found for analysis.
3. Administer one of the following antibiotics according to local protocol:
  - a. Levofloxacin (Levaquin<sup>®</sup>) 500 mg PO QD
    - If presence of flank pain and fever, consider q8h dosing to treat for pyelonephritis.
  - b. Azithromycin (Zithromax<sup>®</sup>) 500 mg PO x1 day, followed by 250 mg PO QD days 2-5
4. For nausea and/or vomiting, administer one of the following, as needed:
  - a. Ondansetron (Zofran<sup>®</sup>) 4.0 mg IV/IO, over 2-5 minutes, or IM q12h
  - b. Promethazine (Phenergan<sup>®</sup>) 12.5-25 mg IV/IO/IM/PO/PR q6h
  - c. Prochlorperazine (Compazine<sup>®</sup>) 10 mg IV/IO/IM/PO q8h
  - d. Prochlorperazine (Compazine<sup>®</sup>) 25 mg PR q12h

---

## **Evacuation**

1. Conduct priority evacuation for all cases because the condition may progress to life-threatening systemic infection and septic shock.

## **Extended Care**

1. Maintain good hydration with small sips of water or sports drinks. (Refer to Protocol III.D and Protocol III.G.)
2. Continue antibiotics, as indicated.
3. Many patients will pass a stone in his/her urine. Continue treatment because of the frequency of multiple stone disease.

## **Follow-up**

1. Following up with a personal or team physician as soon as possible for every case of kidney stones upon the return from an austere environment.

---

## 2. Urinary Tract Infection (UTI)

### Review of Injury/Illness

Mild infections of the bladder and lower urinary tract are common in the austere environment. Dehydration, kidney stones, infrequent urination, or trauma from a bike seat, saddle, or climbing harness can all contribute to a UTI. Symptoms of common STDs, including chlamydia and gonorrhea, are often confused with symptoms of a UTI.

Females are much more likely to suffer a UTI because the female urethra is shorter, leaving the bladder more predisposed to infection.

### Signs and Symptoms

- \* Urinary frequency, urgency, dysuria
- \* Cloudy, malodorous, or dark urine
- \* Mild suprapubic pain or pressure
- \* Back, flank, or costovertebral angle tenderness (CVAT) (may or may not be present)
- \* Fever (may or may not be present)

### Management

#### **BLS**

1. Maintain good hydration with small sips of water or sports drinks. (Refer to Protocol III.D and III.G.)
2. Administer pain management medication according to local protocol. (Refer to Protocol VII.A.)
  - a. Anti-inflammatory medications are most effective.
  - b. Narcotics usually are not necessary to control pain.
3. Monitor for development of fever or back/flank/CVAT pain, which indicates progression.

#### **ALS**

1. Initiate IV fluid therapy with Normal Saline or LR at 150 ml/hour.
2. Administer one of the following antibiotics according to local protocol:
  - a. Levofloxacin (Levaquin<sup>®</sup>) 500 mg PO QD
  - b. Trimethoprim-Sulfamethoxazole (Bactrim DS<sup>®</sup>) 1 tablet PO BID x3 days
  - c. Azithromycin (Zithromax<sup>®</sup>) 500 mg PO x1 day, followed by 250 mg PO QD days 2-5
  - d. Metronidazole (Flagyl<sup>®</sup>) 500 mg PO BID

### Evacuation

1. Conduct routine evacuation if symptoms do not resolve, or worsen, with treatment.
2. Evacuation is usually not required.

---

## **Extended Care**

1. Continue aggressive hydration for 48 hours. (Refer to Protocol III.E.)
2. Continue antibiotics, as indicated.
3. With appropriate hydration and antibiotics, most patients will have a significant decrease in symptoms within 48 hours.

## **Follow-up**

1. Follow up with a personal or team physician for any persistent or recurrent condition upon return from an austere environment.

## **Other/Special Considerations**

1. If the patient complains of UTI symptoms accompanied by discharge (or is a young, and otherwise healthy, male complaining of a UTI), consider treating for chlamydia and gonorrhea. Administer:
  - a. Azithromycin (Zithromax<sup>®</sup>) 2.0 gm PO once **AND** Metronidazole (Flagyl<sup>®</sup>) 2.0 gm PO once.

---

## M. Gynecologic Disorders

### Review of Injury/Illness

Women have the potential to develop unique medical problems in the austere environment. The well-prepared team must plan ahead to address these issues.

Oral contraceptive pills increase the risk of venous thromboembolism. Be vigilant for the development of DVTs and/or PEs. (Refer to Protocol V.H and Protocol V.P.)

### Signs and Symptoms

#### Dysmenorrhea (painful menstruation)

- \* Low abdominal pelvic pain and/or cramping begins with onset of menses and lasts 8-48 hours
- \* Headache
- \* Nausea, vomiting, diarrhea
- \* Uterine mass, adnexal tenderness or mass (may or may not be present)

#### Abnormal Uterine Bleeding

- \* Bleeding different from the patient's normal menstrual cycle (may range from minor spotting to major hemorrhage)
- \* Pelvic or uni/bi-lateral adnexal pain
- \* Low central abdominal tenderness
- \* Uterine mass, adnexal tenderness or mass (may or may not be present)

#### Vaginitis

- \* Vaginal discharge
  - Vulvovaginal Candidiasis (yeast): White, "cottage cheese," adherent, not frothy or malodorous
  - Bacterial Vaginosis: Thin, watery, grayish white, frothy, homogeneous, fishy odor
- \* Dysuria
- \* Vaginal irritation, soreness, burning

### Management

#### General

1. Dysmenorrhea
  - a. Conduct a focused history and physical to rule out other potential causes of pain, especially if the pain is new or unusual in character for the patient.
  - b. Perform a pregnancy test, if available.
  - c. Administer pain management medication. (Refer to Protocol VII.A.) NSAIDs are often sufficient.
2. Abnormal Uterine Bleeding
  - a. It is extremely difficult to differentiate between a true emergency and more benign causes. Definitive care is essential.

- 
- b. Perform a pregnancy test, if available.
    - If the pregnancy test is positive, this constitutes a medical emergency (e.g., ectopic pregnancy, miscarriage) and urgent evacuation is required.
    - Assess and treat for hemorrhage and/or shock. (Refer to Protocol IV.A.)
  - c. Administer pain management medication. (Refer to Protocol VII.A.) NSAIDs are often sufficient.
3. Vaginitis (Vulvovaginal Candidiasis)
    - a. Wear loose-fitting pants and cotton underwear.
    - b. Irrigate the vulva with clean water several times daily.
    - c. Provide and/or instruct patient to use OTC yeast infection treatment following the manufacturer's instructions.

## **ALS**

1. For vaginitis (Bacterial Vaginosis), administer one of the following:
  - a. Metronidazole (Flagyl<sup>®</sup>) 500 mg PO BID for 5 days
  - b. Metronidazole (Flagyl<sup>®</sup>) 0.75% vaginal gel BID for 5 days

## **Evacuation**

1. Conduct urgent evacuation for vaginal bleeding with a positive pregnancy test.
2. Evacuation is usually not necessary for dysmenorrhea, minor abnormal uterine bleeding, and vaginitis.

## **Extended Care**

1. Dysmenorrhea
  - a. Monitor for the development of new symptoms or worsening condition.
  - b. Maintain good hydration with small sips of water or sports drinks. (Refer to Protocol III.D and Protocol III.G.)
2. Vaginitis: Continue treatment regimen, as indicated.

## **Follow-up**

1. Follow up with a personal or team physician for a gynecological evaluation for all conditions upon return from an austere environment.

---

## N. Pregnancy-Related Disorders

### Review of Injury/Illness

Problems during pregnancy in the austere environment almost always require prompt evacuation.

Approximately 15-25% of all pregnancies abort spontaneously. Bleeding in a miscarriage is usually self-limiting but may be heavy

Ectopic Pregnancy is defined as the implantation of fertilized egg at any location outside of the uterus. They are approximately 1% of all pregnancies, with 95% of the implantations located in the fallopian tube. They are always considered a life-threatening emergency.

Late Pregnancy Complications are any conditions (e.g., Placenta Previa, Placental Abruption) that cause vaginal bleeding after 20 weeks gestation and require urgent evacuation.

Extra care should be taken when selecting medication for pregnant women. Consult a reference manual or on-line medical direction before administering **any** prescription medication.

### Signs and Symptoms

#### Miscarriage

- \* Vaginal bleeding (usually self-limiting but may be heavy)
- \* Contractions
- \* Intermittent pain
- \* Expulsion of the products of conception (pain usually resolves after expulsion)

#### Ectopic Pregnancy (most become symptomatic before 12 weeks gestation)

- \* Unilateral low abdominal pain
  - Sudden onset, severe, constant
  - Pain continues after passage of clots or other tissue
- \* Vaginal bleeding with darker blood than normal
- \* Tender adnexal mass
- \* Non-tender cervix
- \* Usually afebrile
- \* May progress to acute abdomen. (Refer to Protocol V.E.)

#### Late Pregnancy Complications

- \* Placenta Previa
  - Sudden, painless, heavy, bright red vaginal bleeding
- \* Placental Abruption
  - Sudden, painful, vaginal bleeding

---

## **Management**

### **BLS**

1. Maintain good hydration with small sips of water or sports drinks. (Refer to Protocol III.D and Protocol III.G.)
2. Assess and treat for hemorrhage and/or shock. (Refer to Protocol IV.A.)
3. Monitor the patient's condition. Provide supportive and symptomatic treatment.
4. Administer pain management medication according to local protocol. (Refer to Protocol VII.A.)
  - a. **DO NOT** administer anti-inflammatory medications (NSAIDs), which may worsen bleeding.
  - b. **DO NOT** administer narcotics, which may compromise the fetus.
5. Prepare the patient for urgent evacuation.

### **ALS**

1. Administer initial fluid bolus 0.9% Normal Saline or LR 250-500 ml, up to a maximum total infusion of 2,000 ml.
2. After administering fluid boluses, adjust IV infusion rate to maintain a urine output of 1.0-2.0 ml/kg/hr.

### **Evacuation**

1. Conduct urgent evacuation for pregnancy accompanied by vaginal bleeding.

### **Extended Care**

1. Maintain hydration and nutrition. (Refer to Protocol VI.)

### **Other/Special Considerations**

1. Mild to moderate exercise is recommended for most women without pregnancy-related complications. This is not associated with increased fetal risk.

### **Delivery**

1. Rarely will an emergency delivery be necessary in an austere environment. Follow standard EMS protocols for vaginal delivery, if needed.

### **Post-partum Care**

1. Immediately after delivery, hold the newborn below the level of the perineum.
2. Clear the oropharynx with a bulb syringe, if available.
3. Double clamp (or tie) the umbilical cord and then cut it between the clamps.
4. Dry the entire newborn and then wrap it warmly, covering the head. Present the baby to the mother.
5. Assess APGAR score at 1 minute and 5 minutes post birth.

---

## Neonatal Resuscitation

1. If breathing does not begin, or is labored:
  - a. Suction the airway with a bulb syringe to remove mucus and secretions.
  - b. Warm the newborn.
2. If pulse < 100 bpm and respiratory effort is poor, then:
  - a. Stimulate the newborn by rubbing vigorously with a towel, including extremities.
  - b. Begin manual respirations, as needed, with an appropriate-sized bag valve mask (BVM) at 40-60 breaths per minute with 100% O<sub>2</sub>. Use mouth-to-mouth, if BVM is not available.
3. If heart rate is absent or < 60 bpm at 30 seconds, after assisted respirations and supplemental oxygen, begin resuscitation according to current American Heart Association (AHA) Neonatal Resuscitation guidelines.

## Mother Care

1. Deliver the placenta via standard EMS protocols.
  - a. Examine placenta for missing tissue.
  - b. Transport expelled placenta and mother to definitive care for further examination.
2. Perform uterine massage to control hemorrhaging. Direct pressure is usually sufficient to control bleeding.
3. Apply cold/ice packs to the perineum for 24 hours, as needed.
4. Maintain hydration and nutrition. (Refer to Protocol V.I.)
5. Administer antibiotics for 48 hours, according to local protocol.

## Extended Care

1. Encourage breastfeeding as soon as both mother and baby are stable. Newborns should feed every 2-3 hours for 5-10 minutes per breast.

---

## O. Head, Eyes, Ears, Nose and Throat

### 1. Headache

#### **Review of Injury/Illness**

The differential diagnosis for the acute headache is large and includes conditions that encompass the spectrum from minor to severe underlying disorders.

#### **Signs and Symptoms**

- \* **Episodic or chronic pain (variable location and intensity possible)**
- \* **Visual disturbances (may or may not be present)**
- \* **Nausea, vomiting (may or may not be present)**

#### **Management**

##### **BLS**

1. If the patient has an atypical headache, check for:
  - a. Elevated BP
  - b. Fever, neck rigidity
  - c. Visual symptoms, visual acuity
  - d. Mental status changes
  - e. Neurologic weakness/symptoms
  - f. Dehydration (Refer to Protocol III.D and III.G.)
  - g. Caffeine withdrawal: Administer caffeine 100-200 mg PO (e.g., 1-2 cups coffee or tea), if caffeine withdrawal is the likely cause.
2. Administer pain management medication. Begin with non-narcotics.(Refer to Protocol VII.A.)

##### **ALS**

1. For headache accompanied by nausea and/or vomiting, administer one of the following, as needed:
  - a. Ondansetron (Zofran<sup>®</sup>) 4.0 mg IV/IO, over 2-5 minutes, or IM q12h
  - b. Promethazine (Phenergan<sup>®</sup>) 12.5-25 mg IV/IO/IM/PO/PR q6h
  - c. Prochlorperazine (Compazine<sup>®</sup>) 10 mg IV/IO/IM/PO q8h
  - d. Prochlorperazine (Compazine<sup>®</sup>) 25 mg PR q12h

#### **Evacuation**

1. Conduct urgent evacuation for a headache described as “the worst headache of my life” or an acute headache accompanied by fever, severe nausea, vomiting, mental status changes, focal neurological signs, acute onset of seizures or loss of consciousness.
2. Evacuation is usually not required if the headache respond to treatment.

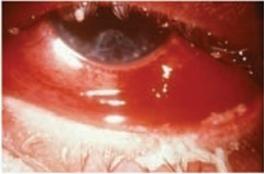
## 2. Eye Disorders

### Review of Injury/Illness

Environmental conditions such as snow, wind, UV light, glare, fatigue, and lack of hygiene can all cause serious conditions. Only a few treatments for eye disorders are practical in an austere environment. These include protection, rest, eye lubrication, anesthetic drops, and antibiotics. Contact lenses exacerbate most issues.

### Signs and Symptoms

Compare eyes to see if the problem affects both sides.

| Condition                           | Signs and Symptoms  | Treatment   |
|-------------------------------------|---|---|
| Dry Eyes                            | <ul style="list-style-type: none"> <li>• Red, painful, feel gritty</li> <li>• Both eyes usually affected</li> <li>• Long period of wearing contact lenses</li> </ul>  | <ul style="list-style-type: none"> <li>• Use artificial tears.</li> <li>• Reduce time wearing contact lenses.</li> <li>• Wear sunglasses to protect eyes.</li> <li>• Antibiotic ointment may lubricate eyes and relieve pain.</li> </ul>  |
| Foreign Bodies                      | <ul style="list-style-type: none"> <li>• Feels like something is in eye</li> <li>• Irritation, redness, tearing</li> <li>• Examine corners of eyes and under lids</li> </ul>  | <ul style="list-style-type: none"> <li>• Irrigate eyes with clean water.</li> <li>• Remove the foreign body, if present.</li> </ul>   |
| Corneal Abrasion                    | <ul style="list-style-type: none"> <li>• Feels like something is in eye</li> <li>• Irritation, redness, tearing</li> <li>• Examine corners of eyes and under lids</li> <li>• Persistent pain and irritation</li> </ul>  | <ul style="list-style-type: none"> <li>• Remove the foreign body, if present.</li> <li>• Apply antibiotic ointment to the inner surface of the eyelid.</li> <li>• Patch the eye for 24 hours, then re-examine.</li> </ul>   |
| Penetrating Injury                  | <ul style="list-style-type: none"> <li>• Obvious penetration</li> <li>• Assess for other injuries</li> <li>• Determine object depth, angle, if feasible.</li> </ul>   | <ul style="list-style-type: none"> <li>• Stabilize object with tape, then surround the object with a cup to prevent jarring.</li> <li>• Patch other eye to prevent ocular movement.</li> <li>• Administer oral pain medications.</li> <li>• Administer oral antibiotics.</li> </ul>   |
| Corneal Inflammation/<br>Ulceration | <ul style="list-style-type: none"> <li>• Red, painful eye</li> <li>• Photophobia</li> <li>• Watery, blurred vision</li> <li>• Cloudy cornea (with bacterial infection)</li> </ul>   | <ul style="list-style-type: none"> <li>• Remove contacts, if worn.</li> <li>• Administer antibiotic drops or ointments.</li> <li>• Administer oral pain medications.</li> </ul>   |
| Conjunctivitis                      |  <ul style="list-style-type: none"> <li>• Red, painful eye (cornea is not red)</li> <li>• Vision is not affected</li> <li>• Discharge of pus (most common with bacterial infection)</li> <li>• Watery discharge (most common with viral infection)</li> <li>• Itchy eye (allergies)</li> </ul> | <ul style="list-style-type: none"> <li>• Treat both eyes, as both will likely become infected.</li> <li>• Administer antibiotic drops or ointments for a minimum of 5 days.</li> <li>• Viral conjunctivitis will clear without treatment.</li> <li>• Administer antihistamine eye drops, if allergies are the likely cause.</li> <li>• If vision becomes affected, it is more serious.</li> </ul> |

| Condition   | Signs and Symptoms  | Treatment  |
|---|---|--|
| UV Keratitis<br>("Snow Blindness" or<br>"Welder's Eye")   | <ul style="list-style-type: none"> <li>• Headache</li> <li>• Affects both eyes</li> <li>• Photophobia</li> <li>• Tearing</li> <li>• Delayed onset of severe pain after being in a high light environment</li> <li>• Face may be burnt (1st degree)</li> </ul>   | <ul style="list-style-type: none"> <li>• Wear sunglasses to protect eyes.</li> <li>• Administer pain medication. <ul style="list-style-type: none"> <li>▫ Oral pain medication (for headache)</li> <li>▫ Local anesthetic drops<br/>(<b>DO NOT</b> give the bottle to the patient.)</li> </ul> </li> <li>• Antibiotic ointment may lubricate eyes and relieve pain.</li> </ul>   |
| Eyelid Infection<br> | <ul style="list-style-type: none"> <li>• Stye <ul style="list-style-type: none"> <li>▫ A small boil arising from the eyelash follicle</li> </ul> </li> <li>• Chalazion <ul style="list-style-type: none"> <li>▫ Infected gland in eyelid (may develop into an abscess or nodule which could affect vision)</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• Apply a warm, damp towel to the affected area.</li> <li>• Administer antibiotic drops or ointments.</li> <li>• A chalazion may need surgery.</li> </ul>   |
| Chemical injury   | <ul style="list-style-type: none"> <li>• Red, irritable eye (following a chemical splash)</li> <li>• Vision may be impaired</li> </ul>  | <ul style="list-style-type: none"> <li>• Immediately irrigate the eyes copiously with Normal Saline, if available, or clean water. <ul style="list-style-type: none"> <li>▫ Irrigate for a minimum of 30 minutes (acid) or until the pain and/or burning subsides.</li> <li>▫ Irrigate for a minimum of 60 min (alkali) or until the pain and/or burning subsides.</li> </ul> </li> <li>• Administer antibiotic drops or ointments.</li> <li>• Administer hourly applications of artificial tears.</li> <li>• Administer pain medication. <ul style="list-style-type: none"> <li>▫ Oral pain medication</li> <li>▫ Local anesthetic drops<br/>(<b>DO NOT</b> give the bottle to the patient.)</li> </ul> </li> </ul> |

### Evacuation

1. Conduct urgent evacuation for perforated eye globe or a sudden loss of vision in a normal-appearing eye.
2. Conduct priority evacuation for a complex lid laceration or hyphema (blood collecting in anterior chamber of the eye).

### Extended Care

1. Reduce exposure to the light by having patient wear sunglasses. Consider applying eye patch(es), if not detrimental to evacuation.

### 3. Ear Infections and Disorders

#### Review of Injury/Illness

Ear impaction is occlusion of the external auditory canal (EAC), commonly caused by the accumulation of ear wax (cerum). Otitis externa is infection of the EAC. It is often caused by prolonged exposure to water (e.g., “swimmer’s ear”). Otitis media is infection of the middle ear, in the sinus cavity behind the eardrum. It is caused by a blockage of eustachian tube. A perforated tympanic membrane (TM) or “perforated ear drum” is a hole or tear in the TM. It may be caused by a history of infection, direct trauma (e.g., close proximity explosion), or after diving.

#### Signs and Symptoms

##### Ear Impaction

- \* EAC blocked with cerum
- \* Visible EAC may be inflamed with redness, warmth, swelling
- \* Patient may report decreased hearing, muffled sounds

##### Otitis Externa

- \* Pain from middle ear (primary symptom - may or may not be severe)
- \* Redness, warmth, swelling to external ear canal
- \* External ear and surrounding area may be tender
- \* EAC may be obstructed or constricted
- \* Purulent drainage (may or may not be present)

##### Otitis Media

- \* Pain from middle ear (primary symptom - may be severe)
- \* No redness, swelling and tenderness to external ear and EAC
- \* Tympanic membrane (TM) is dull and may be seen bulging with fluid or pus

##### Perforated Eardrum

- \* TM may be punctured, torn, or absent on exam

#### Preventive Measures

1. Otitis externa
  - a. **DO NOT** use dry cotton swabs to clean ears.
  - b. Avoid prolonged water contact, if possible.
  - c. Administer an OTC preparation (e.g., SwimEar™), or vinegar mixed with alcohol (1:1), to ear canals before and after swimming, diving, or other water sports.



---

## **Management**

### **BLS**

1. Ear Impaction
  - a. Administer half-strength hydrogen peroxide drops to the EAC and have the patient lie on side with affected ear facing upwards for 20-30 minutes.
    - Begin ear irrigation with warm water, or warm water mixed with half-strength hydrogen peroxide, using a 30 ml syringe with a 16 ga IV catheter. Ensure irrigation fluid is body temperature, as cold water will cause nausea, dizziness, and vertigo.
    - Continually inspect the EAC with otoscope during irrigation.
    - Rely on irrigation, not instrumentation, to dislodge impaction.
  - b. Repeat as necessary.
2. Otitis Externa
  - a. Have the patient keep the affected ear dry. **NO** swimming.
  - b. Apply a few drops of vinegar mixed with alcohol (1:1) every 2-4 hours.
3. Otitis Media
  - a. Maintain good hydration with small sips of water or sports drinks. (Refer to Protocol III.D and Protocol III.G.)
  - b. Inhaled steam from boiled water may help open eustachian tube and allow middle ear drainage.
  - c. Administer pseudoephedrine (Sudafed<sup>®</sup>) 30-60 mg PO q4-6h.
  - d. Consider one of the following oral antihistamines:
    - Loratadine (Claritin<sup>®</sup>) 10 mg PO qd, take on an empty stomach
    - Diphenhydramine (Benadryl<sup>®</sup>) 25-50 PO q6h, if operational situation permits (may cause drowsiness, sedation)
  - e. Administer pain management medication. (Refer to Protocol VII.A.)
  - f. Patient should avoid diving and flying, until symptoms resolve.

### **ALS**

1. Otitis Externa
  - a. Administer Cortisporin<sup>®</sup> topical ear drops, 5-6 drops TID, until 48 hours after symptoms resolve; may place cotton ball in ear after application.
    - If Cortisporin<sup>®</sup> is not available, apply a few drops of vinegar mixed with alcohol (1:1) every 2-4 hours.
    - If condition worsens or persists, consider, azithromycin (Zithromax<sup>®</sup>) 500 mg PO x1 day, followed by 250 mg PO QD days 2-5
2. Otitis Media
  - a. If fever, general malaise, or severe pain is present, administer azithromycin (Zithromax<sup>®</sup>) 500 mg PO x1 day, followed by 250 mg PO QD days 2-5.

- 
3. Perforated Eardrum
    - a. Keep area clean and dry.
    - b. Administer an antibiotic prophylaxis of azithromycin (Zithromax<sup>®</sup>) 500 mg PO x1 day, followed by 250 mg PO QD days 2-5.
    - c. If caused by a close proximity explosion or other trauma, evaluate for underlying or concomitant injury.

### **Evacuation**

1. Conduct urgent evacuation for any ear problem accompanied by AMS, ataxia, vomiting, or septicemia.
2. Conduct routine evacuation for persistent fever, severe pain, or obvious swelling to the face or neck.
3. Conduct convenience evacuation for patients with no improvement after 48 hours of treatment.
4. Evacuation is usually not required for patients that respond to treatment.

### **Other/Special Considerations**

1. Perforated eardrum is possible if otitis media persists and internal swelling worsens. It is usually benign and patient often notes dramatic decrease in pain and ear pressure.
2. If fever develops:
  - a. Administer fever management medication. (Refer to Protocol VII.A.)
  - b. Continue antibiotics, as indicated.
  - c. Reevaluate for evacuation.
3. If septicemia develops (rare in ear infections)
  - a. BLS
    - Maintain good hydration with small sips of water or sports drinks. (Refer to Protocol III.D and Protocol III.G.)
    - Reevaluate evacuation priority.
  - b. ALS
    - Administer initial fluid bolus 0.9% Normal Saline or LR 250-500 ml, up to a maximum total infusion of 2,000 ml.
    - After administering fluid boluses, adjust IV infusion rate to maintain a urine output of 1.0-2.0 ml/kg/hr.
    - Continue antibiotics, as indicated.

---

## 4. Upper Respiratory Infections (Sinusitis and Rhinitis)

### Review of Injury/Illness

Upper respiratory infections include sinusitis and rhinitis (nasal congestion). Sinusitis involves inflammation and/or infection of a sinus or sinuses, the majority of which will resolve without antibiotic treatment (60%). Rhinitis is often associated with upper respiratory illnesses (URIs) and viruses, such as the common cold.

### Anatomy and Physiology

1. The primarily involved sinuses are the frontal, maxillary and ethmoid.
2. Sinusitis is often caused by the inflammation and obstruction of the eustachian tube.
3. Rhinitis is commonly caused by viral infection or seasonal allergies.

### Signs and Symptoms

#### Sinusitis

- \* Sinus pain and pressure (often increases if bent over at the waist)
- \* Tenderness may be elicited upon percussion of the affected sinus
- \* Possible green, yellow, or bloody nasal discharge
- \* Fever (may or may not be present)
- \* May mimic dental pain of the upper teeth (teeth will be non-tender to percussion and not hot or cold sensitive)

#### Rhinitis

- \* Clear nasal drainage
- \* Pale, boggy, or inflamed nasal mucosa
- \* Nasal congestion (may or may not be present)
- \* Sneezing
- \* Itchy, watery, or red eyes

### Management

#### BLS

1. Maintain good hydration with small sips of water or sports drinks. (Refer to Protocol III.D and Protocol III.G.)
2. To relieve obstruction of eustachian tube:
  - a. Nasal irrigation with normal saline (have patient sit w/head forward, chin down) may dislodge obstruction from eustachian tube
  - b. Inhaled steam from boiled water may help open eustachian tube and allow middle ear drainage.
  - c. Administer pseudoephedrine (Sudafed®) 30-60 mg PO q4-6h.

---

d. Consider one of the following oral antihistamines:

- Loratadine (Claritin®) 10 mg PO qd, take on an empty stomach
- Diphenhydramine (Benadryl®) 25-50 PO q6h, if operational situation permits (may cause drowsiness, sedation)

3. Administer pain management medication. (Refer to Protocol VII.A.)

### **ALS**

1. If fever, green, yellow or bloody discharge are present, administer antibiotics according to local protocol.
2. For severe sinusitis, consider Prednisone 60 mg PO qd x5 days to reduce mucosal swelling, which helps open the sinuses.

### **Evacuation**

1. Conduct urgent evacuation for altered mental status, ataxia, or other neurologic signs.
2. Conduct priority evacuation for sinusitis with obvious facial or neck swelling.
3. Conduct routine evacuation for high or persistent fever.
4. Conduct convenience evacuation for sinusitis that does not improve with treatment.
5. Evacuation is usually not required for most cases of sinusitis and rhinitis.

### **Extended Care**

1. Maintain good hydration with small sips of water or sports drinks. (Refer to Protocol III.D and Protocol III.G.)
2. Continue supportive treatment and medications until symptoms improve/resolve.
3. Monitor the patient daily for the development of new symptoms or worsening condition.
4. Continue antibiotics for 10-14 days, if needed.

### **Other/Special Considerations**

1. Sinuses are potential infectious pathways to the brain.
2. Evaluate/monitor for altered mental status, ataxia, vomiting, or other neurologic symptoms.

---

## P. Pulmonary Embolus

### Review of Injury Illness

A pulmonary embolus occurs when a blood clot (often from a deep vein thrombosis [DVT]) travels through the blood stream and lodges in the pulmonary blood supply. This prevents blood from interacting normally with lung tissue to absorb oxygen. DVT may or may not be present simultaneously. Pulmonary embolus is often associated with acute, unexplained dyspnea. It is considered a life-threatening emergency and urgent evacuation is essential.

Risk factors of pulmonary embolus include:

- Prior Hx of DVT (Refer to Protocol V.H.)
- Recent injury or surgery, particularly in a lower extremity
- Central venous catheter placement
- Use of oral contraceptives
- Prolonged period of inactivity (e.g., long aircraft flights, prolonged bed rest)
- Underlying coagulopathy
- Dehydration
- Hx of CHF, recent MI, or cancer

### Anatomy and Physiology

PE has three typical manifestations

1. Embolism
  - a. Most common
  - b. Embolism without infarction
2. Infarction
  - a. Embolism with infarction
  - b. Infarction of a distal branch of the pulmonary arterial circulation that causes ischemia that leads to necrosis of affected lung tissue
3. Massive PE
  - a. Leads to catastrophic cardiopulmonary failure
  - b. A massive clot obstructs the majority of the main left and/or right pulmonary artery that may lead to right heart failure and acutely compromised BP
  - c. May mimic cardiac pain

---

## Signs and Symptoms

### Embolism

- \* Sudden onset of acute dyspnea or dyspnea on exertion (DOE)
- \* Decrease in oxygen saturation (SpO<sub>2</sub>)
- \* Tachypnea, tachycardia
- \* Pleural rub, rales, absent lung sounds (may or may not be present)
- \* Impaired right heart functions
- \* RR > 18 rpm, HR > 90 bpm

### Infarction

- \* Chest pain (frequently posterior or lateral and pleuritic in nature)
- \* Dyspnea, cough (may or may not have bloody sputum)
- \* Low grade fever (< 101° F) (may or may not be present)
- \* Cannot be explained by other causes (e.g., myocardial infarct, pneumonia, trauma)

### Massive PE

- \* Catastrophic event
- \* Massive cardiopulmonary failure
- \* Impaired right heart functions

## Management

### BLS

1. Start oxygen at 2 L/minute via nasal cannula. Increase to maintain SpO<sub>2</sub> of > 92%, as necessary.
2. Administer aspirin 81-325 mg PO.

### ALS

1. If evacuation is delayed, administer enoxaparin 1.0 mg/kg sq q12h.
  - a. If enoxaparin has been administered, **DO NOT** use aspirin and NSAIDs.

### Evacuation

1. Conduct urgent evacuation for all patients with suspected PE.

### Other/Special Considerations

1. If at altitudes greater than 8,000, descend and assess for HAPE. (Refer to Protocol III.A.)
2. For information on enoxaparin, refer to Protocol V.H.

---

## Q. Respiratory Disorders

### Review of Injury/Illness

Common respiratory illnesses include the common cold, influenza, bronchitis, and pneumonia. Symptoms of these diseases are often not exclusive, but a matter of degree. Influenza is unusual in immunized individuals.

### Signs and Symptoms

#### General Respiratory Illness:

- \* Headache
- \* General malaise
- \* Nasal congestion, sneezing, cough (may produce clear sputum)
- \* Sore throat, hoarseness
- \* Lungs are usually clear

#### Common Cold

- \* Headache is common (usually worsens upon standing)
- \* Temperature normal or slightly elevated (fever is rare)

#### Influenza

- \* Acute onset
- \* Lungs are usually clear
  - Wheezing may be noted in 10% of patients
  - More common, if Hx of asthma is present
- \* Myalgia to back, arms and legs and/or arthralgia are frequently noted
- \* Temperature typically elevated (101° F +) initially (subsides over 2-4 days)

#### Pneumonia/Bronchitis

- \* Cough (may or may not yield green, brown, or blood-tinged sputum)
- \* Speech apnea (two-word dyspnea), shortness of breath, cyanosis w/hypoxia
- \* Vigorous chills, AMS, pleuritic chest pain
- \* Fever >101° F or < 96° F
- \* Resting HR > 90 bpm, RR > 18 rpm
- \* Pulse oximetry (O<sub>2</sub> SAT) = SpO<sub>2</sub> < 96%
- \* Lung sounds may be diminished, rales, rhonchi, splinted respirations (may or may not be present)
- \* Atypical pneumonia may present with N/V and no fever

### Management

#### BLS

1. Minimize exertion and/or activities for patient.
2. Maintain good hydration with small sips of water or sports drinks. (Refer to Protocol III.D and Protocol III.G.)
3. Start oxygen at 2 L/minute via nasal cannula. Increase to maintain SpO<sub>2</sub> of > 92%, as necessary.

- 
4. To relieve congestion:
    - a. Administer pseudoephedrine (Sudafed®) 30-60 mg PO q4-6h.
    - b. Consider one of the following oral antihistamines:
      - Loratadine (Claritin®) 10 mg PO qd, take on an empty stomach
      - Diphenhydramine (Benadryl®) 25-50 PO q6h, if operational situation permits (may cause drowsiness, sedation)
  5. To relieve coughing:
    - a. Administer an oral guaifenesin expectorant, following the manufacturer's instructions.
    - b. If coughing becomes painful or severe, administer an oral Guaifenesin DM (with Dextromethorphan), following the manufacturer's instructions.
    - c. If the patient is wheezing and has a prescribed metered dose inhaler (MDI), assistance may be offered for administration.
  6. Administer fever management medication. (Refer to Protocol VII.A.)

## **ALS**

1. To relieve severe coughing or difficulty breathing, administer **one** of the following, as needed:
  - a. Albuterol (Ventolin®) MDI 2 puffs q4h
  - b. Albuterol + ipratropium (Combivent®) MDI 2 puffs q4h
2. Influenza
  - a. Administer appropriate available antiviral drug according to local protocol.
3. Pneumonia/Bronchitis
  - a. Administer one of the following:
    - Levofloxacin (Levaquin®) 500 mg PO QD x7 days
    - Azithromycin (Zithromax®) 500 mg PO x1 day, then 250 mg PO days 2-5

## **Evacuation**

1. Conduct urgent evacuation for severe dyspnea.
2. Conduct priority evacuation for bronchitis and pneumonia.
3. Evacuation is usually not required for colds and influenza.

## **Extended Care**

### **BLS**

1. For severe cases of the common cold, influenza, bronchitis and pneumonia, bed rest may be required for up to 1 week, followed by 1 week of light duties.
2. Maintain hydration and nutrition. (Refer to Protocol V.I.)
3. Continue supportive and symptomatic treatment.

---

## ALS

1. For cases of severe bronchitis/pneumonia
  - a. Administer initial fluid bolus 0.9% Normal Saline or LR 250-500 ml, up to a maximum total infusion of 2,000 ml.
  - b. After administering fluid boluses, adjust IV infusion rate to maintain a urine output of 1.0-2.0 ml/kg/hr.
  - c. Continue antibiotics, as indicated.

### **Other/Special Considerations**

1. If at altitudes greater than 8,000, descend and assess for HAPE. (Refer to Protocol III.A.)
2. Assess for pneumothorax for any patient with sudden onset of dyspnea or cyanosis.
3. Team members in close contact with influenza patients should be administered appropriate antiviral medication according to local protocol, if available.
4. In the presence of a widespread outbreak of influenza, administer an appropriate antiviral medication as prophylaxis after consulting on-line medical direction, if available.
5. If symptoms of sinusitis are present, particularly green or yellow nasal discharge, refer to Protocol V.O.4.
6. For suspected rare infectious disease (e.g. tularemia, plague), administer Doxycycline 100 mg PO BID x10 days.

---

## R. Rhabdomyolysis

### Review of Injury/Illness

Rhabdomyolysis is a rare, but serious and potentially life-threatening condition. It is caused by the destruction of striated skeletal muscle cells and can simultaneously affect different organ systems. Intense exertion (e.g., marathon running) can result in exertional rhabdomyolysis. Early recognition is key to successful management.

### Anatomy and Physiology

1. Rhabdomyolysis can be induced by a variety of causes; those likely to be encountered in an austere setting are:
  - a. Crush injuries, trauma, traumatic asphyxia, extremity ischemia
  - b. Intense exertion
  - c. Envenomation
  - d. Frostbite, lightning strike, electric shock, heat stroke
  - e. Overdose of cocaine, heroin, PCP, amphetamines, or statins
2. Lysis of muscle cells, due to muscle injury, results in the release of various intracellular components (e.g., myoglobin, creatine kinase, potassium, calcium) which disrupt normal metabolic functions.
3. The exact presentation of the metabolic disturbance depends upon the amount and type of intracellular products absorbed into the bloodstream.
4. It may lead to further complications, such as compartment syndrome, metabolic acidosis, hyperkalemia, coagulation defects, acute renal failure, and cardiac arrest
5. Serum creatine kinase (CK or CPK) levels are dramatically elevated to 50,000-200,000 units/L (normal is 22-198 units/L) which indicates significant muscle death and the need for aggressive treatment.

### Signs and Symptoms

#### Cardinal sign

- \* **Urine is dark brown, red, “cola,” or “tea” colored (presence of myoglobin in the urine [myoglobinuria])**
- \* **Positive blood on urine dipstick without gross hematuria suggests myoglobinuria (some dipstick tests may include specific test for myoglobin)**
- \* **Muscle weakness, malaise, fatigue, generalized weakness**
- \* **Myalgia, arthralgia**
- \* **Fever**
- \* **Tachycardia**
- \* **Abdominal pain**
- \* **Nausea, vomiting**
- \* **Seizures, encephalopathy**

---

## **Management**

### **BLS**

1. Maintain good hydration with water or sports drinks. (Refer to Protocol III.D and Protocol III.G.)

### **ALS**

1. Administer initial fluid bolus 0.9% Normal Saline or LR 1.0-2.0 L/hr. After administering the initial fluid bolus, adjust IV infusion rate to maintain a urine output of 200-300 ml/hr.
2. Administer 1.0 mEq/kg sodium bicarbonate slow IV push.
3. Consider administering dantrolene sodium, 1.0 mg/kg IV push, up to a maximum total dose of 10 mg/kg. (Causes drowsiness and/or sedation.)
  - a. Stop administration once symptoms resolve (may not reach maximum total dosage).
  - b. Myoglobinuria **must** be present to administer medications **other than** Normal Saline and sodium bicarbonate.
  - c. **DO NOT** administer if the patient is unable to walk or be upright.

---

## **Evacuation**

1. Conduct urgent evacuation for all patients exhibiting signs of rhabdomyolysis.
2. Conduct priority evacuation for all other patients with myoglobinuria.

## **Extended Care**

1. Monitor I&Os.
2. Administer 100 mEq of sodium bicarbonate to each liter of Normal Saline infused.
3. Maintain IV infusion to keep a urine output of 200-300 ml/hr.
  - a. If urine output cannot be achieved solely by IV infusion, administer **one** of the following:
    - Furosemide 40 mg slow IV push
    - Mannitol 20% (Osmitol<sup>®</sup>) 0.5-1.0 gm IV, over 5-10 minutes
    - Mannitol 20% (Osmitol<sup>®</sup>) 15 ml/min IV infusion

---

## S. Skin Disorders

### Review of Injury/Illness

Frequently encountered skin disorders in the austere environment include cellulitis (with or without lymphangitis), fungal infection, and contact dermatitis. Cellulitis is caused by a bacterial infection. Contact dermatitis is caused by exposure to an irritant or by an allergic reaction. Both cellulitis and fungal infections are often diagnosed as contact dermatitis, but will worsen with steroid treatment.

Cold and/or dry conditions may exacerbate risk of all skin conditions due to dry and cracked skin, resulting in breaks to the skin barrier. Hot and/or moist conditions may facilitate spread of skin irritants and fungal infections.

### Signs and Symptoms

#### Cellulitis

- \* Skin redness (erythema), increased skin warmth, pain, tenderness
- \* Redness usually spreads distal to proximal and can often be traced to a wound
- \* May have fever or associated lymphadenopathy
- \* Lymphangitis (“blood poisoning”) (may or may not be present)
  - Red streaks, often proximal to the wound
  - Fever (may or may not be present)
  - Associated lymphadenopathy
  - Most often preceded by and associated with cellulitis

#### Fungal Infections

- \* Maculopapular type rash with scaling plaques and erythema
- \* Slow-spreading, clearly-defined rash with irregular or circumferential borders
- \* Itching (pruritus)
- \* Typically associated with a specific area of the body
  - Tinea cruris or “jock itch” (groin)
  - Tinea pedis or “athlete’s feet” (feet)
  - Tinea capitis or “cradle cap” (scalp)
  - Tinea versicolor or “ringworm” (may be diffuse, particularly found on the arms, shoulders and torso)
    - Appears as areas of discolored skin that do not tan

#### Contact dermatitis

- \* Acute onset
- \* Itching (pruritus)
- \* Small vesicles or bullae present on skin
  - Vesicles may weep a clear, straw colored fluid
  - Fluid may dry and crust on skin surface
- \* Erythema
- \* Typically shows an exposure pattern delineating topical exposure to irritant or allergen (may give a clue to offending substance)
  - Hands – Suspect soaps or industrial chemicals
  - Belt line – Suspect new laundry detergent



Forearm affected with cellulitis



Upper arm affected with lymphangitis



## **Management**

### **BLS**

1. Cellulitis and/or lymphangitis
  - a. Check for fever, lymphadenopathy
  - b. If a wound is present:
    - Clean wound site with soap and water and irrigate.
    - Apply neomycin-free topical antibiotic ointment.
    - Apply sterile, dry dressing.
  - c. Surrounding cellulitis should be marked on the skin surface with an indelible ink pen. This will allow the initial provider and follow-up providers to track the spread of the cellulitis.
  - d. Warm soaks for 20 minutes q1-2h may help with cellulitis resolution.
  - e. Elevate the affected extremity.
  - f. If the hand or wrist is affected, splint for 24-48 hours.

---

## 2. Fungal Infection

- a. Apply topical antifungal powder, spray, cream or ointment, following the manufacturer's instructions.
  - Continue topical antifungal treatment for 1 week after lesion resolves.
  - **DO NOT** mix creams and powders.
- b. Advise patient to keep area clean and dry (showers OK)
- c. Change underwear and/or socks daily.
- d. Avoid tight fitting clothes covering the affected area.

## 3. Contact Dermatitis

- a. Identification and avoidance of irritants is key to treatment, but identification may be difficult in the field.
- b. Clean wound site with soap and water and irrigate.
- c. Apply topical hydrocortisone ointment (0.5-1.0%) to affected area BID.
- d. Apply sterile, dry dressing.

## ALS

### 1. Cellulitis and/or lymphangitis

- a. Administer antibiotics according to local protocol.
- b. Administer IV antibiotics according to local protocol, if significant lymphangitis is present.

### 2. Fungal Infections (moderate to severe cases)

- a. Administer **one** of the following:
  - Fluconazole (Diflucan<sup>®</sup>) 200 mg PO on the first day, then 100 mg PO QD x2 weeks
  - Ketoconazole (Nizoral<sup>®</sup>) 200 mg PO qd
  - Terbinafine (Lamisil<sup>®</sup>) 250 mg PO qd

### 3. Contact Dermatitis

- a. To relieve itching, administer **one** of the following according to local protocol:
  - Hydroxyzine (Atarax<sup>®</sup>) 25-50 mg PO qd prior to sleeping, if sedation is operationally acceptable (Refer to "Other/Special Considerations" in this section.)
  - Fexofenadine (Allegra<sup>®</sup>) 180 mg PO qd
  - Loratadine (Claritin<sup>®</sup>) 10 mg PO qd, take on an empty stomach
  - Ranitidine (Zantac<sup>®</sup>) 300 mg PO qid
- b. For moderate to severe cases, administer **one** of the following:
  - Triamcinalone topical ointment applied to affected area BID **AND** Dexamethasone 10 mg IM, given as a one time injection
  - Start prednisone 60 mg PO QD. Seek on-line medical direction for appropriate taper. (Refer to "Other/Special Considerations" in this section.)

---

## **Evacuation**

1. Conduct urgent evacuation for patients with fever and/or chills, quickly advancing cellulitis, or lymphangitis.
2. Conduct priority evacuation for contact dermatitis involving the eyes, mouth, or more than 50% TBSA.
3. Conduct routine evacuation for significant cellulitis afflicting the hands or feet or any cases that are unresponsive, or worsen, with treatment.
4. Conduct convenience evacuation for other moderate to severe cases.
5. Evacuation is usually not required for minor cases that respond to treatment.

## **Extended Care**

1. Cellulitis
  - a. Monitor patient's wound status daily.
  - b. Continue to track the visible signs of infection with an indelible ink pen every 12 hours.
  - c. Continue warm soaks and dressing changes, if a wound is present.
  - d. Continue elevation of the affected extremity.
  - e. Continue the splint for hand and/or wrist infections until there is marked improvement.
2. Fungal Infections
  - a. If the condition worsens with treatment, suspect and treat for cellulitis.
    - Re-evaluate evacuation status.
3. Contact Dermatitis
  - a. Obtain Hx to determine underlying causes. Have patient keep a diary of exposure to any irritants.
  - b. If the condition worsens (particularly if accompanied by fever, lymphangitis or lymphadenopathy) then suspect and treat for cellulitis and re-evaluate evacuation status.

## **ALS**

1. If condition worsens while treating for fungal or contact dermatitis, (particularly if accompanied by fever, lymphangitis or lymphadenopathy) then suspect and treat for cellulitis.
2. Consider administering antibiotics according to local protocol.

## **Other/Special Considerations**

1. Hydroxyzine, like most antihistamines, may cause drowsiness and sedation; thus the operational situation may not permit its use. However, the sedative effects of hydroxyzine last for 8-10 hours, while the antipruritic action lasts for 24 hours. This makes it superior to other antihistamines, such as diphenhydramine.
2. Discontinuing steroids abruptly may result in rebound worsening of symptoms and/or other medical problems. Consult on-line medical direction for appropriate taper dosing before stopping prednisone treatment. A typical taper for prednisone is 60 mg PO x7 days, then 40 mg PO x7 days, finishing with 20 mg PO x7 days.
3. Loratadine (Claritin®) typically does not cause drowsiness.

---

## T. Subcutaneous Abscesses

### Review of Injury/Illness

A subcutaneous abscess is a localized soft tissue infection, resulting in a collection of pus. Pain relief is often rapid, following minor surgical intervention. An abscess may form as a reaction to an embedded foreign body, an insect or spider bite, or from a non-traumatic event (e.g., occluded sebaceous glands, ingrown hairs, bacterial infiltration along the hair follicles, and an inversion of skin around a hair follicle or skin pore).

### Signs and Symptoms

- \* **Localized skin infection (surrounding cellulitis may or may not be present)**
- \* **Fluctuant, non-pulsatile mass (palpable movement of fluid [pus] beneath the skin)**
  - A pulsatile mass is NOT an abscess (likely a vascular aneurysm).
  - DO NOT incise any pulsatile mass.
- \* **Lymphangitis, lymphadenopathy (may or may not be present)**
- \* **Fever (may or may not be present)**

### Management

#### **BLS**

1. Surrounding cellulitis should be marked on the skin surface with an indelible ink pen. This will allow the initial provider and follow-up providers to track the spread of the cellulitis.
2. Warm soaks for 20 minutes q1-2h may help with cellulitis resolution.
3. Administer pain management medication. (Refer to Protocol VII.A.)

#### **ALS**

1. If cellulitis, lymphangitis, lymphadenopathy, and/or fever are present, administer antibiotics according to local protocol.
2. If the patient cannot be evacuated in 24 hours, and the abscess is fluctuant and painful, perform Incision and Drainage (I&D). (Refer to Protocol VI.A.1.)
3. If the provider is not comfortable with performing an I&D, needle aspiration of the abscess may be performed.
  - a. Needle aspiration may offer pain relief and decrease the risk of a worsening infection. (Refer to Protocol VI.A.2.) It is often inadequate for complete drainage and the abscess may reform.
  - b. If the abscess reforms, and evacuation to definitive care is delayed, then I&D is the preferred treatment. (Refer to Protocol VI.A.1.)
4. Post-Procedural Wound Care
  - a. Lightly pack the wound with iodoform gauze.
  - b. Apply topical antibiotic ointment.
  - c. Apply dry, sterile gauze.
  - d. Patient should report back for evaluation within 24 hours or if pains worsens, redness increases, or red streaks and/or heavy drainage from wound develops.

---

## **Evacuation**

1. Conduct urgent evacuation for any patient exhibiting systemic symptoms.
2. Conduct routine evacuation for an abscess accompanied by fever, lymphangitis or lymphadenopathy that does not respond to treatment.
3. Conduct convenience evacuation for any abscess that do not respond to treatment or if an I&D needs to be performed.
4. Evacuation is not usually required for abscesses that respond to treatment.

## **Extended Care**

1. Improvement, with decreased pain and swelling, should be noted within 24 hrs after an I&D.
2. Continue to track the visible signs of infection with an indelible ink pen every 12 hours.
3. Following an I&D, remove and replace the outer dressing and packing twice per day. As the wound heals, less packing material will be required to loosely pack the wound.

## **Management of Complications**

1. If the wound is packed too tightly, it may occlude drainage, causing swelling and pain.
  - a. Remove the packing from the wound.
  - b. Clean and irrigate the wound with Normal Saline or sterile water.
  - c. Loosely repack the wound.

---

## U. Fever without Known Cause

### Review of Injury/Illness

A fever is an internal body core temperature  $> 100.5^{\circ}\text{F}$  ( $>38.0^{\circ}\text{C}$ ). Fevers with no obvious initial cause are common in the austere environment and require investigation. Fever is a symptom of inflammation, but not necessarily infection, somewhere in the body. Fevers can be constant, cyclical, or unpredictably variable. Fever is often accompanied by chills, with the patient alternating between feeling hot and cold. A complete history and physical exam is critical to determining the underlying cause of most fevers.

### History and Physical Exam

1. Conduct a complete history, including topics that may not normally be covered:
  - a. Past medical history, including:
    - Detailed history of other episodes of fever
    - Major illnesses
    - Autoimmune diseases
    - Allergic reactions
    - UTI (symptoms may be subtle)
    - STD risk factors
  - b. Past surgical history
  - c. Prescription or OTC (including herbal) drug use
    - Drug-related fever is very common, especially when starting a new drug, drug dose, or drug combination.
  - d. Illicit drug use
  - e. Family history
  - f. Occupational history
  - g. Recent travel (other than the current environment)
2. Conduct a complete physical exam of all body systems, including areas that may not normally be covered:
  - a. Complete skin exam (small rashes or other marks may indicate larger illness)
  - b. Genitourinary exam (STDs and/or other genital infections can cause fever and systemic infection)
  - c. Cardiac (quiet murmur may be only clue for endocarditis)
  - d. Central nervous system (examine cranial nerves and test for neck stiffness)
  - e. Musculoskeletal system (examine for tissue injury or joint inflammation, which can cause fever with or without infection)

---

## **Management**

### **General**

1. Determining the underlying condition is the first priority. Fever can be debilitating, and appropriate treatment may allow the patient to remain operational or self-assist in evacuation procedures.
  - a. Investigate any complaints thoroughly.
  - b. Investigate any newly developed symptoms, even if they appear minor (e.g., rash, urinary irritation).
  - c. Administer Ibuprofen 400 mg PO q8h **AND** Acetaminophen 650 mg PO q8h, alternating doses so that one drug is given every 4 hours.
2. Maintain good hydration with water or sports drinks. (Refer to Protocol III.D and Protocol III.G.)
3. After thorough investigation, if the cause is still unknown:
  - a. Contact on-line medical direction for further guidance.
  - b. Monitor patient closely for development of new signs or symptoms that may determine the underlying cause.
  - c. Document fever pattern.
  - d. Be sure to consider illnesses endemic to the current austere environment (e.g., tropical infections, waterborne diseases, parasites).
  - e. Consider common fever-causing illnesses or conditions (e.g., tuberculosis, UTI, hepatobiliary infection [cholelithiasis can cause fever without associated infection], osteomyelitis, STD, HIV, autoimmune disorder, vasculitis, DVT, neoplasm).

### **Evacuation**

1. Determine evacuation priority by underlying cause or overall patient condition.
2. Evacuation is usually not required for fever that responds to treatment.

### **Extended Care**

1. Continue supportive treatment, as necessary.
2. Maintain good hydration with water or sports drinks. (Refer to Protocol III.D and Protocol III.G.)
3. Monitor for development of new signs or symptoms.
4. Treat underlying cause promptly, once determined.

### **Follow-up**

1. Patients with recurrent, unexplained fever should follow up with a personal or team physician upon returning from an austere environment.

---

## V. Vaccinations

### Review

Vaccinations are operational area specific (e.g., plague, yellow fever, cholera).

Personnel may be used to provide emergency vaccinations during a disease outbreak, epidemic, or disaster situation. EMS personnel should be vaccinated for hepatitis A and B, chicken pox, tetanus, and measles, unless adequate antibodies are demonstrably present. The influenza vaccination should be obtained annually and as recommended by the CDC.

Vaccines (require refrigeration) of special concern in the AEMS environment:

- Tetanus
- Rabies
- Cholera
- Plague (in southwestern United States)
- Smallpox

### General Techniques for Vaccine Administration

1. Most vaccines are given through IM injection into the deltoid muscle of the arm.
  - a. Alternate IM sites may be used.
2. Smallpox vaccines require the use of a bifurcated needle dipped into the vaccine solution.
3. Some vaccines may be given orally (e.g., polio) or intradermally (e.g., PPD).

### Tetanus

1. Tetanus vaccinations require the completion of a 3 injection series.
2. If the tetanus vaccines and/or TiG is unavailable, and the patient is at high risk for developing tetanus, administer antibiotics according to local protocol and contact on-line medical direction.
3. Proper wound preparation and irrigation helps to prevent tetanus. Tetanus vaccinations are **NOT** a substitute for good wound care. (Refer to Protocol VI.Q.1.)
4. If treating a dirty wound, especially if contaminated with soil, manure or feces.
  - a. If the patient has prior history of tetanus immunization and > 5 years have passed since the last injection, administer the tetanus-diphtheria vaccine (Td) 0.5 ml IM.
    - If the patient is pregnant, administer the tetanus toxoid vaccine (Tt) 0.5 ml IM.
  - b. If the patient has no previous anti-tetanus vaccination, administer the tetanus-diphtheria vaccine (Td) 0.5 ml IM **AND** 250 IU Tetanus Immunoglobulin (TiG) IM.
  - c. If the wound is **extremely high risk** in a previously immunized patient, administer the tetanus-diphtheria vaccine (Td) 0.5 ml IM **AND** 250 IU Tetanus Immunoglobulin (TiG) IM.
5. If treating a clean wound, and > 10 years have passed since the last injection, administer the tetanus-diphtheria vaccine (Td) 0.5 ml IM.
  - a. If the patient is pregnant, administer the tetanus toxoid vaccine (Tt) 0.5 ml IM.

---

## **Rabies**

1. Rabies is almost always fatal in unvaccinated individuals.
2. Vaccinations may be given as routine prophylaxis for personnel involved in continuous and extended field operations in rabies high-risk areas (e.g., caves) or whose occupation puts them at frequent risk of rabies exposure (e.g., veterinarians, animal control).
3. Rabies vaccinations should be given if the animal attack is unprovoked or if the animal displayed unusual behavior prior to attack.
4. High risk animals (and predominate location) include:
  - a. Bats (entire United States)
  - b. Raccoons (eastern United States)
  - c. Foxes (Alaska, Arizona, and Texas)
  - d. Coyotes (southern Texas)
  - e. Skunk (California, north central United States, from Montana to Ohio and Kentucky)
  - f. Domestic dogs in rabies endemic areas
5. Wild animals are considered positive for rabies unless the animal or carcass can be brought to lab for analysis.
  - a. Administer the rabies vaccine to the patient unless the animal or carcass tests negative for rabies.
6. Pre-exposure Prophylaxis
  - a. Administer the human rabies vaccine (HDCV) 1.0 ml IM x3 doses, given on days 0, 7, and 21 (or 28).
  - b. Booster injections
    - Administer the HDCV 1.0 ml IM every 2-5 years.
    - Personnel with continuing high risk should be serum tested for rabies antibodies titers every 2 years.
7. Post-exposure Vaccination
  - a. Rabies immunoglobulin (RiG)
    - RiG is an integral part of rabies vaccination for patients without previous vaccination.
      - If the patient has been previously vaccinated against rabies, it is not required.
    - RiG should be given as soon as possible after exposure, preferably within 7 days.
    - RiG is administered directly into the wound. Any remaining RiG is administered IM.
      - It may be diluted with Normal Saline to provide uniform infiltration of multiple wounds.
      - Only small amounts of RiG can be administered in digital wounds. The bulk is administered IM.
    - Only human RiG (HRiG) is available for use in the United States. Dosage is 20 IU/kg.
    - **DO NOT** use the same syringe and needle to give the rabies vaccine, as RiG inactivates it.
  - b. Rabies Vaccine
    - It is administered along with RiG, in patients without previous vaccination.
    - Only human rabies vaccine (HDCV) is available for use in the United States.

- 
- If the patient has not been previously vaccinated:
    - Administer HDCV 1.0 ml IM x5 doses, given on days 0, 3, 7, 14, and 28.
  - If previously vaccinated:
    - Administer HDCV 1.0 ml IM x2 doses, given on days 0 and 3.
    - **DO NOT** administer RiG.

## **Cholera and Plague**

1. The cholera vaccine may be recommended for personnel working in flood disasters.
2. The plague vaccine may be recommended, in certain circumstances, for personnel working closely with immigrants in Arizona, California, Colorado and New Mexico.

## **Smallpox**

1. Use bifurcated needle (2 points) to administer the vaccine.
2. The deltoid muscle of the arm is the recommended site for administration, but any non-cosmetic location will suffice.
3. **DO NOT** prep skin with any antiseptic.
  - a. Alcohol is known to inactivate the vaccine.
  - b. If skin is grossly contaminated, clean with soap and water. Rinse well.
4. Follow the manufacturer's instructions regarding the reconstitution of the vaccine.
5. Dip and withdraw the bifurcated needle into the vaccine or reconstituted vaccine.
  - a. The needle should now contain sufficient vaccine for administration.
  - b. **DO NOT** re-dip needle into the vaccine vial.
6. Make dermal penetrations (insertions) within a 5 mm diameter area, holding the needle perpendicular to the skin.
  - a. Administer the number of insertions according to the manufacturer's instructions.
  - b. Wait 15-20 seconds and note bleeding, which indicates sufficient penetration.
7. Absorb excess vaccine with dry, sterile gauze.
8. Cover the vaccination site with loose gauze, tape, and semi-permeable membrane-type dressing (e.g., op-site) to prevent exposure to others.
  - a. Advise the patient to leave the semi-permeable dressing in place until the provider removes it upon re-examination of the vaccination site.
  - b. Advise the patient to wear a shirt or other covering to cover the vaccination site to prevent exposure to others, especially when close contact is possible.
9. Advise vaccine recipients:
  - a. **DO NOT** touch, rub, or scratch the vaccination site.
  - b. Keep the vaccination site covered with the original dressing. If it gets loose or dirty, return to the health care provider for the dressing change.

- 
- c. Keep vaccine site dry. Cover with plastic and tape during showers.
  - d. Use a separate laundry hamper for clothes, towels, sheets, and pillow cases that may have come into contact with the vaccine.
    - Wash in all suspected contaminated laundry in hot water with detergent and/or bleach.
    - Wash hands thoroughly after handling contaminated laundry.
  - e. Follow up with the health care provider for a re-examination of the vaccine site, as directed.

---

## W. Water-related Exposures

### Review of Injury/Illness

Working in flood or contaminated waters may expose personnel to a variety of problems (e.g., vibrio infection, mycobacterium marinum infection, leeches, aeromonas hydrophila infection, schistosomiasis).

### Anatomy and Physiology

1. Vibrio infection
  - a. Typically enters via a break in the skin
  - b. High risk (e.g., immunocompromised, patients with impaired liver functions)
  - c. 22 cases reported following Hurricane Katrina in 2005
    - 18 cases involved Vibrio wound infections
    - 4 cases involved Vibrio enteric infections
    - 5 patients died, all from wound infections
2. Mycobacterium marinum infection
  - a. May occur following exposure to fresh or salt water
  - b. Organism establishes itself through an open wound
  - c. Most lesions heal within 2-3 years
3. Aeromonas hydrophila infection
  - a. Enters through a puncture or open wound, or leech bite
4. Schistosomiasis
  - a. Caused by the epidermal penetration of the immature larva of bird, rodent or ungulate schistosomes (flatworms)

### Signs and Symptoms

#### Vibrio infections

- \* **Begins with redness and swelling at wound site**
- \* **Rapidly progresses to systemic illness in high risk patients**

#### V. vulnificus

- \* **Fever and/or chills**
- \* **Hemorrhagic bullae (blood tinged blisters)**
- \* **Hypotension**
- \* **Septic shock**

#### V. parahaemolyticus

- \* **Wound infections less severe than V. vulnificus**

---

### Enteric infections

- \* Mild to severe diarrhea, without fever
- \* Fever and/or chills, septic shock (high risk patients)

### Mycobacterium marinum infection

- \* Localized cellulitis (7-10 days following puncture wound or laceration)
- \* Progression includes arthritis, bone erosion, subcutaneous nodules, and superficial desquamation (tissue sloughing)
- \* Red papule (3-4 weeks after inoculation)
  - Papule evolves into hard, purple nodule
  - Scaling and ulceration (may or may not be present)
  - May be 6 cm in diameter (1-2 cm more common)
  - Dermal granulomas (may develop parallel to superficial lymphatics)

### Aeromonas Hydrophila Infection

- \* Cellulitis, erythema, edema, purulent discharge (within 24 hours)
  - Lower extremity is most often involved
- \* Localized pain, lymphangitis
- \* Fever and/or chills
- \* Gas may form in soft tissue (rapidly advances)
  - Bullae or necrotizing myositis (may or may not form)

### Schistosomiasis

- \* “Prickling” sensation (often the first symptom)
- \* Urticarial rash (generally limited to exposed skin)
- \* Erythema and mild edema (within 1 hour after skin penetration)
- \* Initial reaction subsides after 1 hour, leaving red macules
  - Macules become papular over next 10-15 hours
  - Discrete papules 3-5 mm in size, surrounded by a zone of erythema
- \* Vesicles (may or may not evolve into pustules)
  - Frequently form within 48 hours
  - May persist for 1-2 weeks
- \* Pruritus (intensifies over time)

### Leech bites

- \* Freely-bleeding wound that heals slowly
- \* Urticaria, bullae, localized necrosis (high risk patients)
  - Bullae, necrosis, sepsis (rapid development may indicate *Aeromonas hydrophila* infection)

### Preventive Measures

1. Personnel with open wounds should avoid water contact.
2. Personnel working in flood or contaminated waters should wear waterproof gloves and hip waders, chest waders, or a dry suit.
3. For schistosomiasis, roughly dry skin with a towel immediately after leaving water.

---

## **Management**

1. For suspected vibrio, mycobacterium marinum, and aeromonas hydrophila infections, administer antibiotics according to local protocol.
2. Schistosomiasis
  - a. Mild cases: Apply 40% isopropyl alcohol or a 1:1 mixture of isopropyl alcohol and calamine lotion to relieve itching.
  - b. Severe cases: Start prednisone 60 mg PO QD x7 days. Seek on-line medical direction for appropriate taper. (Refer to “Other/Special Considerations” in Protocol V.S.)
3. Leeches
  - a. Remove the leech by applying a few drops of highly salted water, alcohol or vinegar or by holding a hot flame near the attachment site.
  - b. Inspect for and remove any retained mouth parts.

## **Evacuation**

1. Conduct urgent evacuation for any suspected severe aeromonas hydrophila infection.
2. Conduct priority evacuation for any suspected vibrio infection or mild aeromonas hydrophila infection.
3. Conduct routine evacuation for any suspected mycobacterium marinum infection or wound infection developing after water exposure.
4. Conduct convenience evacuation for schistosomiasis.
5. Evacuation is usually not required for leech bites.

## **Extended Care**

1. Continue supportive and symptomatic care.
2. Continue antibiotics, as indicated.

---

## VI. Procedures

- A. Subcutaneous Abscesses
  - 1. Incision and Drainage (I&D)
  - 2. Needle Aspiration
- B. Alternate Wound Closure Techniques
- C. Cervical Spine Clearance
- D. Cricothyroidotomy
- E. Dental Anesthesia
  - 1. Apical Infiltration Anesthesia
  - 2. Buccal Block
  - 3. Inferior Alveolar Nerve Block
  - 4. Superior Alveolar Nerve Block
- F. Dental Splinting
  - 1. Atraumatic Tooth Restoration
  - 2. Non-invasive Monofilament Fixation
- G. Dislocations
  - 1. Digit
  - 2. Mandible
  - 3. Patella
  - 4. Shoulder
- H. Escharotomy
- I. Intraosseous Needle
- J. Local Anesthesia
  - 1. Local Infiltrations
  - 2. Digital Nerve Block
  - 3. Hematoma Block
  - 4. Intercostal Nerve Block (Rib Block)
  - 5. Posterior Tibial Nerve Block at the Ankle (Plantar Nerve Block)
- K. Nasal Packing
  - 1. Anterior
  - 2. Posterior
- L. Needle Thoracostomy
- M. Orthopedic Splints
- N. String Trick (Ring Removal)

- 
- O. Subungual Hematoma**
  - P. Urethral Catheterization**
  - Q. Wound Care**
    - 1. Wound Prep and Irrigation**
    - 2. Laceration Closure**
    - 3. Simple Loop Suture**
    - 4. Vertical Mattress Suture**
    - 5. Instrument Tie**
    - 6. Two-handed Field Tie**
  - R. Suturing Tubes and IV Lines in Place**

---

## A. Subcutaneous Abscesses

### 1. Incision and Drainage (I&D)

#### Indications

1. A fluctuant, painful abscess with evacuation time to a definitive health care facility expected to be more than 24 hours

#### Procedure

#### ALS

1. The procedure requires the use of protective eyewear, sterile surgical or clean exam gloves, and a surgical mask for the protection of the health care provider. (Refer to Protocol II.B.)
2. Surrounding cellulitis should be marked on the skin surface with an indelible ink pen. This will allow the initial provider and follow-up providers to track the spread of the cellulitis.
3. Administer pain management medication, as needed. (Refer to Protocol VII.A.)
4. Prepare the skin around the abscess with povidine-iodine solution, soap and water, or other disinfectant.
5. Provide local anesthesia by infiltrating the subcutaneous anesthetic in a diamond pattern field block. (Refer to Protocol VI.J.1.)
  - a. **DO NOT** use epinephrine-containing agents for this procedure, unless the abscess is located on the head or neck.
  - b. **DO NOT** nick the abscess with the needle.
  - c. **DO NOT** insert a contaminated needle into a multi-dose vial.
6. Consider infiltrating a small amount of the anesthetic directly at the incision site.
7. Prepare the packing.
  - a. The typical packing material is iodoform or plain gauze. It is available in ¼, ½, and 1 inch widths. The 1 inch width has the most field utility. It can be cut to size for most abscesses and is useful for packing/dressing other wounds.
  - b. Cut a strip of gauze from its container to a length that will reach the expected bottom of the abscess and extend approximately 3.0 cm out from the incision site. Save the remainder of the gauze for later use.
8. Determine the orientation of the skin tension lines in the area of the abscess. These lines run perpendicular to the long axis of the underlying muscles.
  - a. The orientation of the skin tension lines can be determined by wrinkling the skin around the abscess between the thumbs and fingers of both hands. Whichever way the skin wrinkles the easiest demonstrates the orientation of the skin tension lines.
9. Verify that the local anesthesia has taken effect.
10. For small abscesses and abscesses in cosmetic areas (e.g., face, neck), make the incision parallel to the skin tension lines. These incisions will heal with less scarring.

- 
11. For larger abscesses not in a cosmetic area, make the incision perpendicular to the skin tension lines. This will permit the wound to open more, allowing for better drainage.
  12. Make the incision using a #11 or #15 scalpel, held in a pencil grip manner at an 80 degree angle. Incise the skin through the underlying subcutaneous tissue and into the abscess in one movement. Extend the incision long enough to expose the entire abscess. In most cases, the incision will be 1-3 cm in length, depending on the size of the abscess. Pus should begin to flow freely from the wound.
  13. Use a hemostat to spread the wound open. It is unnecessary to fully explore the wound with the hemostat to break up hidden pockets.
  14. Irrigate the wound under pressure with Normal Saline or sterile water, if available.
  15. Inspect the wound and the exiting pus for any retained foreign bodies, especially if the abscess was caused by trauma. Carefully attempt to remove any foreign bodies in the wound with forceps or a hemostat. If the foreign body does not remove easily, leave it in place for later removal by a physician. In most instances, the foreign body will be very easy to remove. Document the result of the inspection and note any foreign bodies that were removed and/or left in place.
  16. After the pus has been expressed, insert iodoform or plain gauze to act as a drain.
    - a. The gauze is intended to keep the incision open to allow further drainage. **DO NOT** pack the wound. This may occlude further drainage and is uncomfortable for the patient. The goal is to keep the wound open for 24-48 hours.
    - b. Grasp one end of the gauze, and introduce it into the wound. Advance the gauze to the bottom of the abscess and release the grasp of the hemostat. Carefully remove the hemostat without dislodging the gauze. It is not necessary to suture the gauze in place.
  17. Apply dry, sterile gauze to the wound and secure it with tape or a self adhesive bandage.

### **Post-procedure Care**

1. Patient should report back for evaluation within 24 hours or if pains worsens, redness increases, or red streaks and/or heavy drainage from wound develops.
2. Continue to track the visible signs of infection with an indelible ink pen every 12 hours.
3. Change the dressing daily. Remove the gauze in 1-2 days.
4. Apply warm soaks to the wound for 20 minutes, 3-4 times per day.

---

## 2. Needle Aspiration

### **Indication**

1. A fluctuant, painful abscess with evacuation time > 24 hours to a definitive health care facility
2. If the provider is not comfortable with performing an I&D, needle aspiration of the abscess may be performed.
  - a. Needle aspiration may offer pain relief and decrease the risk of a worsening infection. (Refer to Protocol VI.A.2.) It is often inadequate for complete drainage and the abscess may reform.
  - b. If the abscess reforms, and evacuation to definitive care is delayed, then I&D is the preferred treatment. (Refer to Protocol VI.A.1.)

### **Procedure**

#### **ALS**

1. The procedure requires the use of protective eyewear, sterile surgical or clean exam gloves, and a surgical mask for the protection of the health care provider. (Refer to Protocol II.B.)
2. Administer pain management medication, as needed. (Refer to Protocol VII.A.)
3. Surrounding cellulitis should be marked on the skin surface with an indelible ink pen. This will allow the initial provider and follow-up providers to track the spread of the cellulitis.
4. Prepare the skin around the abscess with povidine-iodine solution, soap and water, or other disinfectant.
5. Locate where the abscess is “pointing” or the central apex of the abscess.
6. Consider introducing a small wheal of local anesthesia at the injection site.
7. Prepare a 10 ml syringe with a 16 ga needle.
8. Introduce the needle through the skin and into the abscess. There will be a “pop,” or a lessening of resistance, when the abscess is entered.
9. Confirm location in the abscess by aspirating pus.
  - a. If no pus is aspirated, carefully redirect the needle, without removing it from the skin, and aspirate again.
  - b. If pus is aspirated, continue to draw back the plunger and aspirate more into the syringe.
  - c. If the syringe fills, unscrew the syringe from the needle and expel the pus. Reattach the syringe and aspirate again.
  - d. Repeat aspiration until no additional pus can be removed.
10. Apply a dry, sterile gauze dressing without antibiotic ointment.

### **Post-procedure Care**

1. Patient should report back for evaluation within 24 hours or if pains worsens, redness increases, or red streaks and/or heavy drainage from wound develops.
2. Continue to track the visible signs of infection with an indelible ink pen every 12 hours.
3. Apply warm soaks to the wound for 20 minutes, 3-4 times per day.
4. If the abscess reforms, consider I&D.

---

## B. Alternate Wound Closure Techniques

### Review

Alternate wound closure techniques include the use of tape, glue, hair (scalp wounds), and staples. Tape and glue are small-size, low-weight alternatives to suture or staple kits. Anesthesia is not required when using tape, glue or hair. The use of wound tape, glue and hair are BLS procedures. The use of staples is an ALS procedure.

### Indications

1. Closure of lacerations that are clean, or have been rendered clean through skin prep, irrigation and debridement (Refer to Protocol VI.Q.1.)

### Contraindications

1. **DO NOT** close contaminated wounds.
2. **DO NOT** close puncture, stab, or gunshot wounds.
3. **DO NOT** close animal or human bites.
4. **DO NOT** close wounds older than 12 hours.

### Procedure

#### General

1. Prep and irrigate all wounds prior to closure. Inspect for retained foreign bodies.
2. Wound Tape (Steri Strips)
  - a. Tape should be ¼ or ½ inch in width.
  - b. It works well with wounds that easily approximate, without gaping or inverting.
  - c. It does not work well with gaping wounds or wounds that occur in densely hair-bearing skin (e.g., scalp).
  - d. Prep skin surrounding wound with a solvent such as acetone or alcohol, if possible.
    - Keep solvents away from the wound edge. **DO NOT** allow solvent into the wound.
  - e. Use tincture of benzoin or wound glue as an adhesive adjunct if the tape absolutely refuses to adhere.
    - If used, allow benzoin or glue to get tacky prior to tape application.
    - Either may also be used to reinforce the wound tape, if it loosens from skin over time.
  - f. Apply tape to one side of wound.
  - g. Apply tape to other side of wound while approximating wound edges with fingers and thumb.
  - h. Leave ¼ or ½ inch separation between tape strips.
  - i. Secure the tape with additional tape, running perpendicular to the tape applied across wound.
3. Wound Glue (Cyanoacrylate Adhesive)
  - a. Wound glue does not have the same tensile strength as sutures.
  - b. It works best for partial thickness wounds.

- 
- c. Wound glue is also useful for dry, cracked skin of the digits encountered in dry or cold environments.
  - d. Approximate wound edges with fingers
  - e. Apply glue over the approximated wound edge, using a light, brushing motion.
  - f. Apply in at least 3 thin layers, allowing the glue to dry after application of each layer (1-2 minutes).
  - g. Avoid excess pressure.
  - h. **DO NOT** get glue into wound.
4. Cross-tying Hair for Scalp Lacerations
    - a. Lay a large-diameter suture (3-0 or 4-0) or section of new, clean fishing line parallel to wound.
    - b. Twist a section of hair on one side of the wound and then the other side of the wound.
    - c. Cross hair sections over the wound to approximate tissues.
    - d. Have an assistant tie the suture or fishing line over hair sections to secure. Leave in place for 5-7 days.
  5. Staples
    - a. Stapling is less complicated and quicker than sutures, but may not be as comfortable to the patient.
    - b. **DO NOT** apply staples to the face.
    - c. It is easy to misapproximate tissue. Results are not universally as good as sutures.
    - d. A specialized extractor is needed for staple removal.
    - e. General technique (follow the manufacturer's instructions)
      - Have an assistant approximate wound edges, or approximate with one hand.
      - Place stapler perpendicular to skin.
      - Apply mild, downward pressure to the stapler into the skin perpendicular to the wound.
      - Release staple by releasing the grip on handle and moving the stapler ahead at 45 degree angle.
      - Repeat as needed.

### **Post-procedure Care**

1. Patient should report back for evaluation within 24-48 hours or if pains worsens, redness increases, or red streaks and/or heavy drainage from wound develops.
2. Change dressings daily, except for follow-up visit days.
  - a. Clean with soap and water.
  - b. Apply topical antibiotic ointment.
  - c. Apply a dry, sterile dressing.
3. Advise patient to keep wound clean and dry.
  - a. After 48 hours, the patient may then shower daily.
  - b. No water activities (e.g., swimming) until 24 hours after staple removal.
4. Monitor for signs and symptoms of infection or worsening condition.
5. Reassess sensory, motor and vascular functions periodically.

- 
6. Tape may be reinforced with wound glue, if needed.
  7. Wound glue may be reinforced, as needed.
  8. Staples may need removal in 7-10 days, followed by wound tape application for and additional 7-10 days.

### **Management of Complications**

1. If infection develops, open the wound to allow for drainage by removing some, or all, of the tape, glue, “hair sutures,” or staples.
2. Administer antibiotics according to local protocol, as needed.

## C. Cervical Spine Clearance

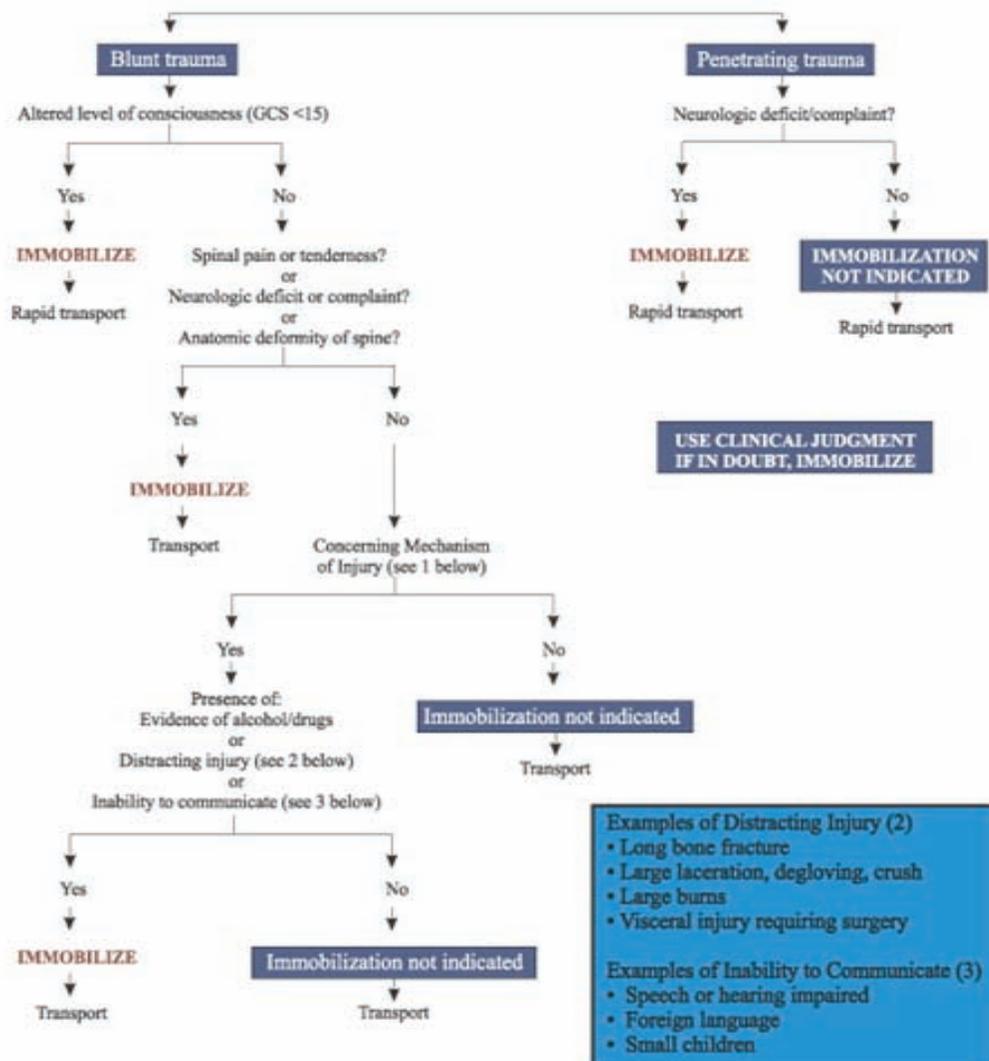
### Review

Field evacuation of an immobilized patient on a backboard significantly extends the evacuation time and increases the risk of further injury to both the patient and the rescuers. It is imperative that the patient's C-spine be evaluated and cleared, if possible, allowing the patient to participate more in the evacuation and greatly reduce the travel time to definitive care.

The protocol for C-spine clearance is best depicted in the NEXUS protocol, which can be performed in the field with approximately 99% certainty. Most important is the caveat, "Use clinical judgment; if in doubt, immobilize."

### Procedure

#### General



- 
1. The C-spine can be considered clear if:
    - a. The patient is conscious and not under the influence of drugs or alcohol.
    - b. There is no other distracting injury that might mask the pain of a cervical injury.
    - c. The patient does not complain of neck pain. No cervical tenderness or bony “step off” of the cervical spine is palpable upon examination.
    - d. The patient can move all four extremities.
    - e. There is no complaint of numbness or parasthesia in the extremities. The patient has intact sensation in all four extremities.

### **Other/Special Considerations**

1. There may still be instances when the patient can or must be evacuated ambulatorily, even though the patient cannot be cleared using the NEXUS protocol (e.g., neck pain with no other findings).
2. The medical provider must use good judgment and balance the clinical findings and mechanism of injury with the risks vs. benefits of evacuating the patient on a backboard.

## D. Cricothyroidotomy

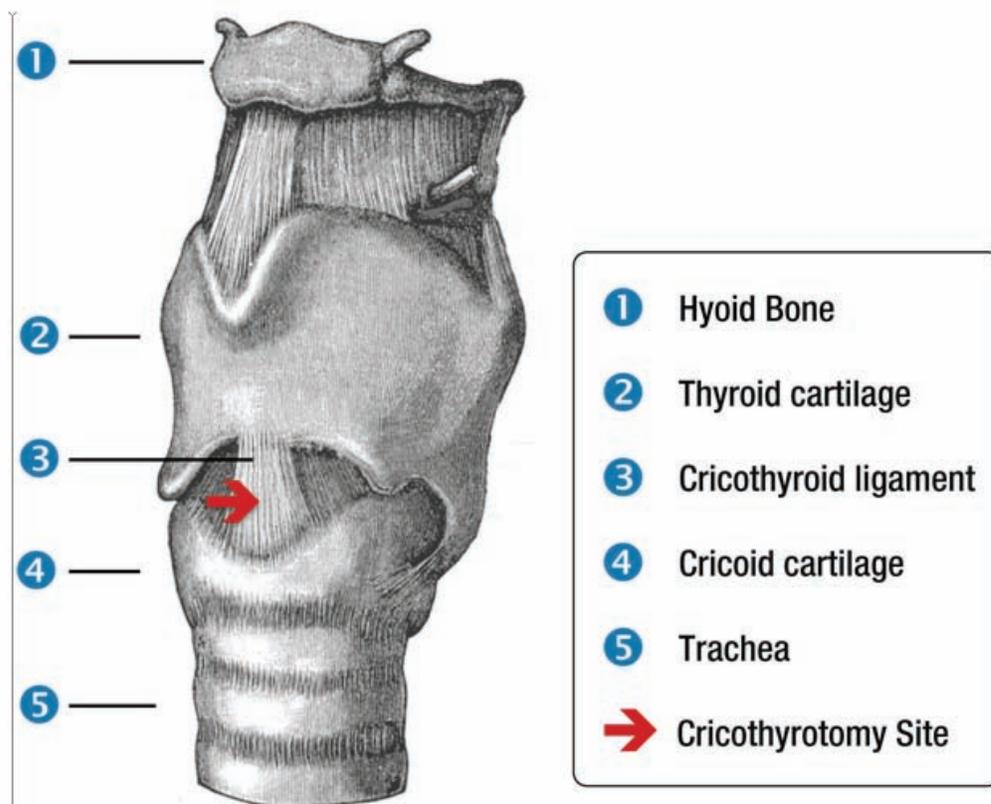
### Indications

1. Perform the procedure if two attempts using other means to secure the airway have failed.
2. Perform the procedure if the patient has a mechanical airway obstruction (e.g., facial fractures, direct airway injury, broken teeth, vomiting, foreign body).

### Procedure

#### ALS

1. Prepare the skin with povidine-iodine solution, soap and water, or other disinfectant.
2. Consider administering 1% or 2% Lidocaine® with epinephrine (1:100,000) 3.0 ml subcutaneously in the area surrounding the incision site to control bleeding.
3. Using the thumb and middle finger of non-dominant hand to stabilize trachea, use index finger to locate the cricothyroid membrane.
  - a. Be careful not to confuse with hyoid membrane by documenting tracheal rings immediately below the cricothyroid membrane.



Cricothyroidotomy

- 
4. Using a #11 or #15 scalpel, make a 1.5 cm incision through the skin and subcutaneous tissues, exposing the cricothyroid membrane.
  5. Use the scalpel to make a transverse stab incision through the membrane into the airway.
  6. Use the handle of the scalpel (or a hemostat) to dilate the opening in the membrane.
    - a. If a tracheal hook is available, insert the hook to further open the airway.
    - b. Insert tracheal hook or finger into the airway to use as guide to insert 6.0 endotracheal tube (ETT).
  7. Insert the previously prepared ETT into the trachea, inflate the cuff, and secure the tube to the patient's neck.  
(Refer to Protocol VI.R.)

---

## E. Dental Anesthesia

### 1. Apical Infiltration Anesthesia

#### Indications

1. Apical infiltration anesthesia is the primary form of dental anesthesia in an austere environment.
2. It is the preferred anesthesia to an individual tooth, teeth, dental pulp, and soft tissues.
3. It is most effective with anterior maxillary teeth and slightly less effective with anterior mandibular teeth. It may not be effective with posterior teeth.
4. If anesthesia is not effective:
  - a. Consider buccal or inferior alveolar block for the posterior teeth of the mandible. (Refer to Protocol VI.E.2 and Protocol VI.E.3.)
  - b. Consider posterior superior alveolar block for the posterior teeth of the maxilla. (Refer to Protocol VI.E.4.)

#### Contraindications

1. **DO NOT** use if there is a known and documented allergy to Lidocaine® or another amide anesthetic (rare).

#### Procedure

##### ALS

1. Apply a topical anesthetic (e.g., 30% topical benzocaine) to the buccal fold area adjacent to the affected tooth. Wait 5 minutes.
2. Draw up 1.5 ml of 1% or 2% Lidocaine® with epinephrine (1:100,000) in a 3.0 ml syringe.
3. Attach a ¾ inch 25-27 ga needle.
4. Insert the needle into the buccal fold with the needle angled toward the apex of the tooth.
  - a. The needle bevel should be facing apex of tooth.
  - b. Advance the needle until bone is encountered, then withdraw slightly (1-2 mm).
5. Aspirate to rule out vascular entry.
6. Inject 1/3 of local anesthetic.
7. Withdraw the needle slightly, angle the needle posteriorly at 45 degrees, and inject second 1/3.
8. Withdraw the needle slightly, angle the needle anteriorly at 45 degrees, and inject last 1/3.
9. Wait 5 minutes. Verify that the local anesthesia has taken effect.

#### Post-procedure Care

1. No post-procedure care is required, other than advising the patient to watch for signs of hematoma or infection (very rare) at the block site, or if anesthesia fails to start wearing off within 12 hours.

---

## **Management of Complications**

1. If there is inadvertent entry in blood vessel:
  - a. Stop the procedure.
  - b. Assure that there are no signs of hematoma.
  - c. Discard the syringe and needle and try again with new equipment.
    - If supplies are short, the syringe may be flushed with Normal Saline or sterile water and used again **ONLY** on the **same** patient.
2. If anesthesia fails to take effect, massage cheek tissue on the facial side of the cheek near the injection site. Wait 10 more minutes. Verify that the local anesthesia has taken effect
3. If anesthesia still fails to take effect, the procedure may be repeated one more time.
  - a. Introduce needle through previously anesthetized tissue.

## 2. Buccal Block

### Indications

1. Buccal block provides anesthesia for the buccal aspect of one side of the mandible.
2. It is easier to perform than inferior alveolar block, but provides less anesthetic coverage.
  - a. The lower teeth are not readily amenable to local infiltration anesthesia due to the more dense structure of the mandible, particularly the posterior lower teeth.

### Contraindications

1. **DO NOT** use if there is a known and documented allergy to Lidocaine® or another amide anesthetic (rare).

### Procedure

#### ALS

1. Apply a topical anesthetic (e.g., 30% topical benzocaine) to the buccal tissue of the cheek, just posterior to the most posterior tooth. Wait 5 minutes.
2. Draw up 2.5 ml of 1% or 2% Lidocaine® with epinephrine (1:100,000) in a 3.0 ml syringe.
3. Attach a 1¼ inch 25-27 ga needle.
4. Retract the cheek away from the teeth and introduce the needle into the tissue where the cheek meets the gum near the tooth/teeth being treated.
5. Insert the needle at a 45 degree angle into the buccal tissue just posterior to the most posterior tooth (immediately anterior-lateral to the mandible).
  - a. Aspirate to rule out vascular entry.
  - b. Deliver a small amount of local anesthetic.
  - c. Advance the needle deeper into the tissue (¾-1 inch), injecting the remainder of the anesthetic. Aspirate frequently to rule out inadvertent vascular injection.
6. Wait 10 minutes. Verify that the local anesthesia has taken effect.
7. If working on the posterior lower teeth, a second injection may be required to complete the block.



### Post-procedure Care

1. No post-procedure care is required, other than advising the patient to watch for signs of hematoma or infection (very rare) at the block site, or if anesthesia fails to start wearing off within 12 hours.

---

## **Management of Complications**

1. If there is inadvertent entry in blood vessel:
  - a. Stop the procedure.
  - b. Assure that there are no signs of hematoma.
  - c. Discard the syringe and needle and try again with new equipment.
    - If supplies are short, the syringe may be flushed with Normal Saline or sterile water and used again **ONLY** on the **same** patient.
2. If anesthesia fails to take effect, massage cheek tissue on the facial side of the cheek near the injection site. Wait 10 more minutes. Verify that the local anesthesia has taken effect
3. If anesthesia still fails to take effect, the procedure may be repeated one more time.
4. Introduce needle through previously anesthetized tissue.

---

### 3. Inferior Alveolar Nerve Block

#### Indications

1. Inferior alveolar nerve blocks provide local anesthesia for procedures involving the lower teeth of one side of the jaw.
2. This procedure is technically more complicated than the buccal block, but provides a greater area of anesthesia.
  - a. It is associated with a significant (10-20%) chance of failure to achieve anesthesia.
  - b. It may need to be repeated to obtain adequate anesthesia.
3. The lower teeth are not readily amenable to local infiltration anesthesia due to the more dense structure of the mandible, particularly the posterior lower teeth.

#### Contraindications

1. **DO NOT** use if there is a known and documented allergy to Lidocaine® or another amide anesthetic (rare).

#### Procedure

##### **ALS**

1. Apply a topical anesthetic (e.g., 30% topical benzocaine) to the soft tissue V-shaped structure located at the medial aspect of the mandibular ramus. Wait 5 minutes.
2. Draw up 2.5 ml of 1% or 2% Lidocaine® with epinephrine (1:100,000) in a 3.0 ml syringe.
3. Attach a 1½ inch 25-27 ga needle.
4. Retract the cheek away from the teeth and introduce the needle into the tissue where the cheek meets the gum near the tooth/teeth being treated.
5. Place the syringe on top of tooth #4 and align with the occlusal plane.
6. Introduce the needle on the lingual side and into the center base of the soft tissue V-shaped structure located at the medial aspect of the mandibular ramus.
  - a. Aspirate to rule out vascular entry.
  - b. Deliver a small amount of local anesthetic.
7. Advance the needle until you reach the bone, maintaining parallel alignment with the occlusal plane.
  - a. The long needle should be buried into the tissue about ¾ of its length when you strike the bone.
    - If you are shallow and hit the bone early, slightly withdraw the needle and redirect it more posteriorly.
    - If bone is not struck, the needle is too far posterior. Slightly withdraw the needle and redirect it more anteriorly.
      - Advance the needle again ¾ of its length until you hit the bone.
8. Aspirate frequently to rule out vascular entry.
9. Inject the remainder of the anesthetic.

---

10. Wait 10 minutes. Verify that the local anesthesia has taken effect.

11. If working on the posterior lower teeth, a second injection may be required to complete the block.

### **Post-procedure Care**

1. No post-procedure care is required, other than advising the patient to watch for signs of hematoma or infection (very rare) at the block site, or if anesthesia fails to start wearing off within 12 hours.

### **Management of Complications**

1. If there is inadvertent entry in blood vessel:

a. Stop the procedure.

b. Assure that there are no signs of hematoma.

c. Discard the syringe and needle and try again with new equipment.

- If supplies are short, the syringe may be flushed with Normal Saline or sterile water and used again **ONLY** on the **same** patient.

2. If anesthesia fails to take effect, massage cheek tissue on the facial side of the cheek near the injection site. Wait 10 more minutes. Verify that the local anesthesia has taken effect

3. If anesthesia still fails to take effect, the procedure may be repeated one more time.

4. Introduce needle through previously anesthetized tissue.

---

## 4. Superior Alveolar Nerve Block (Posterior Superior Alveolar Block)

### Indications

1. Superior alveolar nerve blocks provide anesthesia for the proximal teeth of the maxilla.
  - a. Local infiltration may not provide adequate anesthesia for proximal maxillary teeth due to increased bone density.
2. It does not provide anesthesia for the anterior teeth. For anterior maxillary teeth, use local infiltration.

### Contraindications

1. **DO NOT** use if there is a known and documented allergy to Lidocaine® or another amide anesthetic (rare).

### Procedure

#### **ALS**

1. Apply a topical anesthetic (e.g., 30% topical benzocaine) to the buccal fold of the cheek, opposite of the second maxillary molar. Wait 5 minutes.
2. Draw up 2.5 ml of 1% or 2% Lidocaine® with epinephrine (1:100,000) in a 3.0 ml syringe.
3. Attach a ¾-1 inch 25-27 ga needle.
4. Retract the cheek away from the teeth and introduce the needle into the tissue where the cheek meets the gum near the tooth/teeth being treated.
5. Insert the needle into the buccal fold of the cheek, opposite of the second maxillary molar.
  - a. Aspirate to rule out vascular entry.
  - b. Deliver a small amount of local anesthetic.
6. Direct the needle upward posteriorly and medially from the second molar, injecting the remainder of the anesthetic. Aspirate frequently to rule out inadvertent vascular injection.
  - a. Needle depth is typically around 5/8 inch (16 mm), but varies according to patient's bone structure.
  - b. The depth will vary according to the bony structures of the patient.

### Post-procedure Care

1. No post-procedure care is required, other than advising the patient to watch for signs of hematoma or infection (very rare) at the block site, or if anesthesia fails to start wearing off within 12 hours.

### Management of Complications

1. If there is inadvertent entry in blood vessel:
  - a. Stop the procedure.
  - b. Assure that there are no signs of hematoma.

- 
- c. Discard the syringe and needle and try again with new equipment.
    - If supplies are short, the syringe may be flushed with Normal Saline or sterile water and used again **ONLY** on the **same** patient.
  2. If anesthesia fails to take effect, massage cheek tissue on the facial side of the cheek near the injection site. Wait 10 more minutes. Verify that the local anesthesia has taken effect
  3. If anesthesia still fails to take effect, the procedure may be repeated one more time.
  4. Introduce needle through previously anesthetized tissue.

---

## F. Dental Splinting

### 1. Atraumatic Tooth Restoration

#### **Indications**

1. Atraumatic tooth restoration provides temporary treatment for dental carie or pulpitis, if evacuation is delayed or not possible.
  - a. Prevents entry of food, air and water into cavity, significantly reducing pain
  - b. Prevents further intrusion of decay
  - c. Reduces risk of abscess formation
  - d. Can stabilize and save the tooth

#### **Contraindications**

1. If abscess may be present:
  - a. Facial swelling is present.
  - b. Constant tooth pain is present.
  - c. Tooth is significantly sensitive to percussion.
  - d. Apical or periodontal abscess is noted on exam.

#### **Procedure**

##### **General**

1. Administer pain management medication. (Refer to Protocol VII.A.)
2. For severe pain, consider dental anesthesia. (Refer to Protocol VI.E.)
3. It is essential to keep the cavity dry because it allows better visualization and the cement sets better in a dry environment.
  - a. Apply gauze between the tooth and cheek (buccal side).
  - b. Place gauze on the lingual side of the tooth, when working with a lower tooth.
  - c. Change the gauze if it becomes saturated.
4. Remove the decay using a dental spoon.
  - a. Remove some decay from the bottom of the cavity. (It is not necessary to remove all of the decay.)
  - b. Remove and scrape all decay from the edge and sides of the cavity, and clean of decay.
  - c. Wipe away any decayed tissue with gauze.
5. If the cavity is in close contact with the gingival tissue or an adjacent tooth, apply a temporary, improvised stent on the gum between the teeth prior to applying cement.
  - a. A clean toothpick, tooth from a hair comb, or soft stem of a leaf may be used.
  - b. Ensure ends of the stent are blunt to avoid puncturing tissue.

- 
- c. Remove after application of glass ionomer cement (GIC), do not incorporate into GIC.
6. Apply a small ball of GIC to the end of a filling tool or curved hemostat.
    - a. Place the small ball into the cavity and spread it over cavity floor and corners.
    - b. Place another small ball of GIC against the first application and along the sides of the cavity and continue adding GIC until the cavity is filled.
    - c. Smooth any extra cement around the edge of the cavity.
    - d. Remove any excess cement before it sets and hardens.
  7. Shape the cement at the crown to resemble the top of a normal tooth.
  8. Remove any free or loose pieces of cement with a forceps.
  9. Use a dental probe or pick to remove cement from gingival tissue.
  10. Check occlusion. It should be as close to normal as possible.
    - a. If the cement is too high, teeth will strike the cement filling first. The filling may crack from pressure applied during occlusion.
      - If the cement is still wet:
        - A smooth spot will be apparent where the opposing tooth bit into the cement.
        - Scrape away some of the cement from this spot.
      - If the cement is dry:
        - Have the patient bite on carbon contact paper, which will darken the cement if too much is present.
        - Scrape and remove the excess cement (carbon marked) with a dental probe or pick.
        - If carbon contact paper is unavailable, improvise by using paper darkened with a pencil.
  11. **DO NOT** consider the procedure complete until the treated tooth fits properly against the opposing teeth.

### **Post-procedure Care**

1. NPO for 1 hour.
2. Advise the patient to follow a soft diet for 24 hours.
3. Avoid biting or chewing food with the temporary filling, as they are not as strong as permanent ones.

### **Management of Complications**

1. If tooth pain worsens after application of temporary filling, re-evaluate for an abscess. If an abscess is suspected, remove the filling and treat the abscess according to local protocol.

### **Follow-up**

1. The patient should see their team or personal dentist and/or oral surgeon as soon as possible upon return from an austere environment.
  - a. Dental evaluation is required.
  - b. Placement of a permanent filling is needed.

---

## 2. Non-invasive Monofilament Fixation

### **Indications**

1. Non-invasive monofilament fixation splints and stabilizes repositioned avulsed teeth, reduced tooth dislocations, and reduced alveolar fractures of the maxilla or mandible.

### **Procedure**

#### **ALS**

1. Administer pain management medication. (Refer to Protocol VII.A.)
2. For severe pain, consider dental anesthesia. (Refer to Protocol VI.E.)
3. Start by creating an anchor.
  - a. Tie a loop of large suture material around a tooth that is two teeth anterior from the injury, if possible. Leave one end long.
  - b. Tie another loop of suture material around a tooth that is two teeth posterior from the injury. Leave one end long.
  - c. Tie both long ends together with a surgeon's knot and two square knots. This is the anchor line.
  - d. If the second tooth away from the injury is absent or unavailable for use as an anchor, use the tooth immediately adjacent to the injured one.
4. Secure adjacent teeth to the suture anchor.
  - a. Place the suture material around the tooth adjacent to the injured tooth.
  - b. Bring one end of the suture material underneath the anchor line and the other end above the anchor line, and tie with two square knots.
  - c. Repeat for the other adjacent tooth.
5. Secure the injured tooth to the anchor line.
  - a. Place the suture material around the injured tooth.
  - b. Bring one end of the suture material underneath the anchor line and the other end above the anchor line, and tie with two square knots.
6. Ensure that tissue is not penetrated.

### **Post-procedure Care**

1. Advise the patient to gargle warm water or saline every 2-4 hours.
2. Advise the patient to follow a soft diet for 24 hours.
3. Maintain stabilization until patient is seen by dentist or oral surgeon.

---

## **Management of Complications**

1. If unable to stabilize the tooth with non-invasive fixation. Consider suturing the tooth in place.
  - a. Administer pain management medication. (Refer to Protocol VII.A.)
  - b. For severe pain, consider dental anesthesia. (Refer to Protocol VI.E.)
  - c. Use a modified horizontal mattress suture anchored to the gingival tissue on both sides of the injured tooth. (Refer to Protocol VI.F.)
  - d. The suture runs over the crown of the injured tooth.

## **Follow-up**

1. The patient should see their team or personal dentist and/or oral surgeon as soon as possible upon return from an austere environment.

## G. Dislocations

### 1. Digit

#### Review of Injury

Three different joints of each finger or toe can become dislocated. The most commonly dislocated is the Proximal Interphalangeal Joint (PIP), followed by the Distal Interphalangeal Joint (DIP), followed by the Metacarpophalangeal Joint (MCP). The vast majority of these injuries are dorsal dislocations.

#### Anatomy and Physiology

1. A dislocated digit joint is usually obvious and easy to diagnose.
2. The finger appears crooked and often bends at an abnormal angle.
3. Specifically, the distal bone of the joint will be moved dorsal to its normal position.

#### Signs and Symptoms

- \* Severe pain
- \* Unwillingness to move affected joint
- \* Significant swelling around the affected joint
- \* Crooked, deformity

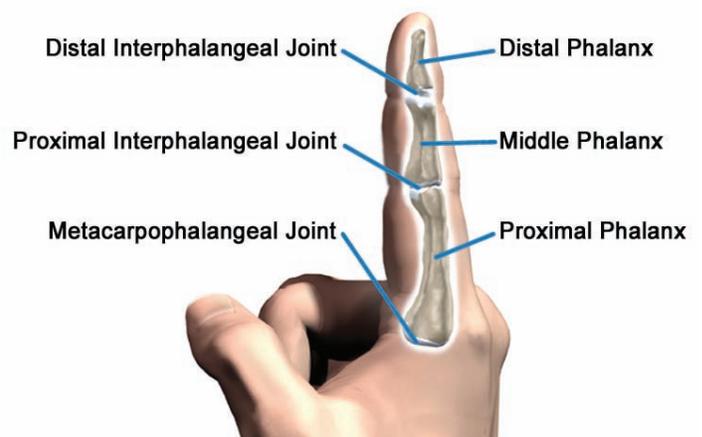
#### Procedure

##### General

1. Administer pain management medication.  
(Refer to Protocol VII.A.)
2. All joints proximal to the injured joint should be flexed, including the wrist.
3. Grip the distal bone of the affected joint firmly.
4. First the distal bone should be hyperextended.
5. Then the base of the distal bone is pushed into flexion, maintaining contact with the proximal bone head.
6. The joint usually reduces easily with a palpable and audible click.

#### Post-procedural Care

1. For PIP and DIP dislocations, tape the injured finger to an adjacent finger (“buddy taping”) to prevent hyperextension. Early motion is allowed.
2. For MCP dislocations, apply a dorsal-volar splint, holding the joint at 90 degrees of flexion.



---

## **Extended Care**

1. Maintain splinting or taping until definitive medical care is reached.

## **Follow-up**

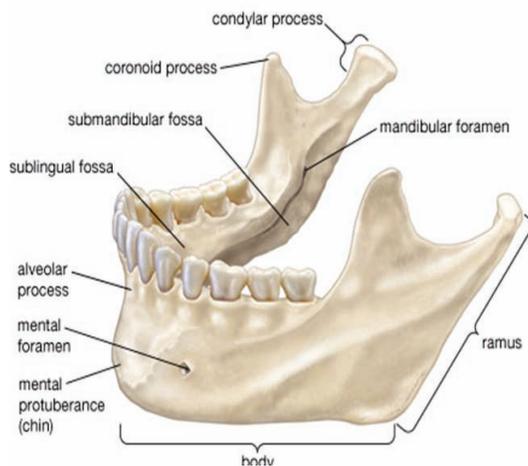
1. The patient should see their team or personal physician as soon as possible upon return from an austere environment.
  - a. An exam and radiograph is needed after any dislocation reduction to rule out other injuries.
  - b. Surgery may be needed if there is significant tendon or ligament damage.

## 2. Mandible

### Review of Injury

Mandible dislocation is a rare condition that can result from a traumatic or non-traumatic injury. Acute anterior dislocations are the most common and result from extreme jaw opening (e.g., vomiting, seizure, muscle spasm, yawning, dystonic reaction).

### Anatomy and Physiology



### Physical Exam

1. Conduct and document a thorough exam of the head and neck, including the nervous system.
  - a. Inspect for gingival lacerations, which may indicate open fracture.
  - b. Perform the “tongue blade test” to evaluate for mandible fracture. (Refer to Protocol IV.H.)
  - c. **DO NOT** attempt reduction for any mandible fractures.
2. Palpate the temporal mandibular joint (TMJ) for abnormalities.
  - a. Anterior dislocations result in a palpable depression at the TMJ.
  - b. Unilateral dislocations result in the deviation of the jaw away from the side of the dislocation.

### Signs and Symptoms

- \* **Uni- or bilateral pain at the TMJ**
- \* **Difficulty speaking or swallowing**
- \* **Malocclusion**

---

## **Procedure**

### **General**

1. Administer pain management medication. (Refer to Protocol VII.A.)
2. Assess for mandible or other facial fracture before attempting reduction.
  - a. **DO NOT** attempt reduction for any mandible fractures.
3. Position the patient sitting facing the provider.
4. Using both hands, place thumbs on the patient's inferior molars, as posteriorly as possible. (Pad thumbs to protect from biting.)
5. Wrap remaining fingers around and under both sides of the mandible.
6. Using both thumbs, apply downward and backward pressure on the mandible while slowly opening the mouth.
7. With successful reduction, the mandible should move posteriorly and be able to close with reduced pain.

### **Extended Care**

1. The patient should not open his/her mouth more than 2.0 cm for 14 days following the reduction.
2. Advise the patient to follow a soft diet for 72 hours following the reduction.

### **Follow-up**

1. The patient should see their team or personal physician as soon as possible upon return from an austere environment.
  - a. An exam and radiograph is needed after any dislocation reduction to rule out other injuries.

---

### 3. Patella

#### Review of Injury

A dislocated patella (knee cap) is often due to a twisting injury or a fall. When dislocated, the patella is abnormally shifted to the lateral aspect of the knee.



#### Physical Exam

1. If no other major knee deformity, assess for knee dislocation.
2. Check and record distal pulses and sensation, as neurovascular injury is possible.

#### Symptoms

- \* Rapid swelling
- \* Difficulty with knee flexion
- \* Acute anterior knee pain
- \* Abnormal patella location, lateral to normal position

#### Procedure

##### General

1. Document neurovascular status pre- and post-reduction.
2. If a neurovascular injury is suspected:
  - a. **DO NOT** reduce without on-line medical direction.
  - b. Splint and evacuate the injury.
3. Administer pain management medication. (Refer to Protocol VII.A.)
4. Slowly straighten the knee.
5. Apply gentle pressure to the lateral inferior aspect of the patella.

- 
6. Attempt to push it back up onto the distal femoral articular groove.
  7. Splint the joint in full extension.

### **Post-procedural Care**

1. Apply ice/cold pack for pain and swelling.
2. Maintain splint and extension until definitive care is reached.
3. Weight-bearing activity is allowed with the joint in a full extension splint.

### **Follow-up**

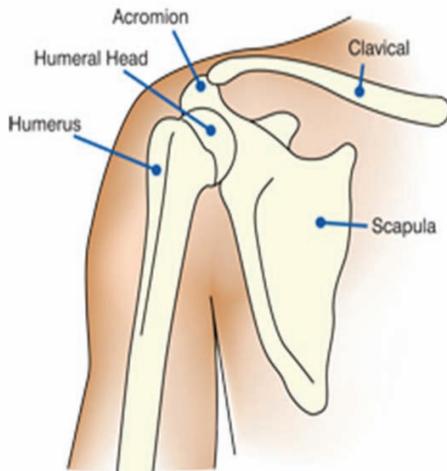
1. The patient should see their team or personal physician as soon as possible upon return from an austere environment.
  - a. An exam and radiograph is needed after any dislocation reduction to rule out other injuries.

## 4. Shoulder

### Review of Injury

The shoulder is the most commonly dislocated joint among adults. The head of the humerus is dislocated anteriorly and inferiorly in greater than 90% of injuries. The dislocation commonly occurs after a fall or a blow to the arm in the abducted and externally rotated position. Posterior dislocations commonly occur after a seizure.

### Anatomy and Physiology



### Physical Exam

1. Visual exam:
  - b. Abnormally shaped shoulder
  - a. Loss of deltoid contour
2. Physical exam:
  - a. Humeral head palpable anteriorly
3. Check and record distal pulses and sensation, as neurovascular injury is possible.

### Signs and Symptoms

- \* Severe pain
- \* Deformed shoulder, loss of contour
- \* Unable to internally rotate arm (unable to touch the uninjured shoulder)

---

## **Procedure**

### **General**

1. Document neurovascular status pre- and post-reduction.
2. If a neurovascular injury is suspected:
  - a. **DO NOT** reduce without on-line medical direction.
  - b. Splint and evacuate the injury.
3. Administer pain management medication. (Refer to Protocol VII.A.)
4. The key to reduction is a slow and steady application of the technique with adequate pain medication and muscle relaxation. There are many techniques to reduce an anterior shoulder dislocation; this is the most common technique:
  - a. The patient should be lying on his/her back.
  - b. Wrap a towel or blanket around the patient's chest; have an assistant use it to apply counter traction.
  - c. Pull the arm, bent to a right angle at the elbow, steadily out to the side.
  - d. Apply axial traction to the arm. This may take 5-15 minutes.
  - e. Gently rotate the arm internally and externally while applying traction (baseball throwing position).
    - With a successful reduction, the patient should experience an immediate decrease in pain.
    - Have the patient touch the uninjured shoulder to confirm reduction.
    - Apply a swath and sling.
    - If unable to reduce the dislocation, apply a swath and sling, maintain pain control, and evacuate.

### **Post-procedural Care**

1. Document the patient's neurovascular status, as the axillary nerve is commonly injured.
2. Maintain sling and swath until definitive care is reached.

### **Evacuation**

1. Conduct urgent evacuation for a suspected neurovascular injury.

### **Follow-up**

1. The patient should see their team or personal physician as soon as possible upon return from an austere environment.
  - a. An exam and radiograph is needed after any dislocation reduction to rule out other injuries.

## H. Escharotomy

### Review

An escharotomy is an advanced procedure performed on circumferential burn patients with severe edema from full-thickness or third degree burns. It is performed when the severity of the burn produces edema that limits circulation to tissue distal to the burnt area or restricts the patient's ability to breathe. A scalpel is used to make incisions through the burned skin, allowing the tissue to expand and reducing pressure on the underlying vasculature or the chest wall.

Escharotomies should only be performed by an ALS provider after consult on-line medical direction.

### Indications

1. The burns constrict the chest and restrict respiratory efforts.
2. The burns constrict a limb and impair distal circulation.
3. The procedure is approved by on-line medical direction.

### Procedure

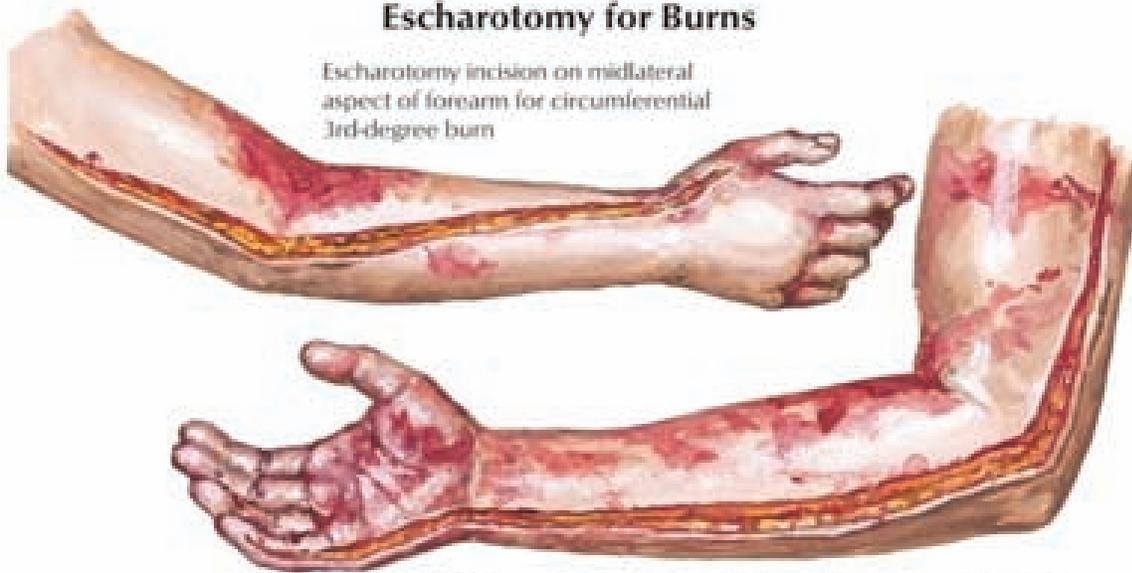
#### ALS

1. Administer pain management medication. (Refer to Protocol VII.A.)
  - a. Local anesthetic injection is unnecessary because only the insensate burn is incised.
2. Monitor distal pulses throughout the procedure.
3. Prepare the skin with povidine-iodine solution, soap and water, or other disinfectant.
4. Use a #11 or #15 scalpel to incise through the eschar into the subcutaneous tissue. (Refer to the illustration for incision locations.)
  - a. On extremities, the first incision should be made on lateral side. Make the incision on medial side, if ischemia is not resolved after lateral incision.
  - b. Only eschar is incised, **DO NOT** incise subcutaneous fat.
  - c. **DO NOT** incise unburned skin.
5. Bleeding should be minimal (if subcutaneous fat was not incised) and can be controlled with pressure.
6. After the procedure, apply a moist dressing covered in antibiotic cream/ointment or gauze soaked in Normal Saline or sterile water.
7. A compression wrap and elevation of the extremity after the procedure will help to control bleeding.
8. Administer antibiotics according to local protocol.



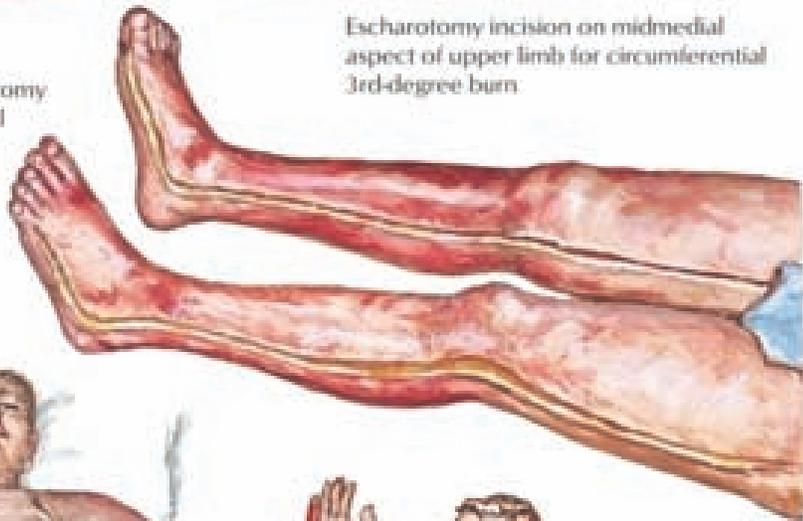
## Escharotomy for Burns

Escharotomy incision on midlateral aspect of forearm for circumferential 3rd-degree burn

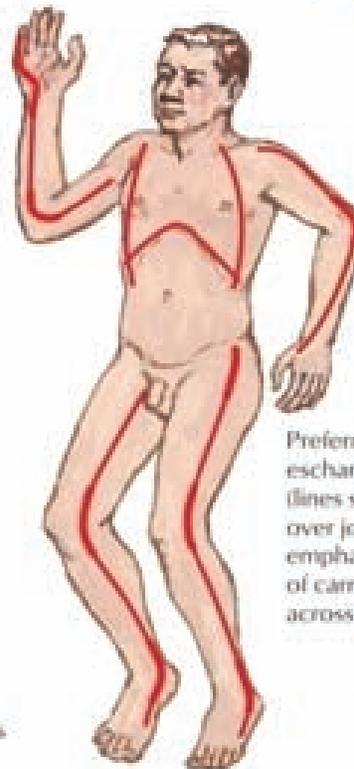


Escharotomy incision on midmedial aspect of upper limb for circumferential 3rd-degree burn

Medial and lateral escharotomy incisions for circumferential 3rd-degree burns of lower limbs



Escharotomy incisions for circumferential 3rd-degree burns of lower limbs and trunk in severely burned patient



Preferred sites for escharotomy incisions (lines shown thicker over joints to emphasize importance of carrying incisions across involved joints)

*F. Netter M.D.*

## I. Intraosseous (IO) Needle

### Review

Use device-specific instructions when obtaining IO access. Use common IO access sites (e.g., tibial tuberosity, sternum, humeral head) using various types of IO injection devices. (Refer to the illustrations for locations.) An IO should only be performed on a manufacturer-approved site for that device.

IO access can be obtained by an ALS provider.

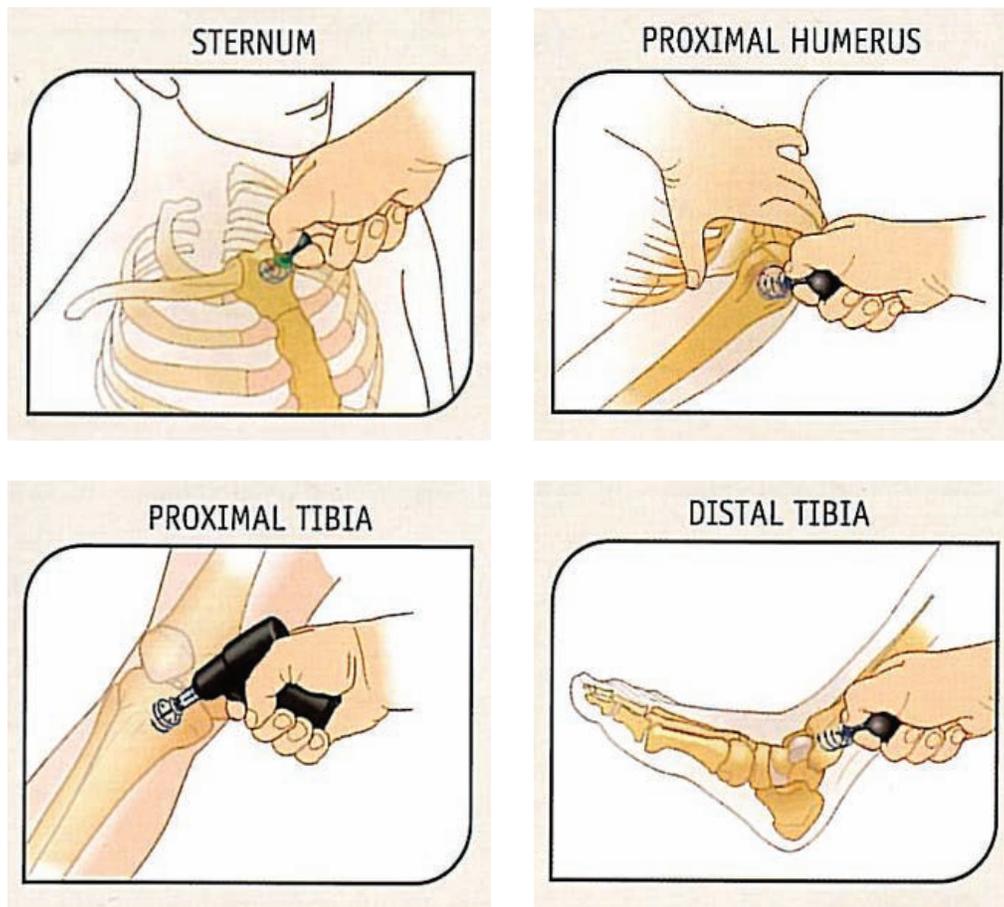
### Indications

1. Consider IO access if IV access cannot be obtained after 2 attempts.
2. It is necessary for life-sustaining treatment.

### Other/Special Considerations

1. Fluid delivery is often painful. Consider administering 5.0 ml of Lidocaine® through the IO, prior to administering IV fluids.
2. High pressure infusion is often required. Use pressure bag or inflate BP cuff around bag.

### IO Needle Injection Sites



---

## J. Local Anesthesia

### 1. Local Infiltrations

#### **Review**

This is the most common and easiest way to administer local anesthesia. It is important to match the correct size needle to the appropriate syringe to avoid generating excess pressure in the tissue, which is painful.

#### **Indications**

1. Local anesthesia may be appropriate for a wide variety of conditions. It is often included as a step in other procedures included in this field guide.

#### **Procedure**

##### **ALS**

1. Prepare the skin with povidine-iodine solution, soap and water, or other disinfectant.
2. Draw up the amount of anesthesia desired in a 3.0-5.0 ml syringe.
3. Attach a 21-27 ga needle.
4. Holding the needle at approximately a 45 degree angle, insert the needle into the subcutaneous tissue below the dermis. Pull back on the plunger and aspirate for blood.
  - a. If blood is observed in the syringe, this means that the needle has inadvertently entered a blood vessel. Move the needle and pull back on the plunger again.
  - b. If no blood is observed in the syringe, the needle is not in a blood vessel and injection is safe.
5. Inject enough of the anesthetic to raise a small wheal in the tissue.
6. Withdraw the needle to the skin's edge. Reinsert the needle, angling toward the next desired space while injecting.
7. Repeat Step 6 until one entire side of the wound has been infiltrated with the anesthetic.
8. Repeat Steps 4-6 on the opposite side of the wound.
9. Wait 1 minute. Verify that the local anesthesia has taken effect.

#### **Other/Special Considerations**

1. A smaller needle may not aspirate blood even if it has entered a blood vessel, because blood cells may clump at the needle head and prevent aspiration into the syringe. Move the needle frequently to avoid delivering a large bolus of anesthesia into a blood vessel.
2. Infiltrate the subcutaneous tissue as slowly as possible. This will minimize the pain of administration.
3. Infiltrate the proximal side of the wound first, before injecting the distal side. This will provide partial anesthesia and the injections into the distal side will be less painful.
4. True allergic reactions to amide-based (e.g., Lidocaine,<sup>®</sup> bupivacaine) local anesthetics are extremely rare.

## 2. Digital Nerve Block

### Review

A digital nerve block provides excellent local anesthesia for a digit and is better tolerated than attempting local infiltration within the digit. Both finger and thumb nerve blocks are referred to as digital nerve blocks.

### Indications

1. Administer digital nerve blocks for digits as pain control for an injury and/or prior to a procedure.

### Procedure

#### ALS

#### Finger Block

1. Prepare the skin with povidine-iodine solution, soap and water, or other disinfectant.
2. Draw up 3.0-5.0 ml of the anesthetic in a 3.0-5.0 ml syringe with a 21-27 ga needle.
  - a. **Confirm that the anesthetic selected is epinephrine-free.**
  - b. Epinephrine-containing anesthetics can cause serious harm due to vasoconstrictive effects when used in this procedure.
3. Insert the needle at a 45 degree angle, 1.0 cm into the tissue slightly palmar to the mid-point of the web space.
  - a. Aspirate to rule out vascular entry.
  - b. Deliver a small amount of local anesthetic.
  - c. For the ulnar side of the small finger and radial side of the index finger, where there is no web space, inject the side of the finger immediately distal to the metacarpophalangeal joint (MCP). Initial injection should be slightly palmar from the mid-line of the side of the finger.
4. Begin injecting anesthetic slowly.
5. Withdraw the needle, injecting continuously.
6. Redirect the needle dorsally and palmarly while injecting slowly.
7. Move needle frequently to avoid injecting the agent as a single bolus.
8. Repeat Steps 3-7 on the opposite side of the finger using an additional 3.0-5.0 ml of local anesthetic.
9. Wait 1 minute. Verify that the local anesthesia has taken effect.



---

## Thumb Block

The nerve supply to the thumb is slightly different than the fingers. The digital nerve runs mid-line along the palmar side of the thumb and several small branches of the radial nerve supply the dorsal aspect of the thumb.

1. Prepare the skin with povidine-iodine solution, soap and water, or other disinfectant. Include both sides of the thumb just distal to the MCP.
2. Draw up 3.0-5.0 ml of the anesthetic in a 3.0-5.0 ml syringe with a 21-27 ga needle.
  - a. **Confirm that the anesthetic selected is epinephrine-free.**
  - b. Epinephrine-containing anesthetics can cause serious harm due to vasoconstrictive effects when used in this procedure.
3. Locate the lateral mid-line of the thumb just distal to the MCP.
  - a. Make the first injection at 90 degrees.
  - b. Make the second injection at a 45 degree angle toward the palmar aspect of the thumb.
  - c. Make the third injection at a 45 degree angle toward the dorsal aspect of the thumb.
  - d. **DO NOT** remove the needle between injections. Withdraw the needle to the skin edge and redirect it in the desired direction.
4. Repeat Step 3 on the opposite side of the thumb.
5. Wait 1 minute. Verify that the local anesthesia has taken effect **prior** to beginning any additional procedures.

## Other/Special Considerations

1. **DO NOT** use local anesthetics containing epinephrine in any digit (e.g., toe, finger, or thumb) or small vascular area.
2. Massaging the tissue after injection may help facilitate the onset of anesthesia, particularly if there is a delay in obtaining anesthesia.
3. True allergic reactions to amide-based (e.g., Lidocaine,<sup>®</sup> bupivacaine) local anesthetics are extremely rare.

---

### 3. Hematoma Block

#### Indications

1. Reduction of closed fractures and dislocations
  - a. Primarily of the upper arm (e.g., radius, ulna fractures)
  - b. Also used for ankle fractures
  - c. Effective only in the acute management of these injuries
2. Pain relief following fracture and dislocation, with delayed evacuation
3. Technique is ineffective if hematoma has coagulated

#### Contraindications

1. Open fractures
2. Injuries > 24 hours old

#### Procedure

##### **ALS**

1. Prepare the skin with povidine-iodine solution, soap and water, or other disinfectant.
2. Draw up the amount of anesthesia desired in a 10 ml syringe.
  - a. Avoid longer lasting local anesthetics to allow for more timely re-evaluation of sensory, motor and vascular functions, if possible.
3. Attach a 21-27 ga needle.
4. Inject enough of the anesthetic to raise a small wheal in the tissue.
5. Locate the hematoma by visualization and palpation.
6. Insert the needle into the hematoma. Pull back on the plunger and aspirate for blood.
  - a. If blood containing fat droplets (from bone marrow) is observed in the syringe, it is a good indicator of entry into the hematoma.
  - b. Do not give as a single bolus injection. Move needle frequently to avoid inadvertent vascular injection.
  - c. Some authorities recommend aspirating and removing the blood from the hematoma prior to injection of the local anesthetic.
    - This may increase the effectiveness of the block.
    - This may make aspiration to avoid vascular injection more reliable.
7. Inject 10-15 ml of the local anesthetic solution into the hematoma.
8. Wrap with an elastic bandage (ACE wrap).
  - a. Do not apply the bandage too tightly.
  - b. Monitor fingers for paleness, decreased capillary refill
9. Wait 15 minutes. Verify that the local anesthesia has taken effect **prior** to beginning any additional procedures.

---

## **Post-Procedure Care**

1. Re-evaluate sensory, motor, and vascular functions when anesthesia fades.

## **Management of Complications**

1. Clinical studies do not indicate a significant risk of infection following a hematoma block.
  - a. If infection develops, administer antibiotics according to local protocol.
2. True allergic reactions to amide-based (e.g., Lidocaine,<sup>®</sup> bupivacaine) local anesthetics are extremely rare.

---

## 4. Intercostal Nerve Block (Rib Block)

### Review

Analgesic pain management should be attempted prior to performing an intercostals nerve block (ICNB).

ICNB has several potential benefits, including improved respiratory effort by decreasing hypoventilation and reduced risk of atelectasis and pneumonia.

Longer lasting (e.g., bupivacaine) anesthetics are the preferred agents for pain control, when using an ICNB.

**This procedure carries the risk of inadvertent pneumothorax. The choice of anatomic location for injection reduces the risk of pleural puncture.**

- Traditionally, ICNB is performed posteriorly, where the nerve is separated from the pleura by a thin layer of fascia.
- More anteriorly, at the posterior axillary line, the internal intercostal muscle is situated between the nerve and the pleura.
- Most rib fractures occur anteriorly or laterally, and are amenable to nerve blockade performed at the posterior axillary line.
  - The posterior axillary line is the **preferred site** for injection when managing anterior and lateral rib fractures.
  - Injection is performed more anteriorly than the traditional method.
  - It takes advantage of the additional anatomic protection and reduced risk of pleural puncture provided by the internal intercostal muscle.

Traditional posterior intercostal nerve blocks are **NOT** recommended for field use in an austere setting.

### Indications

1. Perform ICNB for pain management for rib fracture pain that is not significantly alleviated by analgesia, especially if evacuation is significantly delayed or not possible.

### Contraindications

1. Flail chest
2. Skin infection present at site of injection

### Procedure

1. Position the patient sitting upright and leaning forward.
2. The injured rib is identified by palpation and followed posteriorly to the proximal axillary line.
3. Prepare the skin with povidine-iodine solution, soap and water, or other disinfectant.
4. Draw up 10 ml of the anesthetic in a 10 ml syringe.
5. Attach a 21-27 ga needle.
6. At the proximal axillary line, retract the skin at the inferior border of the injured rib superiorly and over the rib, using the index finger of the non-dominant hand.
7. Using the dominant hand, direct the needle and syringe at an 80-degree angle (pointing toward the patient's head), to puncture the skin near the tip of the index finger in the non-dominant hand.

- 
8. Advance the needle until the rib is encountered.
  9. Release skin retraction, which moves the needle perpendicular to the chest wall and toward the inferior edge of the rib.
  10. Switch the syringe to the non-dominant hand. Place the palm of the dominant hand against the chest and walk (advance) the needle off the inferior edge of the rib with the middle finger of the dominant hand
  11. The needle is slowly introduced 3.0 mm. Pull back on the plunger and aspirate for blood.
    - a. If blood is observed in the syringe, this means that the needle has inadvertently entered a blood vessel. Move the needle and pull back on the plunger again.
    - b. If no blood is observed in the syringe, the needle is not in a blood vessel and injection is safe.
  12. Inject 2.0-5.0 ml of the anesthetic into the surrounding tissue, while moving the needle in and out 1.0 mm to ensure that the compartment between the internal and external intercostals muscles is penetrated. The intercostal nerve is located in this compartment.
  13. Repeat Steps 6-12 on the two ribs above and below the fractured rib, due to the innervation from overlapping intercostals nerves.
  14. Wait 5 minutes. Verify that the local anesthesia has taken effect **prior** to beginning any additional procedures.

### **Post-procedure care**

1. Monitor the patient for 30 minutes following the completion of the nerve block.
2. Assess and treat for signs and symptoms of pneumothorax. (Refer to Protocol VI.L.)
  - a. If pneumothorax is not suspected, the patient can be discharged from care, pending follow-up.
  - b. Provide the patient with instructions and/or information regarding pneumothorax and advise the patient to return immediately if signs or symptoms develop (e.g., shortness of breath, difficulty breathing, increasing pain at site of nerve block, blood-tinged sputum).
3. **DO NOT** repeat ICNB for a minimum of 24 hours due to the risk of bupivacaine-induced toxicity.

### **Management of Complications**

1. If infection at site develops (extremely rare), administer antibiotics according to local protocol.
2. True allergic reactions to amide-based (e.g., Lidocaine,<sup>®</sup> bupivacaine) local anesthetics are extremely rare.

### **Follow-up**

1. Re-evaluate the patient if he/she returns emergently with symptoms suggestive of pneumothorax.
2. Otherwise, examine and evaluate upon patient's next scheduled visit.
3. Patients with uncomplicated rib fractures should see their team or personal physician upon return from an austere environment.
  - a. An exam and radiograph is needed after any ICNB to determine the presence of a pneumothorax.

---

## 5. Posterior Tibial Nerve Block at the Ankle (Plantar Nerve Block)

### Review

This procedure provides a blockade of sensation to the posterior tibial nerve (and its plantar divisions) at the ankle level, providing anesthesia to all but the lateral-most section of the sole of the foot.

### Indications

1. To provide local anesthesia to the majority of the plantar surface of the foot prior to suturing lacerations or performing other surgical procedures

### Contraindications

1. **DO NOT** use if there is a known and documented allergy to Lidocaine® or another amide anesthetic (rare).
2. Presence of established significant neuropathy (e.g., diabetes) of the posterior tibial nerve

### Procedure

#### ALS

1. Remove the shoes and socks from both feet and compare sensation and skin warmth.
2. Always check and document the neurosensory, neuromotor and vascular status of the injured foot prior to the administration of any local anesthetic.
3. Prepare the skin with povidine-iodine solution, soap and water, or other disinfectant.
4. Draw up 10 ml of 1% or 2% Lidocaine® without epinephrine in a 10 ml syringe.
  - a. Avoid the use of longer lasting anesthetics due to risk of subsequent injury caused by lack of sensation and/or awareness of injury.
5. Attach a 21-27 ga needle.
6. The injection is administered to the medial aspect of the ankle. (Refer to the figures on the following page.)
  - a. Draw a horizontal line laterally and medially from the top (superior) aspect of the medial malleolus of the ankle.
  - b. Determine the point of maximum intensity (PMI) of the posterior tibial artery and mark it with an "X."
  - c. Draw a line vertically and superiorly from the "X" marking the PMI to intersect with the horizontal line extending from the medial malleolus.
  - d. Where the two lines intersect, insert the needle at a 90 degree angle perpendicular to the skin, up to the hub of the needle. Aspirate to rule out inadvertent vascular entry.
  - e. Inject approximately 1/3 of the anesthetic.
7. Slightly withdraw the needle and re-direct posteriorly at a 45 degree angle, up to the hub of the needle. Aspirate again to rule out inadvertent vascular entry.
  - a. **DO NOT** extend needle past the Achilles' Tendon.
8. Inject another 1/3 of the anesthetic.



Mark a line running horizontally from the medial malleolus.



Palpate and mark the PMI of the posterior tibial artery with an "X."



Draw a second line to intersect the first line.



The first injection is at a 90 degree angle and is given at the intersection of the two lines.



Withdraw the needle slightly and angle the needle at a 45 degrees angle towards the malleolus.



Withdraw the needle slightly again and redirect the needle at a 45 degree angle towards the Achilles' Tendon.

9. Slightly withdraw the needle and re-direct anteriorly at a 45 degree angle, up to the hub of the needle. Aspirate again to rule out inadvertent vascular entry.
  - a. **DO NOT** extend needle past the medial malleolus
10. Inject the remainder of the anesthetic.
11. The nerve block efficacy depends on the spread of the anesthetic in the subcutaneous space between the Achilles' Tendon and the medial malleolus.
12. Wait 15-30 minutes. Verify that the local anesthesia has taken effect **prior** to beginning any additional procedures.
  - a. **DO NOT** inject additional anesthesia during this period.
  - b. The posterior tibial nerve is a larger nerve and blockade may demonstrate delayed onset of anesthesia.
  - c. Massaging the tissue after injection may help facilitate the onset of anesthesia, particularly if there is a delay in obtaining anesthesia.
  - d. Anesthesia is often preceded by transient vasodilation of the foot's vasculature
    - Foot may appear red, flushed, and warm to the touch (hyperemic) usually after 5-10 minutes.
    - Vasodilation effects are a good early indicator of a successful nerve block.
    - Anesthesia typically follows the vasodilation effects.
    - Compare to uncovered opposite foot.

---

## **Post-procedure Care**

1. Re-evaluate and document motor function and vascular status upon completion of procedure.
2. **DO NOT** allow weight bearing activities on the anesthetized foot until sensation fully returns.
3. Patient should report back for evaluation within 12-24 hours or if symptoms of infection (e.g, pains worsens, redness increases, red streaks, swelling, fever) from injection site develops.

## **Management of Complications**

1. If anesthesia still fails to take effect or is incomplete in depth or coverage, consider repeating a nerve block with an additional 5.0 ml of anesthesia or proceed with a direct local infiltration.
2. True allergic reactions to amide-based (e.g, Lidocaine,<sup>®</sup> bupivacaine) local anesthetics are extremely rare.

## **Follow-up**

Injection site should be examined and re-evaluated on patient's subsequent visits for the original injury or condition.

---

## K. Nasal Packing

### 1. Anterior Nasal Packing

#### **Indications**

1. To help control epistaxis, particularly if source of bleeding is anterior
2. To help compress swelling in significant nasal trauma
  - a. Helps prevent septal hematoma, a rare but significant complication
  - b. Septal hematoma may lead to necrosis of nasal cartilage and resulting “saddle” deformity of nose

#### **Procedure**

1. Place the patient in an upright, sitting position.
2. Have patient clear clots from nose (may blow nose gently), if possible.
  - a. Be prepared to control renewed nose bleeding
  - b. Apply a topical nasal decongestant spray, such as oxymetazalone (Afrin®).
  - c. Place gauze sponge or pledget moistened with Normal Saline into the nostril.
  - d. Leave gauze in place for 10 minutes, with gentle compression by patient.
3. Position a clean or sterile drape on the patient’s chest.
4. Open a package of ¼ inch x 72 inch petrolatum gauze.
  - a. If unavailable, use ¼ inch plain packing gauze after first applying petrolatum to gauze.
5. Using bayonet forceps, other forceps, or a hemostat, begin introducing petrolatum gauze into the anterior portion of the nose.
  - a. A nasal speculum, if available, is helpful in examining the interior of the nose and in providing exposure while packing.
  - b. Apply layer by layer, approximately ½-1 inch at a time.
  - c. Begin posteriorly and work anteriorly, initially placing gauze as posteriorly as possible.
6. Fill nostrils completely, but not so much that nostrils blanch.
7. Leave the end of packing at the end of the nostril, incorporated into the packing (not hanging loose).
8. To compress swelling following significant nasal trauma:
  - a. Pack both nostrils.
  - b. Apply a nasal splint, if available, and tape in place.
    - Nasal splints are useless without anterior nasal packing.
9. Another technique is using a commercial nasal/regular tampon.
  - a. Coat the tampon with a sterile surgical lubricant.
  - b. Insert tampon horizontally along the nasal floor, as far posteriorly as possible.
  - c. Inflate/expand the tampon, following the manufacturer’s instructions.

- 
- Some commercial nasal tampons are expanded by the application of water (Merocel device)
  - Other nasal tampons have a cuff that is inflated with air (e.g., Rapid Rhino Balloon).

### **Post Procedure Care**

1. Advise the patient to keep his/her head elevated for 2-3 days.
2. Apply cold/ice packs for 24-48 hours.
3. Monitor for posterior nasal bleeding.

### **Management of Complications**

1. Control bleeding for epistaxis according to Protocol IV.C.
  - a. If bleeding source is anterior, consider packing opposite side to increase pressure on the nasal septum.
  - b. If bleeding source is now believed to be posterior, refer to Protocol VI.K.2.
2. Septal hematoma
  - a. Appears as an area of swelling and ecchymosis in the nasal septum
  - b. May be noted on initial presentation or during follow-up evaluation
  - c. If good lighting/visualization is possible
    - Apply topical nasal local anesthetic with epinephrine and wait 10 minutes.
    - Aspiration is particularly important if septal hematoma is bilateral.
      - Aspirate hematoma with a 18-20 ga needle and syringe.
      - Apply bilateral anterior nasal packing.
3. Septal Abscess
  - a. This condition develops days after injury
    - It appears as an area of swelling, erythema in the nasal septum.
    - Fever may be present.
  - b. Aspiration is particularly important if septal abscess is bilateral.
    - Aspirate abscess with a 18-20 ga needle and syringe.
    - Apply bilateral anterior nasal packing.
    - Pus noted following aspiration.
  - c. Administer antibiotics according to local protocol.

### **Follow-up**

1. Patients with epistaxis and anterior nasal packing should see a personal or team physician upon return from an austere environment. Packing should be removed in 2-3 days, if possible.
  - a. If physician follow-up is not possible, remove packing in 2-3 days
  - b. Packing should be reapplied if significant bleeding reoccurs or if a septal hematoma is noted (especially if drained).

---

## 2. Posterior Nasal Packing

### Review of Injury/Illness

Uncontrolled epistaxis may cause significant bleeding and airway obstruction. Bleeding that originates from the posterior nasopharynx is particularly dangerous.

### Indication

1. Uncontrolled posterior epistaxis

### Procedure

1. If available, insert a commercially prepared nasal balloon into the posterior phalanx and inflate, following the manufacturer's instructions.
2. Alternate option
  - a. Prepare a 14 French Foley catheter (tip is cut to minimize distal irritation).
  - b. Advance catheter along floor of nose (straight in) until it is visible in the mouth.
  - c. Fill a balloon with 5.0 ml Normal Saline.
    - **DO NOT** inflate if catheter is not visible in mouth
  - d. Retract catheter until it is well opposed to posterior nasal pharynx.
  - e. Add an additional 5.0 ml of Normal Saline to the balloon.
  - f. Clamp the catheter into place without using excessive anterior pressure.
  - g. Apply proper anterior nasal packing (Refer to Protocol VI.K.1.)
3. Administer levofloxacin (Levaquin<sup>®</sup>) 500 mg PO QD.

### Post procedure

1. Leave the balloon and packing in place for 48-72 hours.
2. Continue antibiotics, as indicated.

## L. Needle Thoracostomy

### Indication

1. Progressive respiratory distress with known, or suspected, torso trauma to resolve a tension pneumothorax.

### Procedure

**A needle thorocostomy can be performed by a BLS provider.**

1. Decompress the chest on the side of injury.
2. Consider having the patient sit upright at an 30-45 degree incline, if hemodynamically stable.
3. Prepare the skin with povidine-iodine solution, soap and water, or other disinfectant.
4. Use a 14 ga, 3.25-inch needle/catheter unit:
  - a. Insert the needle into the second intercostal space at the mid-clavicular line.
  - b. The needle can also be inserted through 5th intercostal space at the mid-axillary line.
5. Ensure the needle entry into the chest is **NOT** medial to the nipple line and is **NOT** directed toward the heart.



6. After decompression, remove the needle, but leave the catheter in place.
7. Be suspect of needle clotting, if no air exchange is heard.
8. Be prepared to perform multiple needle decompressions to resolve tension pneumothorax.
  - a. There is no limit on number of decompression attempts.
  - b. Even over multiple attempts, remove the needles but leave the catheters in place.
9. Attach the catheter to a one-way flutter valve (e.g., Heimlich Valve, a finger of a sterile glove) to prevent air re-entry, but allow air to be expelled, with expiration through the catheter.

---

## M. Orthopedic Splints

### Review

Materials used in orthopedic splinting in an austere setting are:

- Moldable aluminum padded splints (e.g., Sam splint)
  - Lightweight, easy to use
  - Useful for teams operating on foot
  - Ready to use, do not need water application and setting time
  - May not be able to obtain an ideal fit
- Fiberglass
  - Once set, holds up well
    - Can get wet accidentally and still retain form and strength
    - Resists breakage upon weight bearing
  - Heavier than moldable aluminum splints
  - Lighter than plaster splints
  - Ideal for fixed facility, vessel or vehicle-based teams
  - Available in rolls or in pre-cut splints
    - Package must be kept sealed to avoid inadvertent setting from ambient moisture
    - Pre-cut splints may be of value to teams operating on foot
- Plaster
  - Less desirable for use in an austere setting
  - Weighs more than fiberglass
  - Splint will lose structural integrity if it gets wet, becoming useless
  - Splint breaks down easily with weight bearing

### Indications

1. For the definitive treatment of orthopedic injuries, as opposed to the temporary splints used to provide first aid or emergency stabilization
2. May also be used for the temporary stabilization of injuries, pending and during evacuation

### Use of Fiberglass Splints

1. A measuring tape or piece of gauze (or any such material) may be used to measure the patient for splint length.
2. Cut an appropriate length of material from the roll, or use a pre-cut splint.
3. Slightly separate the padding from the fiberglass at both ends of the splint.
4. Roll and fold the edge of the fiberglass away from the ends of the splint, preventing sharp edges of fiberglass from causing irritation.
5. If desired, additional padding can be applied prior to splint application, using bulk cast padding material (e.g., Webril)
  - a. If used, apply additional padding **prior** to wetting fiberglass.

- 
6. Dip splint once in clean water, or splash/spray water on splint. **DO NOT** use hot water.
    - a. Not much water is needed.
    - b. Fiberglass will actually set to ambient moisture alone.
    - c. Fiberglass sets more slowly and evenly, if cold water is used.
  7. Lay the splint on a towel and smooth out the splint, removing any lumps or folds in the material.
    - a. This can be done on any flat surface, even without a towel.
  8. Apply the splint to the injured extremity and securely wrap with an elastic bandage (ACE wrap).
    - a. **DO NOT** apply bandage too tightly
  9. Hold desired angles while the splint sets.
    - a. The splint will set quickly over a few minutes.
  10. Check and record distal pulses and sensation as neurovascular injury is possible. Re-check with any change in pain or appearance of extremity.

## **Type of Splints**

### **Posterior Splint of the Foot or Ankle**

1. Indications
  - a. Foot fractures
  - b. Ankle fractures and sprains (preferred splint for ankle fractures)
2. Application
  - a. Apply the splint to plantar and posterior aspects of foot and lower leg.
  - b. Extend the splint to the ends of the toes and 2/3 the way up the lower leg, leaving room to flex the knee without chafing.
  - c. A splint at the ankle joint should be set at a 90-degree flexion. Have the patient sit with his/her leg down, foot against floor, and ankle at 90 degrees while the splint sets.

### **Posterior Splint of the Lower Leg**

1. Indications
  - a. Lower leg fractures
  - b. Ankle fractures
2. Application
  - a. Apply the splint to plantar and posterior aspects of foot and lower leg.
  - b. Extend the splint to the ends of the toes and posteriorly beyond the knee to mid thigh.
  - c. The knee should be flexed slightly to 10-20°.
  - d. A splint at the ankle joint should be set at a 90-degree flexion. Have the patient sit with his/her leg down, foot against floor, and ankle at 90 degrees while the splint sets.

---

## Sugar-tong Splint of the Ankle

1. Indications
  - a. Lower leg fractures
  - b. Ankle fractures and sprains
2. Application
  - a. Apply the splint in a “U” shape to the lateral and medial sides of the ankle.
  - b. The bottom of the “U” runs below the plantar aspect of the foot.
  - c. A splint at the ankle joint should be set at a 90-degree flexion. Have the patient sit with his/her leg down, foot against floor, and ankle at 90 degrees while the splint sets.

## Posterior Splint of the Knee

1. Indications
  - a. Knee injuries
2. Application
  - a. Apply the splint to the posterior aspect of the leg.
  - b. Extend the splint just proximal of the ankle joint, leaving the ankle free with full range of motion (ROM).
  - c. Extend the other end of the splint to the mid to upper thigh. The splint should not chafe the buttocks.

## Dorsal Hand Splint

1. Indications
  - a. Metacarpal or carpal fractures of the fingers (not the thumb)
  - b. Flexor tendon lacerations
  - c. Hand infections
  - d. Significant lacerations or crush injuries to the hand
2. Application
  - a. Apply several unfolded gauze pads between the fingers, leaving the long ends facing the palm.
    - Ball-up long ends of gauze pads into the palm.
    - **DO NOT** over stretch the web space between the fingers.
  - b. Apply the splint to the dorsal aspect of the hand and forearm. The splint should not chafe against or limit ROM of the elbow.
  - c. Extend the splint from finger tips to 2/3 the length of the forearm.
  - d. Set and maintain the splint at the following angles:
    - Wrist at a 30-degree dorsi-flexion
    - Metacarpophalangeal joints (MCPJ) at a 90-degree flexion
    - Proximal interphalangeal joint (PIPJ) at 10- to 20-degree flexion
    - Distal interphalangeal joint (DIPJ) at 10- to 20-degree flexion

- This is known as the “cobra head” position, as opposed to the classic (“beer can”) position of function used in temporary emergency splinting
  - » The cobra head position stretches the collateral ligaments of the MCPJ.
  - » Allows for quicker return of normal hand function (ROM) after splint is discontinued.
- It is applied dorsally to compress and control swelling that is most likely to manifest on the dorsum of the hand but may be applied to volar aspect, if needed (angles remain the same).

## **Radial Gutter Splint (known as a “Thumb Spica,” if the thumb is splinted in extension)**

### 1. Indications

- a. Thumb fractures
- b. Tendon injuries of the thumb
- c. Tendonitis of the thumb
- d. Torn ulnar collateral ligament or UCL (“game keeper’s thumb” or “skier’s thumb”)
- e. Scaphoid fracture of the wrist
  - Uses wider splint and incorporate more of the wrist
  - Known as the Triple S Splint

### 2. Application

- a. Apply the splint to the dorsal aspect of the thumb and extend it to the radial aspect of the forearm, incorporating 2/3 the length of the forearm.
- b. Set and maintain the splint at the wrist at a 30-degree dorsi-flexion.
- c. Thumb angles vary with injury.
  - Thumb fracture: Set in mild extension in line with radius
  - Flexor tendon injury: Set in mild flexion of thumb
  - Extensor tendon injury: Set in mild extension of thumb
  - Torn UCL: Set with mild extension of thumb with slight ulnar deviation of the MCPJ

## **Volar Wrist Splint**

### 1. Indications

- a. Wrist sprains
- b. Suspected carpal fractures (except scaphoid – Refer to “Radial Gutter Splint.”)
- c. Tendonitis of the wrist

### 2. Application

- a. Apply the splint to the palmar aspect of the hand and volar aspect of the wrist.
- b. Extend the splint from the MCPJs to 2/3 of the length of the forearm, leaving MCPJs free with full ROM.
- c. Set and maintain the splint at the wrist at a 30-degree dorsi-flexion.

---

## Posterior Splint of the Arm

1. Indications
  - a. Elbow fractures
  - b. Fractures of the distal humerus
  - c. Fractures of the forearm
2. Application
  - a. Apply the splint to the ulnar aspect of the hand, wrist and forearm and the posterior aspect of the elbow and upper arm, leaving the MCPJs free with full ROM.
  - b. Set and maintain splint at the following angles:
    - Wrist: 30-degree dorsi-flexion
    - Elbow: 90-degree flexion
  - c. Give the patient a sling for comfort, but he/she must remove the sling and elevate the elbow above his/her head periodically during the first few days following injury.

## Sugar-tong Splint of the Arm/Elbow

1. Indications
  - a. Elbow fractures
  - b. Forearm fractures, particularly distal radius and ulna fractures
2. Application
  - a. Apply the splint from the dorsal aspect of hand. Extend it along the forearm, around the elbow, and finish on the volar (palmar) aspect of the hand to create a “U” shaped splint.
  - b. Leave the MCPJ’s free with full ROM
  - c. It prevents supinations and pronation of the wrist and movement of the radius and ulna.
  - d. Give the patient a sling for comfort, but he/she must remove the sling and elevate the elbow above his/her head periodically during the first few days following injury.

## Digital Splints

1. Indications
  - a. Distal fractures of the digits (fractures near the MCPJ need a dorsal hand splint)
  - b. Significant lacerations to the digits
  - c. Mallet finger injury
2. Application
  - a. Typically, a padded aluminum digital splint is used.
  - b. A Sam splint or fiberglass splint can also be cut to size and used.
  - c. Use gauze wrap to secure the splint to the digit during the acute phase of the injury (first few days), then use tape.

- d. The splint should extend the length of the finger, leaving the MCPJs free with full ROM.
  - Mallet finger need only be splinted from the PIPJ to the DIPJ, leaving the DIPJ free with full ROM.
- e. The splint may be applied to the palmar or dorsal aspect of the digit.
- f. Maintain the following angles:
  - Mallet finger: Splint in extension. **DO NOT** overextend.
  - Other injuries: Splint finger in slight flexion.

## **Compression Wraps**

1. Indications
  - a. Used to provide compression to reduce internal bleeding and swelling in knee and ankle sprains
  - b. May be used alone for minor sprains or in conjunction with a splint for more serious injuries
2. Materials
  - a. Stockinet
  - b. Bulk padding (e.g., ABD pads, gauze pads, any suitable material)
  - c. Cast padding material (e.g., Webril)
  - d. Gauze roll bandage
  - e. Elastic bandage (e.g., ACE wrap)
    - Avoid using elastic tape bandages (e.g., Coban) in the field for this purpose, as it may easily become too tight.
3. Application
  - a. Cut a piece of stockinet to extend beyond the site of injury. If not available, proceed to the next step.
  - b. Apply generous padding to the site of injury (anterior, posterior, lateral and medial aspects).
  - c. Wrap the area with cast padding material, if available.
  - d. Wrap the area with gauze roll bandage, proximal to distal.
  - e. Fold back stockinet from both ends, if used.
  - f. Wrap with an elastic bandage.
    - Care must be taken to not apply too tightly (restricts blood flow) or too loosely (does not serve intended function)
4. If using a splint, generous padding with cast padding material (e.g., Webril) will be sufficient.

## **Post-procedure Care**

1. Advise the patient to seek immediate evaluation if numbness, tingling, loss of sensation, pallor, increased swelling, or worsening pain develops in the injured extremity.
2. Check neuromotor and vascular status frequently.
3. Ice and elevation should be used in the first few days following injury.
4. Patient with lower extremity injuries should avoid weight bearing activities.

---

## N. String Trick (Ring Removal)

### Review

This is an alternative to using ring cutters to remove a ring from a swollen finger. Generally, it should be attempted **prior** to using ring cutters, the ring is usually not damaged.

### Indications

1. Removal of ring to prevent tissue damage due to swelling or edema
2. Prophylactic removal of ring in patients with digit and/or hand injuries

### Procedure

#### **BLS**

1. Evaluate and document neurosensory, motor and vascular functions of affected digit/hand before starting removal.
2. Select a pack of suture material (e.g., 2-0 Silk) on a straight needle, but many options are available.
3. Insert the dull end of the needle under and past the ring, moving distal to proximal.
  - a. This can be done by hand or with a needle driver or hemostat (for a curved needle).
  - b. **DO NOT** puncture the skin.
4. Pass only a small portion of the suture to the proximal side of the ring. Leave the bulk of the suture distal to the ring.
5. Wrap the finger tightly with the distal portion of the suture. **DO NOT** overlap the suture.
6. Continue wrapping the finger until past the proximal interphalangeal joint (PIP).
7. Tape the end of the suture to the finger.
8. Lubricate the finger and suture.
9. Grasp the proximal end of the suture.
10. Pull the suture against the ring and begin an unscrewing motion (rotating the suture around the ring).
11. The ring should follow the suture like a screw and come off the finger.

### Post-Procedure Care

1. Apply ice and elevate the affected digit/hand.
2. Re-evaluate and document neurosensory, motor and vascular status of the affected digit/hand.

### Management of Complications

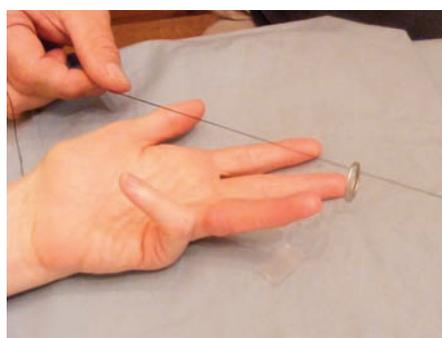
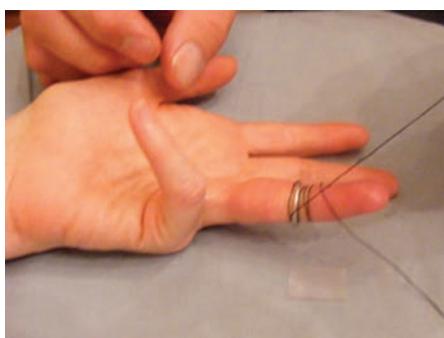
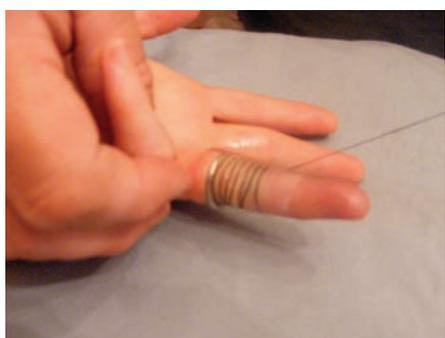
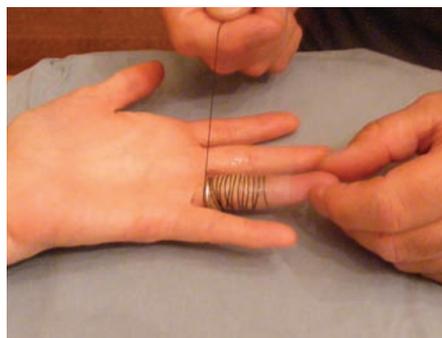
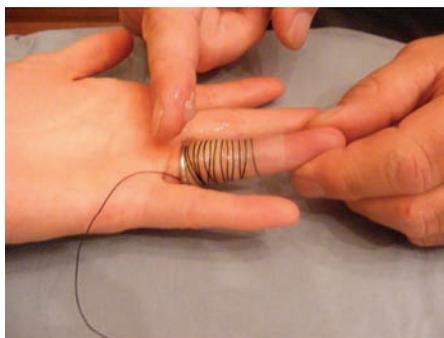
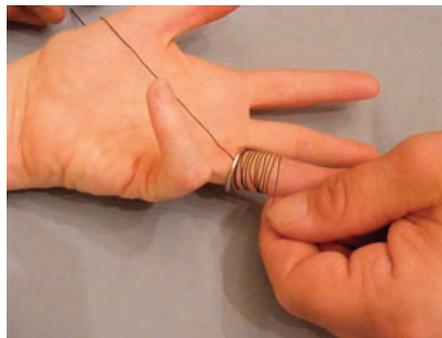
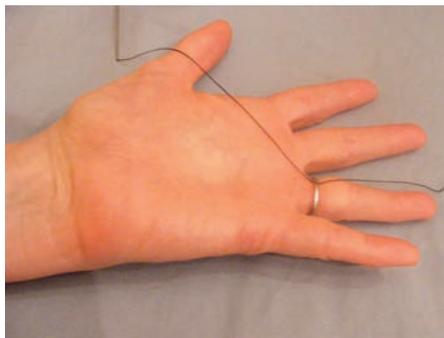
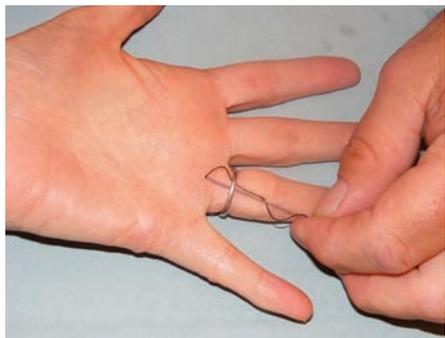
1. If the suture runs out before the ring clears the PIP or any other point of swelling, repeat the procedure. It is common to use several repetitions before being able to completely remove a ring.

## **Other/Special Considerations**

1. Anesthesia is normally unnecessary for this procedure. However, if the finger is extremely painful, as from a crush injury, etc., a digital nerve block may be used. (Refer to Protocol VI.J.2.)

## **Follow-up**

1. Advise the patient to seek follow-up care for loss of sensation, loss of motor function, or any signs of infection (increasing pain, redness, swelling, red streaks, drainage, or fever).



---

## 0. Subungual Hematoma

### Indications

Painful hematoma beneath nailplate, usually the result of a crush or blunt force impact to the digit.

### Signs and Symptoms

- \* **Blood between nailplate and nailbed with no opening to allow draining**
- \* **Pain under nail**

### Procedure

#### ALS

1. Check distal sensation, digital extension, and flexion for an obvious fracture.
2. Administer pain management medications, if needed. (Refer to Protocol VII.A.)
3. Prepare the skin with povidine-iodine solution, soap and water, or other disinfectant.
4. If a heating source is available, use a paper clip to melt a hole in the nailplate. (Re-shape the paper clip as shown. **DO NOT** use paper clips with plastic coating.)



- a. Heat the paper clip over heat source until it is red hot. Protect fingers with a thermal barrier when handling the hot paper clip.
  - b. Melt a hole through the nailplate, distal to the lunula.
5. If a heating source is not available, use a 16-18 ga needle to drill a hole in the nailplate.
    - a. Twist the needle in a circular motion, applying pressure until hematoma is entered.
  6. Allow blood to drain. Gentle pressure may be applied.
  7. Soak the digit in clean, disinfected water to assist the evacuation of blood, if available.
  8. Apply a dry, sterile dressing or an adhesive bandage.
  9. Splint fingers or buddy-tape toes, if a fracture is suspected.
  10. Administer antibiotics, according to local protocol.

---

## P. Urethral Catheterization

### Indications

1. To provide accurate urine output in patients receiving IV fluids
  - a. Useful for patients who are unconscious or cannot cooperate with intake and output monitoring
2. Urinary retention
3. Urogenital trauma
4. Major trauma, if evacuation is significantly delayed

### Procedure

1. Most of the required equipment is included with a standard catheterization set.
  - a. Foley Catheters are variously sized and are thus not included in the set.
2. Explain the procedure to the patient.
3. Wash hands thoroughly with soap and water. Put on sterile gloves.
4. Open catheterization set in a **sterile** manner.
5. Saturate sterile sponges or cotton balls with an antiseptic solution (usually included in the set).
6. Attach the included syringe to the catheter and inflate the balloon to ensure proper working order.
7. Apply sterile, water-soluble lubricant to the first several inches of the catheter.

### **For male patients:**

1. Place a sterile drape under the penis and another above the penis to cover the abdomen (or use a fenestrated drape with penis exposed).
2. Grasp the patient's penis with one hand and retract the foreskin (if present).
3. Using the other hand, prep the entire glans with the antiseptic sponges. Begin at the urethral meatus and work proximally. Repeat twice.
4. Raise the shaft of the penis upright to straighten the urethra.
5. Introduce the tip of the catheter through the meatus.
6. Advance the catheter gently and steadily until urine flows into catheter.
  - a. In males, usually requires 7-9 inches of catheter advancement.
  - b. Once urine flow is noted, advance another 2 inches.
  - c. If mild resistance is noted, slightly increase traction on penis and continue with gentle and steady advancement.
7. Inflate the catheter balloon with 3-5 ml of Normal Saline.
8. Gently pull back on catheter until resistance is noted, and then stop. This places the balloon against the prostatic urethra.
9. Reposition the retracted foreskin (if present).
10. Attach the catheter to a drainage collection bag.

---

### **For female patients:**

1. Position patient with knees bent, hips flexed, and feet resting 2 ft apart.
2. Place a sterile drape just under the buttocks and the fenestrated drape over the perineum, exposing the labia.
3. With one hand, separate the patient's labia to expose the urethral meatus.
4. Clean the surrounding area with antiseptic sponges, working downward from anterior to posterior. Repeat twice. **DO NOT** move back anteriorly.
5. Introduce the catheter into the meatus.
6. Advance the catheter gently and steadily until urine flows into catheter.
  - a. In females, usually requires 2-3 inches of catheter advancement
  - b. Once urine flow is noted, advance another 2 inches.
7. Inflate the catheter balloon with 3-5 ml of Normal Saline.
8. Gently pull back on catheter until resistance is noted.
9. Attach the catheter to a drainage collection bag.

### **Both sexes**

1. Run the catheter tubing along the patient's leg and tape the connecting tubing to the patients thigh. **DO NOT** place any tension on the catheter.
2. Attach the collection bag to the stretcher, cot, or bed at a level below that of the patient to facilitate drainage by gravity.
  - a. Clamp the drainage bag when re-positioning patient.
  - b. Coil extra drainage tubing on the bed or stretcher and avoid dependent loops.
3. Note amount (ml) and quality of urine (e.g., clear, cloudy, straw colored, dark, amber, brown, blood tinged, gross blood) drained with initial placement of catheter.

### **Post-procedure Care**

1. Keep catheter in place only as long as needed.
2. Monitor tubing for urine flow.
3. Clean the urethral meatus with soap and water twice daily.
4. Monitor urine output.
  - a. Monitor hourly, if the patient is receiving IV fluids.
  - b. Empty the drainage bag every 8 hours and record output.
  - c. If there is no urine output and patient's bladder feels full:
    - Disconnect the catheter from the drainage tubing.
    - Using gloves and aseptic technique, flush and irrigate the catheter with 30 ml of Normal Saline, warmed to body temperature.

- 
5. Observe for signs of infection related to catheter.
    - a. Local infection around the meatus (e.g, pain, redness, swelling)
    - b. Purulent discharge around the catheter
    - c. UTI, cystitis, nephritis
      - Physical change in the urine (e.g, foul odor, cloudy, bloody, dark color, pus)
      - Fever > 100° F
      - Abdominal, pelvic, flank, or back pain
      - Nausea, vomiting, or “shaking” chills

### **Management of Complications**

1. If infection develops, administer antibiotics according to local protocol.
2. Remove catheter, if the patient’s condition permits, or if the infection continues to worsen after the initiation of antibiotics.

---

## Q. Wound Care

### 1. Wound Prep and Irrigation

#### Review

The most common complication in wound management is infection. Contamination of the wound with foreign material or pathogenic bacteria from the patient's own skin greatly increases the risk of infection. Retained foreign bodies, such as glass fragments, small chips of rock or wood fragments on the surfaces of tissues, also increase the risk complications. Prepping and irrigation of the wound significantly decrease these risks.

#### Indications

1. If no life threatening injury or condition requiring rapid evacuation exists, all wounds encountered in an austere environment should be prepped and irrigated.
  - a. This is critical for dirty or grossly contaminated wounds and all wounds incurred in a river, lake, or marine environment.
2. Wound prep may be performed carefully without local anesthesia. (Refer to Protocol VI.Q.1.)
3. If the wound is to be sutured or stapled by an ALS provider, wound prep and irrigation should be performed after the administration of local anesthesia. (Refer to Protocol VI.J.)

#### Procedure

### Wound Prep

#### **BLS**

1. Prepare the skin with povidine-iodine solution, soap and water, or other disinfectant.
  - a. If these are not available, almost any mild, non-perfumed soap will work, as will regular water.
    - The water should be disinfected and boiled for 1-3 minutes. Allow the water to cool before using.
    - **DO NOT** use alcohol, hydrogen peroxide, or other disinfecting agents, as they will further injure the exposed tissues.
  - b. Scrub the skin immediately surrounding the wound, working outward several inches.
    - **DO NOT SCRUB THE EXPOSED TISSUE OF THE WOUND ITSELF**, as this will further damage the injured tissues and any exposed vessels.
2. Rinse away all traces of disinfectant with Normal Saline or water.

#### **ALS**

1. If wound is being prepared for closure with sutures or staples:
  - a. Prepare the skin with povidine-iodine solution, soap and water, or other disinfectant.
  - b. Provide local anesthesia prior to performing wound prep and irrigation. (Refer to Protocol VI.J.)

---

## Wound Irrigation

### BLS

1. Wound irrigation is best performed utilizing pressure.
  - a. Due to the potential risk of dislodging a blood clot and resulting hemorrhage, **DO NOT IRRIGATE NECK WOUNDS**. Gently wash away surgical scrub or soap with normal saline or disinfected water without pressure.
  - b. Irrigate skin and subcutaneous tissue **ONLY**. Be especially alert if the wound extends into the muscle layer.
2. Use a 30 ml syringe with an 16 or 18 ga catheter and splash shield (Xerowet™).
  - a. A 16 or 18 ga needle may also be used, but be sure to securely attach it to the syringe so it does not dislodge when irrigation begins.
3. Draw the irrigation solution into the syringe.
  - a. Normal Saline is the preferred solution, but water that has been disinfected and boiled can be used. Allow water to cool before using.
4. Hold the syringe a couple inches away from the wound, at approximately a 45 degree angle, and flush the wound with the solution.
5. Apply enough pressure to the syringe that the irrigation fluid comes out in a vigorous stream.
6. Be sure to lay gauze sponges, towels, or other absorbent material around the area (but not near the wound) to catch the runoff.
  - a. In a cold environment, take measures to keep the patient as dry as possible away from the wound site.
7. Forceps or hemostats may be used to further expose the wound for irrigation. Remove any easily-removed foreign bodies.
8. The wound should be prepped and irrigated until clean.
  - a. For clean, tidy wounds, a minimum of 100 ml of irrigation solution should be used.
  - b. For contaminated wounds, a minimum of 250 ml of irrigation solution should be used.
  - c. Continue irrigation until all foreign bodies, clotted blood, and loose tissue fragments have been removed.

### ALS

1. If wound is being prepared for closure with sutures or staples:
  - a. Prepare the skin with povidine-iodine solution, soap and water, or other disinfectant.
  - b. Provide local anesthesia prior to performing wound prep and irrigation. (Refer to Protocol VI.J.)

---

## 2. Laceration Closure

### **Indications**

1. Wound closure is specifically indicated in the following circumstances:
  - a. A delay to definitive treatment of more than 6 hours
  - b. Wound is relatively clean and tidy, or can be rendered so
  - c. Important structures (e.g., tendons, joints, bones) are exposed and need skin coverage
  - d. To control bleeding
2. Field closure of other appropriate wounds is advised for field operations lasting 6 hours or longer

### **Anatomy and Physiology**

1. Epidermis, dermis, subcutaneous tissue, fascia, periosteum, bone
2. Layers that hold a suture: dermis and fascia.

### **Procedure**

#### **ALS**

1. Evaluate and document neurosensory, motor, and vascular functions.
2. Ascertain tetanus immunization status.
  - a. Administer anti-tetanus prophylaxis, if indicated and available. (Refer to Protocol V.V.)
3. Administer prophylactic antibiotics according to local protocol, if indicated.
4. Inform patient of needed procedure.
5. Prepare the skin with povidine-iodine solution, soap and water, or other disinfectant.
6. Provide local anesthesia. (Refer to Protocol VI.J.)
7. Perform wound prep and irrigation. (Refer to Protocol VI.Q.1.)
8. Repeat motor function exam, assessing for ROM and strength.
  - a. If tendons are visible in the hand or foot:
    - Have patient demonstrate the position of the hand or foot at the time of injury.
      - Repeat irrigation in this position
    - Observe the tendon while moving through ROM.
      - Look for laceration or other injury not obvious upon examination.
      - Disturbing or manipulating the tendon is not necessary.
9. Repeat irrigation.
10. Identify tissue structures, skin alignment, and lines of tension.
11. Place holding sutures for a large wound.
  - a. The suture holds skin in loose approximation.

- b. It may be removed, if needed, as repair reaches one of the holding sutures.
12. Begin the closure of wound with sutures.
13. Approximate tissues as closely as possible to original position, using as few evenly-spaced sutures as possible.
  - a. Wound should not be closed so tightly that it cannot drain.
  - b. **DO NOT** leave big gaps of exposed tissue between sutures.
14. Clean the wound with Normal Saline.
15. Apply topical neomycin-free antibiotic ointment.
16. Dress with non-adherent, light petrolatum-based dressing.
17. Cover with dry, sterile dressing.
  - a. Bandage further for anatomic location, as needed.
  - b. Facial and scalp wounds do not generally require a bandage, unless:
    - Significant swelling is present or likely to occur (apply pressure dressing).
    - Significant bleeding was present.
18. Re-assess neurosensory, motor, and vascular functions.

### Guidelines for Suturing Lacerations By ALS Personnel

| Wound Location  | Type of Suture    | Suture Material               | Suture Size | Needle Size        |
|-----------------|-------------------|-------------------------------|-------------|--------------------|
| Scalp           | Simple Loop       | Polypropylene or Nylon        | 4-0 or 3-0  | PS-2 or equivalent |
| Face and Neck   | Simple Loop       | Polypropylene or Nylon        | 6-0 or 5-0  | P-3 or equivalent  |
| Lips            | Simple Loop       | Polypropylene, Nylon, or Silk | 6-0 or 5-0  | P-3 or equivalent  |
| Intraoral       | Simple Loop       | Plain Gut or Silk             | 5-0 or 4-0  | P-3 or equivalent  |
| Hand (Palmar)   | Simple Loop       | Polypropylene or Nylon        | 5-0         | P-3 or equivalent  |
| Hand (Dorsal)   | Simple Loop       | Polypropylene or Nylon        | 5-0         | PS-2 or equivalent |
| Torso           | Vertical Mattress | Polypropylene or Nylon        | 4-0 or 3-0  | PS-2 or equivalent |
| Lower Extremity | Vertical Mattress | Polypropylene or Nylon        | 4-0 or 3-0  | PS-2 or equivalent |

### Evacuation

|                     |  |
|---------------------|--|
| <b>Urgent</b>       | Patients with life-threatening underlying or concomitant injury, or significant loss of blood<br>Patients that becomes septic or condition rapidly deteriorates for any reason |
| <b>Priority</b>     | Patients with wounds closed to control bleeding or with significant vascular compromise  |
| <b>Routine</b>      | Patients with an open fracture, joint injury, tendon injury or grossly contaminated wound, decreased ROM or sensation; or if signs of infection develop in follow-up           |
| <b>Convenience</b>  | Other patients with extensive muscle involvement   |
| <b>Not required</b> | Minor wounds without evidence of sensory, motor or vascular compromise   |

---

## **Extended Care**

1. Advise the patient to keep the wound clean and dry for 48 hours.
  - a. The patient may shower daily **after** 48 hours.
  - b. **NO** swimming or water activities until 24 hours after suture removal.
2. Re-assess neurosensory, motor and vascular functions for any changes in digital and extremity wounds.
3. Reconfirm the absence of other injuries.

## **Management of Complications**

1. **DO NOT** close wounds that cannot be rendered clean by prep and irrigation.
  - a. Dress with lightly saline-soaked or dry, sterile dressing.
  - b. Conduct priority evacuation.
2. Infection is most common (e.g., cellulitis, purulent drainage, lymphangitis, fever).
  - a. Administer antibiotics according to local protocol.
  - b. Conduct routine evacuation.
3. Loss of motor function or sensation
  - a. Apply a splint, if not previously done.
  - b. Conduct routine evacuation

## **Other/Special Considerations**

1. Puncture, gunshot, and stab wounds
  - a. **DO NOT** close these wounds.
2. Open fractures, joint space involvement, and bone, cartilage, or tendon lacerations
  - a. Apply a splint, if not previously done.
  - b. Administer antibiotics according to local protocol.
3. Animal bites (Refer to Protocol III.B.)
  - a. **DO NOT** close primate and human bites.
  - b. Administer antibiotics according to local protocol.
  - c. Consider rabies prophylaxis. (Refer to Protocol V.V.)

## **Follow-up**

1. Perform wound check and dressing change 12-24 hours after procedure and then again in 24-48 hours, unless bleeding or foul-smelling drainage appears.
2. The patient should follow-up with a personal or team physician upon return from an austere environment or return immediately if signs and symptoms of infection develop (e.g., redness, swelling, pus, red streaks, fever and/or general malaise), if there is loss of sensation or movement, or a cold, pale digit/extremity.

- 
3. Have patient seek suture removal, as follows:
    - a. Face and neck: 5 days
    - b. Other wounds not under tension: 7-10 days
    - c. Wounds under tension (over joints): 10-14 days
    - d. Suture removal can be performed in field during prolonged operations.
  4. For best healing and cosmetic results, advise patient to:
    - a. Avoid exposing wound to sunlight for the next 6 months
    - b. Keep the wound taped for 2 weeks
      - Not practical for hair-bearing wounds (e.g., scalp)

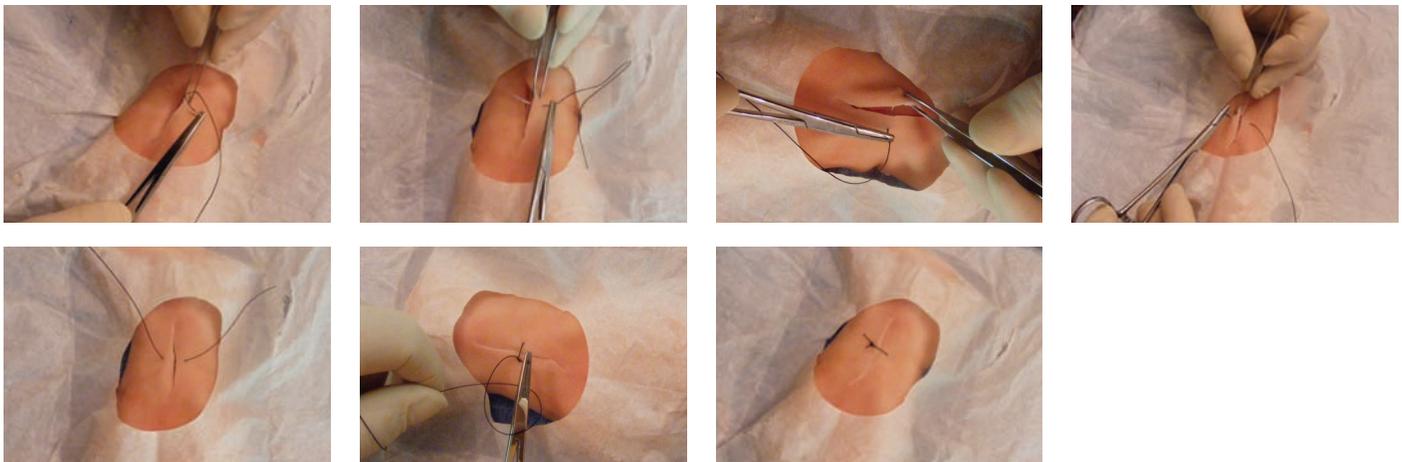
### 3. Simple Loop Suture

#### Review

The simple loop suture is the most commonly used closing procedure. It is useful to close wounds on almost any part of the body. Some wounds will be too deep to place suturing with the preferred technique, so an alternate technique can be used.

#### Procedure

1. Select the appropriate suture and needle combination.
2. Using forceps, grasp one skin edge of the wound. Lift and slightly evert the skin edge. Place the suture needle the appropriate distance from the skin edge (refer to chart) and perpendicular to the skin. Push the needle into the skin, twisting the wrist to follow the arc of the needle.
3. Continue to hold the skin up with suture needle and needle driver. Release the skin grasped by forceps.
4. Using the forceps, grasp the opposing skin edge. Lift and slightly evert the opposing skin edge. Pass the needle through it, following the arc of the needle in an upward direction.
5. Secure suture with an instrument tie. (Refer to Protocol VI.Q.5.)



#### **Alternate Technique**

1. Select the appropriate suture and needle combination.
2. Using forceps, grasp one skin edge of the wound. Lift and slightly evert the skin edge. Place the suture needle the appropriate distance from the skin edge (refer to chart) and perpendicular to the skin. Push the needle into the skin, twisting the wrist to follow the arc of the needle.
3. Release the skin grasped by the forceps. Use the forceps to grasp the needle. Release the needle driver's grasp on the needle. Pull the needle through the wound opening with the forceps.
4. Re-arm the needle driver with the needle. Using the forceps, grasp the opposing skin edge. Lift and slightly evert the opposing skin edge. Pass the needle through the wound, following the arc of the needle in an upward direction. Exit the skin the appropriate distance from the wound edge (refer to chart).
5. Secure suture with an instrument tie. (Refer to Protocol VI.Q.5.)

---

## Suture Placement

| Location            | Distance from wound edge | Total Width of Suture |
|---------------------|--------------------------|-----------------------|
| Face, neck          | 3-5 mm                   | 6-10 mm               |
| Palm                | 5 mm                     | 10 mm                 |
| Plantar Foot        | 10-15 mm                 | 20-30 mm              |
| Most other wounds   | 10-15 mm                 | 20-30 mm              |
| Larger, deep wounds | 15-20 mm                 | 30-40 mm              |

## Other/Special Considerations

1. Sutures should be deeper than wide to allow wound edges to close with slight eversion.
2. **DO NOT** invert wound edges by placing sutures wider than deep.

## 4. Vertical Mattress Suture

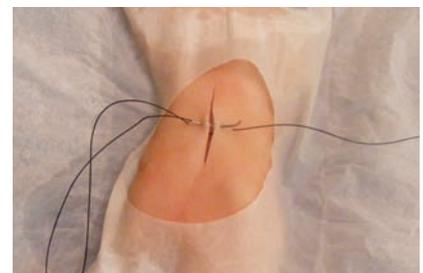
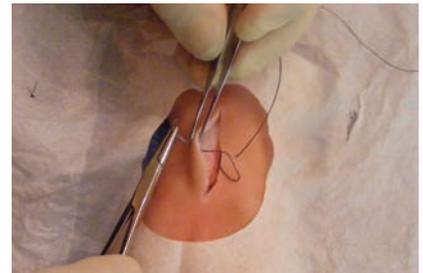
### Review

This suture is useful for wounds on most places of the body, including the chest, abdomen, back, arm, leg, dorsal aspect of the hand and foot. It is particularly useful where the skin is attached more loosely to underlying structures and prone to inversion on closure. Neck wounds may be closed with fine vertical mattress sutures (5-0), provided they are removed within 5 days.

Think, “far/far, near/near,” when using this technique.

### Procedure

1. Select the appropriate suture and needle combination.
2. Using forceps, grasp one skin edge of the wound. Lift and slightly evert the skin edge. Place the suture needle perpendicular to the skin approximately 1.0 cm from the wound edge.
3. Push the needle into the skin, twisting the wrist to follow the arc of the needle, first downward and then upward. Exit the needle into the wound.
4. Release the skin grasped by the forceps. Use the forceps to grasp the needle. Release the needle driver's grasp on the needle. Pull the needle through the wound opening with the forceps.
5. Re-arm the needle driver with the needle. Using the forceps, grasp the opposing skin edge. Lift and slightly evert the opposing skin edge. Pass the needle through the wound at the same distance you exited on the other side, following the arc of the needle in an upward direction.
6. Release the skin grasped by the forceps. Use the forceps to grasp the needle. Release the needle driver's grasp on the needle. Pull the needle through the skin with the forceps.
7. Rearm the needle so that the needle may be passed through the wound in the opposite direction.
8. On the side of the wound that the needle exited the skin, use the forceps to grasp the skin edge of the wound. Lift and slightly evert the skin edge. Place the suture needle perpendicular to the skin approximately 0.5 cm from the wound edge.
9. Push the needle into the skin, twisting the wrist to follow the arc of the needle, first downward and then upward. Exit the needle into the wound.
10. Continue to hold the skin up with the suture needle and needle driver. Release the skin grasped by the forceps.
11. Using the forceps, grasp the opposing skin edge. Lift and slightly evert the opposing skin edge. Pass the needle through the wound at the same distance you exited on the other side, following the arc of the needle in an upward direction.
12. Secure the suture with an instrument tie. (Refer to Protocol VI.Q.5.)



---

### **Other/Special Considerations**

1. Vertical mattress sutures are very good for closing wounds where the skin is loosely attached to underlying tissue, as they automatically evert the wound edge.
2. The distances from the wound edge referenced above (0.5 and 1.0 cm) are appropriate for most wounds. Consider entering and exiting closer to the wound edge for superficial skin closure on the neck and dorsal aspect of the hand.
3. When securing the instrument tie, ensure that the knot is lying on the side of the wound, not on top.

## 5. Instrument Tie

### Review

The instrument tie is a surgeon's knot, followed by two or more square knots. This knot-tying technique is quicker, easier, and conserves suture material.

The needle end of the suture is the "working end." The needle-free end of the suture is the "bitter end." When tying the final knot, think, "over/under, over/under."

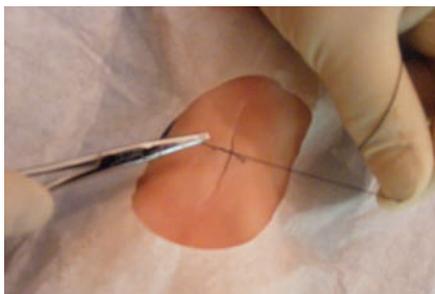
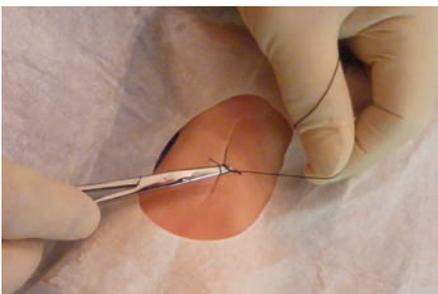
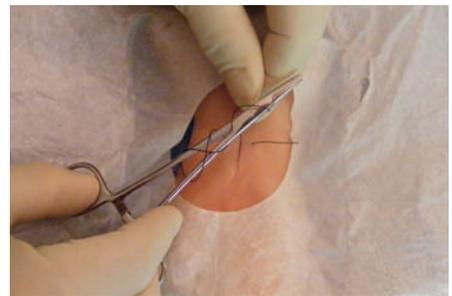
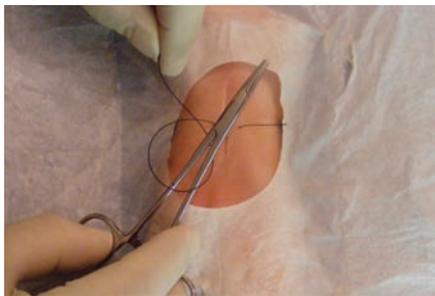
### Indications

1. This technique for knot tying may be used in a number of different procedures and is referenced throughout this field guide.

### Procedure

#### **Surgeon's Knot**

1. After placing the suture, release the needle and the working end from the needle driver.
2. Pull the working end through until 1.0-2.0 cm of the bitter end remains on the opposite side of the wound.
3. Wrap the working end of the suture twice around the needle driver.
4. Keeping the working end wrapped around the needle driver, grasp the bitter end with the needle driver.
5. Pull the working end from the needle driver, while still grasping the bitter end in the driver.
6. Continue to pull the working end until the knot slides down to skin level. **DO NOT** tie too tightly. Tighten the knot just enough to approximate and evert the wound edge. Place the knot to one side of the wound, being careful that the knot lies flat. The surgeon's knot is complete.

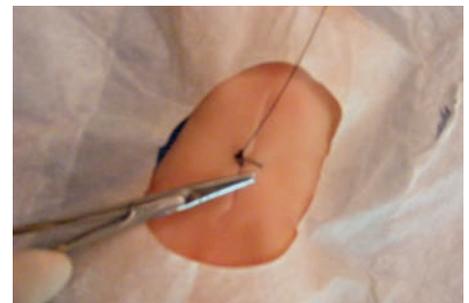
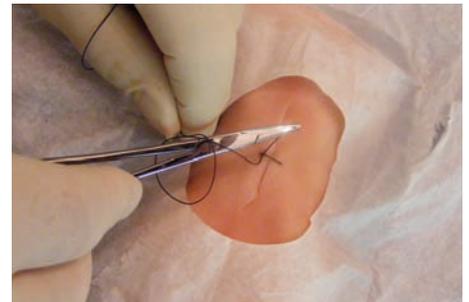
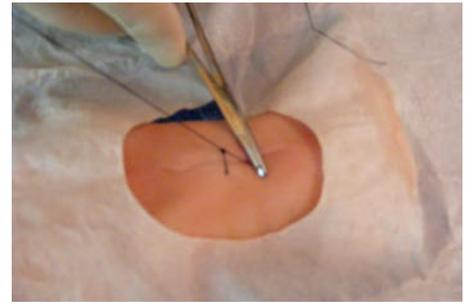
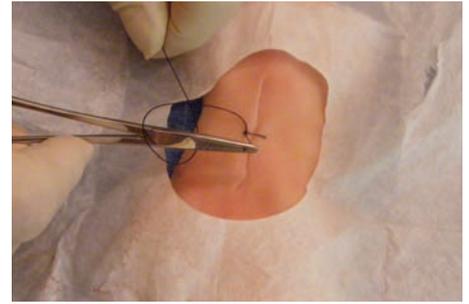


## Square Knot

1. Take the working end and wrap it once around the needle driver.
2. Note the direction in which the bitter end is facing. Keeping the working end wrapped around the needle driver, grasp the bitter end with the needle driver.
3. Pull the working end away from the driver in the same plane in which the bitter end was facing. Keep the needle driver in alignment with this plane. This provides the first half of the square knot.
4. The bitter end of the knot should now be aligned in the opposite direction. Wrap the working end once again around the needle driver.
5. Pull the working end away from the driver in the same plane in which the bitter end was facing. Keep the needle driver in alignment with this plane. This is the second and final half of the square knot.
6. Adjust tension to secure the knot. **DO NOT** tie too tightly. Ensure that the knots lie flat as they are tied.
7. Repeat these Steps 1-7 to complete a second square knot. This knot may be tied more tightly.
8. The instrument tie with a surgeon's knot and two square knots is now complete. Tie additional square knots, as needed.

### Other/Special Considerations

1. Keep the needle driver in alignment with the bitter end of the knot when tying square knots. Pull the working end away from the needle driver aligned with this same plane.
2. Tie knots with just enough tension to approximate and evert the wound edge. **DO NOT** tie too tightly, as it will strangle the tissue.
3. There should be no appreciable gaps between the wound edges once the knot is tied.



## 6. Two-handed Field Tie

### Review

This is a simple hand tie to do in the field. This is a good technique to use when suturing lines and tubes in place, or when a needle driver is not available. This technique for knot tying may be used in a number of different procedures.

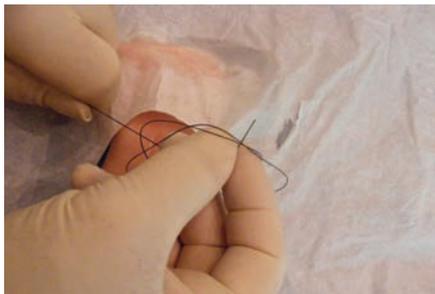
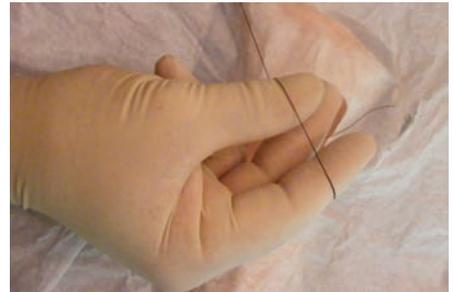
The needle end of the suture is the “working end.” The needle-free end of the suture is the “bitter end.”

### Indications

1. Particularly useful when suturing tubes and IV catheters in place for added security (Refer to VI.R.)

### Procedure

1. After placing the suture, pick up the working end with one hand, allowing the needle to hang free.
2. Bring the thumb, index, and middle fingers of the other hand together in a grasping position.
3. Wrap the working end around the thumb, index, and middle fingers.
4. Use the thumb, index, and middle fingers to grasp the tip of the bitter end.
5. Pull the working end away from the grasping hand, in the direction of the bitter end, being careful that the knot lies flat when tied.



### Other/Special Considerations

1. An instrument tie generally conserves more suture material than a hand tie.
2. The instrument tie is preferred for suturing lacerations and most other procedures.

---

## R. Suturing Tubes and IV Lines in Place

### Review

Chest tubes, tracheostomy tubes and central IV catheters are often sutured in place to prevent inadvertent dislodgment. Peripheral IV catheters may also be sutured in place for added security during patient evacuation or with burn patients.

A straight needle is preferred for this procedure.

### Procedure

1. Using a straight needle, or a curved needle with a needle driver, pass the needle through the skin for a width of approximately 1.0 cm. Place the suture near the hub of the catheter, tube, or the product's prefabricated suture anchor points.
2. Tie a knot to the skin using an instrument tie or a two-handed field tie. (Refer to Protocol VI.Q.5 and Protocol VI.Q.6.)
3. Wrap one end of the suture clockwise around the hub of the catheter or tube twice. Wrap the other end of the suture counter-clock-wise around the hub of the catheter or tube twice.
  - a. If the device has prefabricated suture anchor points, follow the manufacturer's instructions to correctly secure the device.
4. Tie another knot, using an instrument tie or two-handed field tie to secure the device.

### Other/Special Considerations

1. Always tie a knot to the skin first. Tie the device to the first knot. **DO NOT** tie device directly to the skin.
2. Tie the first knot securely. **DO NOT** tie too tightly, as it will overly distort or strangle the tissue.
3. Tie the second knot securely. **DO NOT** constrict the lumen of the line or tube.

---

## VII. Appendices

Appendix A. Pain Management

Appendix B. Glasgow Coma Scale

Appendix C. Mini-Mental Status Exam

Appendix D. IV Drip Chart

Appendix E. Formulary

---

## Appendix A. Pain Management

Administer pain management medications when specific protocols advise to do so. Always check for known allergies before administering medications. In cases of head injury, perform a baseline neurological assessment before administering any pain medications.

Occasionally, lengthy evacuation times will necessitate adequate pain control over an extended time period. Morphine sulfate IV/IO/IM is an effective treatment for acute onset of severe pain. All narcotic medications may **ONLY** be administered by an ALS provider.

### Management

#### **BLS**

1. Administer NSAIDs (e.g., ibuprofen, naproxen), as directed.
2. Administer acetaminophen (e.g., Tylenol<sup>®</sup>) 650 mg PO q8h.

#### **ALS**

1. When administering opiates, have naloxone (Narcan<sup>®</sup>) readily available.
  - a. If the patient is experiencing severe respiratory depression, administer 0.4-2.0 mg IV push every 2 minutes, up to a maximum dose of 10 mg or until recovery.
2. Carefully administer morphine sulfate when patient is in severe shock.

#### **Immediate Pain Control**

1. If IV/IO access is obtained, administer Morphine Sulfate, 2.0-4.0 mg IV/IO slow push. Administer 2 mg every 5 minutes until pain is controlled. No upper limit.
  - a. Half life is 2-4 hours. Dose appropriately.
  - b. Monitor for respiratory depression.

#### **Severe Vomiting**

1. Initiate IV hydration, if indicated. (Refer to Protocol IV.E.)
2. For nausea and/or vomiting, administer one of the following, as needed:
  - a. Ondansetron (Zofran<sup>®</sup>) 4.0 mg IV/IO, over 2-5 minutes q6h, or IM/PO q12h
  - b. Promethazine (Phenergan<sup>®</sup>) 12.5-25 mg IV/IO/IM/PO/PR q6h
    - This medication may be used to offset nausea caused by morphine.
  - c. Prochlorperazine (Compazine<sup>®</sup>) 10 mg IV/IO/IM/PO q8h
  - d. Prochlorperazine (Compazine<sup>®</sup>) 25 mg PR q12h

#### **Eye Injury**

1. For minor scratches and eye pain, use one drop of proparacaine hydrochloride 1% (Alcaine<sup>®</sup>) for pain relief.
2. **DO NOT** use proparacaine hydrochloride if the eye has an impaled object.
3. **DO NOT** give the bottle of proparacaine hydrochloride to the patient.

## Appendix B. Glasgow Coma Scale

The Glasgow Coma Scale is based on a 15-point scale for estimating and categorizing the outcomes of brain injury on the basis of overall social capability or dependence on others.

The Glasgow Coma Scale is used for measuring level of consciousness, especially after a head injury. Add the total from the three sections to get the total score out of 15.

| Eye Opening Response |   |
|----------------------|---|
| Spontaneous          | 4 |
| To Voice             | 3 |
| To Pain              | 2 |
| No Response          | 1 |

| Motor Response             |   |
|----------------------------|---|
| Obeys Command              | 6 |
| Localizes Pain             | 5 |
| Withdraws to Pain          | 4 |
| Flexion to Pain (Abnormal) | 3 |
| Extension to Pain          | 2 |
| No Response                | 1 |

| Verbal Response<br>(with Age Adjustments) |   |
|---|---|
| 5 YEARS-ADULT                             |   |
| Oriented and Converses                    | 5 |
| Disoriented and Converses                 | 4 |
| Inappropriate Words                       | 3 |
| Incomprehensible Sounds                   | 2 |
| No Response                               | 1 |
| 2 YEARS-5 YEARS                           |   |
| Appropriate Words                         | 5 |
| Inappropriate Words                       | 4 |
| Cries/Screams                             | 3 |
| Grunts                                    | 2 |
| No Response                               | 1 |
| < 2 YEARS                                 |   |
| Smiles/Coos/Cries                         | 5 |
| Cries                                     | 4 |
| Inappropriate Cries/Screams               | 3 |
| Grunts                                    | 2 |
| No Response                               | 1 |

Glasgow Coma Score Total =

# Appendix C. Mini-Mental Status Exam

Patient \_\_\_\_\_ Examiner \_\_\_\_\_ Date \_\_\_\_\_

**Maximum Score**

**Orientation**

- 5 ( ) What is the (year) (season) (date) (day) (month)?
- 5 ( ) Where are we (state) (country) (town) (hospital) (floor)?

**Registration**

- 3 ( ) Name 3 objects: 1 second to say each. Then ask the patient all 3 after you have said them. Give 1 point for each correct answer. then repeat them until he/she learns all 3. Count trials and record. TRIALS \_\_\_\_\_

**Attention and Calculation**

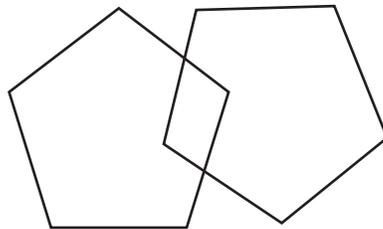
- 5 ( ) Serial 7's. 1 point for each correct answer. Stop after 5 answers. Alternatively, spell "world" backwards.

**Recall**

- 3 ( ) Ask for the 3 objects repeated above. Give 1 point for each correct answer.

**Language**

- 2 ( ) Name a pencil and watch.
- 1 ( ) Repeat the following: "No ifs, ands or buts"
- 3 ( ) Follow a 3-stage command:  
"Take a paper in your hand, fold it in half, and put it on the floor."
- 1 ( ) Read and obey the following: CLOSE YOUR EYES
- 1 ( ) Write a sentence.
- 1 ( ) Copy the design shown:



\_\_\_\_\_ Total Score  
 ASSESS level of consciousness along a continuum \_\_\_\_\_  
 Alert Drowsy Stupor Coma

"MINI-MENTAL STATE." A PRACTICAL METHOD FOR GRADING THE COGNITIVE STATE OF PATIENTS FOR THE CLINICIAN. *Journal of Psychiatric Research*, 12(3); 189-198, 1975. Used by permission.

## Appendix D. IV Drip Chart

**DISCLAIMER:** We have taken considerable care while collecting this information to assure accuracy and appropriate content. The user is reminded that ultimate responsibility for accuracy of calculations and appropriateness of medication rests with the prescriber and professional actually administering the medication.

### IV Infusion Drip Rates

| Volume to be Infused in ml/hour | Select IV Drip Chamber Size in Drops/ml |      |      |      |
|---------------------------------|---|------|------|------|
|                                 | 10                                      | 15   | 20   | 60   |
|                                 | Drops/Minute **                         |      |      |      |
| 10                              | 1.7                                     | 2.5  | 3.0  | 10.0 |
| 30                              | 5.0                                     | 7.5  | 10.0 | 30.0 |
| 50                              | 8.0                                     | 12.5 | 17.0 | 50.0 |
| 70                              | 12.0                                    | 17.5 | 23.0 | 70.0 |
| 90                              | 15.0                                    | 22.5 | 30.0 | 90.0 |
| 125*                            | 20.8                                    | 31.0 | 42.0 | N/A  |
| 175                             | 29.0                                    | 43.8 | 58.0 | N/A  |
| 250                             | 29.0                                    | 43.8 | 58.0 | N/A  |

1 Delivers one liter over 8 hours.

2 Round to nearest value

1.0 ml = 1.0 cc

## Appendix E. Formulary

### Review

Formulary medications are listed as follows: Generic name [e.g., Trade name] (comment or formulation)

### Medications

|   |   |
|---|---|
| Acetaminophen [e.g., Tylenol <sup>®</sup> ]                       | DEET 20%, 30%, and 35% (topical insect repellent preparations)            |
| Acetazolamide [e.g., Diamox <sup>®</sup> ]                        | Dexamethasone [e.g., Decadron <sup>®</sup> ]                              |
| Acetylsalicylic Acid (ASA, Aspirin)                               | Dextrose 5%/Lactated Ringer's (D5LR)                                      |
| Activated charcoal (with/without Sorbitol)                        | Dextrose 5%/Normal Saline (D5NS)  |
| Adenosine [e.g., Adenocard <sup>®</sup> ]                         | Dextrose 50% (D50W)   |
| Albuterol [e.g., Proventil <sup>®</sup> , Ventolin <sup>®</sup> ] | Diazepam [e.g., Valium <sup>®</sup> ]                                     |
| Albuterol + Ipratropium [e.g., Combivent <sup>®</sup> ]           | Diltiazem [e.g., Cardizem <sup>®</sup> ]                                  |
| Amiodarone [e.g., Cordarone <sup>®</sup> ]                        | Dimenhydrinate [e.g., Dramamine <sup>®</sup> ]                            |
| Atropine Sulfate (Atropine)                                       | Diphenhydramine Hydrochloride [e.g., Benadryl <sup>®</sup> ]              |
| Azithromycin [e.g., Zithromax <sup>®</sup> ]                      | Dopamine Hydrochloride [e.g., Intropin <sup>®</sup> ]                     |
| Bacitracin (or other topical antibiotic) ointment                 | Doxycycline hydrochloride [e.g., Vibramycin <sup>®</sup> ]                |
| Benzocaine 30% (topical)  | Enoxaprim [e.g., Lovenox <sup>®</sup> ]                                   |
| Benzoin (compound tincture)                                       | Epinephrine Auto-Injector [EpiPen <sup>®</sup> , EpiPen Jr <sup>®</sup> ] |
| Bupivacaine 0.5% [e.g., Marcaine <sup>®</sup> ]                   | Epinephrine (1:1,000 for SC injection; 1:10,000 for IV/IO injection)      |
| Calamine (lotion)   | Fexofenadine [e.g., Allegra <sup>®</sup> ]                                |
| Calcium Gluconate   | Fluconazole [e.g., Diflucan <sup>®</sup> ]                                |
| Calcium Chloride  | Furosemide [e.g., Lasix <sup>®</sup> ]                                    |
| Captopril [e.g., Capoten <sup>®</sup> ]                           | Glucagon [e.g., GlucaGen <sup>®</sup> ]                                   |
| Carbamide Peroxide [e.g., Debrox <sup>®</sup> ]                   | Glucose paste (oral)  |
| Chlorhexadine [e.g., Hibiclens <sup>®</sup> ]                     | Guaifenesin-Dextromethorphan (active ingredients in cough elixirs)        |
| Clindamycin [e.g., Cleocin <sup>®</sup> ]                         | Haloperidol [e.g., Haldol <sup>®</sup> ]                                  |
| Cyanoacrylate adhesive (wound glue)                               | Hetastarch solution [e.g., Hextend <sup>®</sup> ] (infusion)              |
| Cyclizine [e.g., Bonine <sup>®</sup> ]                            |   |

---

Hydrocortisone 0.5% and 1% (topical)

Hydroxyzine [e.g., Vistaril,<sup>®</sup> Atarax<sup>®</sup>]

Hypertonic Saline Solution 3%

Ibuprofen [e.g., Advil,<sup>®</sup> Motrin<sup>®</sup>]

Ipratropium [e.g., Atrovent<sup>®</sup>]

Ketoconazole [e.g., Nizoral<sup>®</sup>]

Lactated Ringer's Solution (LR)

Levofloxacin [e.g., Levaquin<sup>®</sup>]

Lidocaine Hydrochloride 1% and 2% [Lidocaine<sup>®</sup>]  
(with/without epinephrine)

Loperamide [e.g., Imodium<sup>®</sup>]

Loratadine [e.g., Claritin<sup>®</sup>]

Lorazepam [e.g., Ativan<sup>®</sup>]

Magnesium Sulfate (Magnesium)

Mannitol 20% [Osmitrol<sup>®</sup>] (infusion)

Meclizine [e.g., Antivert<sup>®</sup>]

Methylprednisolone [e.g., Medrol<sup>®</sup>]

Metoprolol [e.g., Lopressor,<sup>®</sup> Toprol<sup>®</sup>]

Metronidazole [e.g., Flagyl<sup>®</sup>] (oral or 0.75% vaginal gel)

Midazolam [e.g., Versed<sup>®</sup>]

Morphine Sulfate (Morphine)

Naloxone [e.g., Narcan<sup>®</sup>]

Naproxen Sodium [e.g., Naprosyn,<sup>®</sup> Aleve<sup>®</sup>]

Neomycin/Polymyxin B Sulfates/Hydrocortisone Otic Suspension [e.g., Cortisporin<sup>®</sup>]

Nifedipine [e.g., Procardia,<sup>®</sup> Adalat<sup>®</sup>]

Nitroglycerin (sublingual tabs or spray, topical paste or patch)

0.9% Normal Saline solution (NS)

Ondansetron [e.g., Zofran<sup>®</sup>]

Oxygen (O<sub>2</sub>)

Oxymetazalone [e.g., Afrin<sup>®</sup>]

Penicillin [e.g., Pen-VK<sup>®</sup>]

Povidine-iodine [e.g., Betadine<sup>®</sup>] (solution or scrub)

Prednisone [e.g., Deltasone<sup>®</sup>]

Prochlorperazine [e.g., Compazine<sup>®</sup>]

Promethazine [e.g., Phenergan<sup>®</sup>]

Proparacaine Hydrochloride 1% [e.g., Alcaine<sup>®</sup>]

Pseudoephedrine [e.g., Sudafed<sup>®</sup>]

Ranitidine [e.g., Zantac<sup>®</sup>]

Scopolamine [e.g., Transdermal Scop<sup>®</sup>]

Silver Sulfadiazine [e.g., Silvadene<sup>®</sup>]

Sodium Bicarbonate

Terbinafine [e.g., Lamisil<sup>®</sup>]

Thiamin (Vitamin B1)

Triamcinalone (topical ointment)

Triethanolamine Polypeptide [e.g., Cerumenex<sup>®</sup>]

Trimethoprim-Sulfamethoxazole [e.g., Bactrim DS,<sup>®</sup> Septra<sup>®</sup>]

Vasopressin [e.g., Pitressin<sup>®</sup>]

---





