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**CHAPTER 5**

**ENVIRONMENTAL TREATMENT  
PROTOCOLS**

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## **BITES AND STINGS**

### **Specific information needed**

- A. Type of animal. Time of exposure.
- B. Symptoms
  - 1. Local – pain, stinging.
  - 2. Generalized –nausea, weakness, itching, trouble breathing, dizziness, muscle cramps.
  - 3. History of previous exposures, allergic reactions.

### **Specific objective findings**

- A. Identification of spider, bee, marine animal if possible.
- B. Local signs – erythema, swelling, heat in area of bite.
- C. Systemic signs – hives, wheezing, respiratory distress, abnormal vital signs.

### **Treatment**

SNAKES      See Snake Bites

#### SPIDERS AND SCORPIONS

- A. Ice for comfort.
- B. Bring in spider if captured or if dead for accurate identification.
- C. Transport for observation if systemic signs and symptoms present.

#### BEEES AND WASPS

- A. Remove sting mechanism. Try not to squeeze venom sac if this remains on stinger.
- B. For at-home first aid – a paste of water and meat tenderizer (containing papain) can be applied for local symptomatic relief.
- C. Observe patient for signs of systemic allergic reaction. Transport rapidly if needed. Treat anaphylaxis per protocol.
- D. If patient has allergy kit, consider administration to patient as appropriate.
- E. Transport all patients with systemic symptoms or history of systemic symptoms from prior bites.

#### MARINE ANIMALS

- A. Remove victim from water.
- B. Treat airway, breathing, or other problems from water aspiration.
- C. Assess and treat allergic reactions per protocol.
- D. To prevent further contamination
  - 1. Remove any stingers that can be easily lifted off (surgical removal is sometimes necessary).
  - 2. Remove nematocysts (from jellyfish, etc.) without squeezing or discharging.
    - a. Wash with sea water (not fresh water).
    - b. Pour alcohol (or vinegar) over area. Continue until pain relieved. May take 15-30 minutes.
    - c. Dust cysts with flour, baking soda, talcum powder, or shaving cream, then gently scrape off remaining cysts.
- E. For fish bites or stings, apply very warm water to skin for 15-30 minutes until pain relieved.

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- F. IV, volume expander (NS or RL), TKO if severe contamination has occurred. Administer morphine sulfate, 2-4 mg IV, repeat as needed to total of 0.2 mg/kg for pain relief. Consider fentanyl 25-50 mcg. May repeat x 1.
- G. Transport patients with severe symptoms of envenomation or history of generalized allergic reaction.

**Specific precautions**

- A. For all types of bites and stings, the goal of prehospital care is to prevent further inoculation and to treat allergic reactions.

Allergy kits consist of injectable epinephrine and oral antihistamine, and are prescribed for persons with known systemic allergic reactions. Prehospital care personnel still need to transport, even if assisting the patient with their own medication.

About 60% of patients who have experienced a generalized reaction to a bite or sting in the past will have a similar or more severe reaction upon reinoculation. Thus, although it is not inevitable, this group of patients must be considered at high risk for anaphylaxis. In addition, a small group of patients will have anaphylaxis as a "first" reaction.

Time since envenomation is important. Anaphylaxis rarely develops more than 60 minutes after inoculation.

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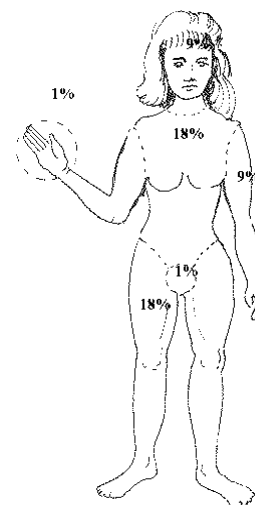
## BURNS

### Specific information needed

- A. History of injury – time elapsed since burn. Was patient in a closed space with steam or smoke? Electrical contact? Loss of consciousness? Accompanying explosion, falls, toxic fumes?
- B. Past history – prior cardiac or pulmonary disease, medications?

### Specific objective findings

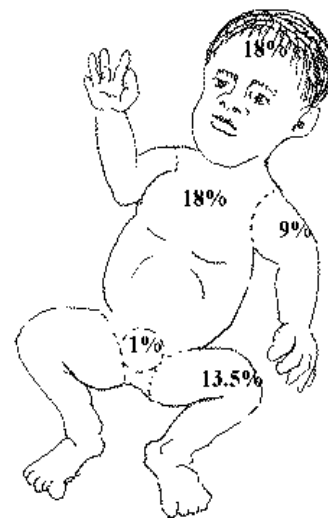
- A. Vital signs.
- B. Extent of burns – description or diagram of areas involved (during long transports only). Have diagrams ready to draw on.
- C. Depth of burns –  
Superficial - erythema only  
Significant - blistered or charred areas.
- D. Evidence of CO poisoning or other toxic inhalation – altered mental state, headache, vomiting, seizure, coma.
- E. Evidence of inhalation burns – respiratory distress, cough, hoarseness, singed nasal or facial hair, soot or erythema of mouth.
- F. Entrance and exit wounds for electrical burns.
- G. Associated trauma.



### Treatment

#### THERMAL BURN

- A. Remove clothing which is smoldering or which is non-adherent to the patient.
- B. O<sub>2</sub>, high flow (10-15 L/min), mask with non-rebreathing bag, if indications of respiratory burns, toxic inhalation, or significant smoke exposure. Titrate to pulse oximetry > 90% if possible.
- C. Assess and treat for associated trauma (blast or fall).
- D. Remove rings, bracelets, and other constricting items.
- E. If significant burn is moderate-to-severe (over 15% of body surface area), cover wounds with dry clean dressings – use wet dressings only if skin still smoldering.
- F. Use cool, wet dressings in smaller burns (less than 15%), for patient comfort.
- G. If more than 30% significant burn and transport time > 30 minutes, contact base to consider
  - 1. Optimum destination hospital.
  - 2. IV – volume expander (NS or RL), TKO or by amount of burn. Contact base for rate.
  - 3. Fentanyl 25-50 mcg or Morphine sulfate, 2-4 mg, for pain relief. May repeat x 1.
  - 4. Transport, monitoring vital signs.



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## INHALATION INJURY

- A. O<sub>2</sub>, high flow (10-15 L/min), using mask with non-rebreathing reservoir bag during full time of transport. Pulse oximetry may not be accurate with inhalation injuries – CO will give a falsely high pulse oximeter reading in spite of severe functional hypoxia.
- B. Monitor CO if appropriate.
- C. Be prepared to ventilate or assist if respirations inadequate.
- D. Consider need for early intubation.
- E. Monitor cardiac rhythm.

## CHEMICAL BURNS

- A. NOTIFY HAZ-MAT Unit as soon as any chemical contamination is recognized. Protect rescuer from contamination. Wear appropriate gloves and clothing.
- B. Remove all clothing and any solid chemical which might provide continuing contamination.
- C. Assess and treat for associated injuries.
- D. Decontaminate patient using running water for 15-20 minutes on scene, and continue as able during transport.
- E. Check eyes for exposure and rinse with free-flowing water for 15-20 minutes on scene, and continue as able during transport.
- F. Evaluate for systemic symptoms which might be caused by chemical contamination. Contact base hospital if questions.
- G. Remove rings, bracelets, constricting bands.
- H. Wrap burned area in clean, dry cloths for transport. Keep patient as warm as possible after decontamination.
- I. Consult base or Poison Control Center (PCC) for special treatment or procedures as needed.

## ELECTRICAL INJURY

- A. Protect rescuers from continued live electric wires.
- B. Separate victim from electrical source only when area safe for rescuers.
- C. Initiate CPR as needed. Defibrillation (per Cardiac Arrest protocol), prolonged respiratory support may be needed.
- D. Immobilize cervical spine, assess for other injuries.
- E. Monitor patient for possible dysrhythmias. Treat as per dysrhythmia protocol.
- F. IV – volume expander (NS or RL), TKO or as directed.

## **Specific precautions**

- A. Leave blisters intact when possible.
- B. Suspect airway burns in any facial burns or burns received in closed places. Edema may become severe, consider early intubation. Humidified O<sub>2</sub> is useful if available.
- C. Death in the first 24 hours after burn injury is due to airway burns, fluid loss, or toxic inhalants (carbon monoxide or cyanide). Fluids are calculated on the basis of extent of significant burns, (i.e., those in which there is skin blistering or disruption).
- D. Assume carbon monoxide poisoning in all closed space burns. Treatment is 100% O<sub>2</sub> continued for several hours, or hyperbaric oxygenation. In addition, other toxic products

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of combustion are more commonly encountered than realized. Many of these products will also give false pulse oximetry readings.

- E. Consider MI as a cause of injury in firefighters who are burned. Consider suicide attempt as cause of burn, and child abuse in pediatric burns.
- F. Lightning injuries can cause prolonged respiratory arrest. Prompt, continuous respiratory assistance (sometimes for hours to days) can result in full recovery.
- G. Field decontamination of chemical exposures has been shown to significantly reduce extent of burn. It is rare to encounter a chemical which is not properly decontaminated by copious water.

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## DECOMPRESSION/DIVING INJURY

### Specific information needed

- A. Symptoms
  - 1. Chest – pain, trouble breathing, cough.
  - 2. Joints – pain, cramps.
  - 3. CNS – headache, dizziness, fatigue.
- B. Setting
  - 1. Underwater diving.
  - 2. Depressurization or inadequate pressurization at high altitudes.
  - 3. Air tank failure during dive.
  - 4. High altitude exposure (such as flying) after scuba diving.

### Specific objective findings

- A. Decompression illness
  - 1. Cough, respiratory distress without pneumothorax.
  - 2. CNS – focal central or spinal deficits, confusion, seizures, coma.
  - 3. Cardiovascular – dysrhythmias, low BP.
  - 4. Skin – tenderness, mottling, red rash from bubble emboli.
- B. Air embolism
  - 1. Pneumothorax, tension pneumothorax.
  - 2. Focal signs as above.

### Treatment

- A. Decompression illness
  - 1. Keep patient at complete rest in supine position.
  - 2. O<sub>2</sub>, high flow (10-15 L/min), mask with reservoir bag.
  - 3. IV – volume expander (NS or RL), large bore, TKO or as directed.
  - 4. Contact base for optimum transport destination.
- B. Air embolism
  - 1. Treat as above for decompression illness.
  - 2. Observe for signs of tension pneumothorax and treat with rapid transport.
  - 3. Consider needle decompression if indicated.

### Specific precautions

Decompression illness is secondary to formation of nitrogen bubbles in the bloodstream as atmospheric pressure decreases, and excess gas comes out of solution in the blood, usually during ascent from a dive or when using pressurized breathing apparatus. Air emboli occur when decreasing pressures cause air in the lungs to over expand and rupture alveoli. In addition to lung damage, embolization of gas can cause a stroke-like picture from blocked flow in other distal arteries.

"Bends," the most common form of decompression illness, is caused by nitrogen bubbles in joints and bones, and usually occurs within 3 hours of surfacing. Though "bends" are extremely uncomfortable, they are not usually fatal, however close observation will reveal more serious forms of decompression illness.

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## **DROWNING**

### **Specific information needed**

- A. How long patient was submerged.
- B. Fresh or salt water, degree of contamination, water temperature.
- C. Diving accident. Water depth.

### **Specific objective findings**

- A. Vital signs.
- B. Neurologic status – monitor on a continuing basis.
- C. Lung exam – rales, pulmonary edema, or respiratory distress.

### **Treatment**

- A. Clear upper airway of vomitus or large debris.
- B. Start CPR if needed. Do not drain lungs prior to initiating ventilatory assistance except in sea-water victims.
- C. Stabilize neck prior to removing from water if any suggestion of neck injury. Remove from water on back-board.
- D. Suction as needed.
- E. O<sub>2</sub>, high flow (10-15 L/min), mask with non-rebreathing reservoir bag, regardless of condition.
- F. If patient not awake and alert
  - 1. Assist ventilation using bag-valve-mask.
  - 2. Intubate and apply positive pressure ventilation.
  - 3. IV – volume expander (NS or RL), TKO or as directed.
  - 4. Monitor cardiac rhythm during transport.
- G. Transport patient, even if normal by initial assessment.

### **Specific precautions**

- A. Be prepared for vomiting. Patients should be secure on spine board for log-rolling to protect airway.
- B. All possible drownings or submersions should be transported. Even if patients initially appear fine, they can deteriorate. Monitor closely. Pulmonary edema often occurs due to aspiration, hypoxia, and other factors. It may not present for several hours.
- C. Beware of neck injuries – they often go unrecognized. Collar and backboard can be applied in the water.
- D. If patient is hypothermic, defibrillation may be unsuccessful until the patient is rewarmed. Prolonged CPR may be needed.

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## **HIGH ALTITUDE ILLNESS**

### **Specific information needed**

- A. Present symptoms – headache, trouble breathing, confusion, fatigue, nausea.
- B. Current and highest altitude, time at this altitude, duration of ascent.
- C. Medical problems, medications, previous experience at altitude.

### **Specific objective findings**

- A. Vital signs.
- B. Mental status – confusion, lack of coordination, coma.
- C. Lungs – respiratory rate, distress, wet lung sounds, sputum (bloody or frothy).

### **Treatment**

- A. Put patient at rest, position of comfort.
- B. O<sub>2</sub>, high flow (10-15 L/min), by mask with non-rebreathing reservoir bag.
- C. Reduce flow after 30 minutes to 1-2 L/min to conserve O<sub>2</sub> during long transports.
- D. Suction as needed. Assist ventilations if patient has cyanosis, confusion, and poor respiratory effort.
- E. Descend with patient at least 2,000-3,000 feet. If symptoms severe, use litter or personnel to carry patient.
- F. IV – NS, TKO, if conditions permit, or saline lock.
- G. Monitor vitals during transport.

### **Specific precautions**

- A. Recognition of the problem is the most critical part of treating high altitude illness. While in the mountains, recognize symptoms which are out of proportion to those being experienced by the rest of the party – fatigue, or trouble breathing (particularly at rest).
- B. The mainstay of treatment is descent from altitude. Even a loss of 2,000-3,000 feet makes enough difference in the O<sub>2</sub> content of air that symptoms may be relieved or stop progressing. Oxygen administration can also relieve symptoms and may allow more time for orderly evacuation.
- C. In addition to the more common pulmonary edema, cerebral edema may occur, with confusion and a stroke-like picture with focal deficits. Treatment is the same.
- D. Acute mountain sickness, the mildest form of illness during altitude adaptation, consists of fatigue, headache, and poor sleeping without CNS or respiratory symptoms. Treatment is rest and hydration. This increases the body's time to acclimatize.
- E. When evaluating high altitude illness while in the mountains recreationally, do not be overly casual. Any party member with suspected acute mountain illness who is mentally confused or who has resting tachycardia or increased respiratory rate should be helped to descend without delay. Do not allow a hiker to "rest overnight" if symptoms are present at rest OR if location is such that treatment with oxygen is not immediately available.

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## **HYPERTHERMIA**

### **Specific information needed**

- A. Patient age, activity level.
- B. Medications – depressants, tranquilizers, alcohol, etc.
- C. Associated symptoms – cramps, headache, nausea, weakness.

### **Specific objective findings**

- A. Vital signs, temperature (Heat Stroke usually 104 degrees Fahrenheit (40 degrees Centigrade) or greater).
- B. Mental status – confusion, coma, seizures, psychosis.
- C. Skin flushed and warm – with or without sweating.
- D. Air temperature and humidity, patient dress.

### **Treatment**

- A. Ensure airway.
- B. O<sub>2</sub>, moderate flow, 4-6 L/min. Titrate to pulse oximetry > 90%.
- C. Remove clothing. Cool with water-soaked sheets. Ensure adequate air flow over patient for evaporative loss.
- D. IV – volume expander (NS or RL), large bore
  - 1. TKO if vital signs stable.
  - 2. Fluid bolus of 20 ml/kg, if signs of hypovolemia.
- E. Test blood for glucose level.
- F. Administer dextrose 50%, 50 ml IV, in secure vein, if glucose level < 60 mg/dl.
- G. Administer benzodiazepine per protocol.
- H. Monitor cardiac rhythm.
- I. Monitor vitals during transport.

### **Specific precautions**

- A. Heat stroke is a medical emergency. It is distinguished by altered level of consciousness. Sweating may still be present especially in exercise-induced heat stroke. Other persons at risk for heat stroke are the elderly and persons on medications which impair the body's ability to regulate heat.
- B. Differentiate heat stroke from – heat exhaustion (hypovolemia of more gradual onset and no mental status changes), and heat cramps (abdominal or leg cramps). Be aware that heat exhaustion can progress to heat stroke.
- C. **DO NOT LET COOLING IN THE FIELD DELAY YOUR TRANSPORT.** Cool patient as possible while enroute.

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## **HYPOTHERMIA AND FROSTBITE**

### **Specific information needed**

- A. Length of exposure.
- B. Air temperature, water temperature, winds, patient wet, or wet clothes.
- C. History and timing of changes in mental status.
- D. Medications – steroids, alcohol, tranquilizers, anticonvulsants, others.
- E. Medical problems – diabetes, epilepsy, alcoholism, etc.
- F. With local injury – history of thawing or refreezing?

### **Specific objective findings**

- A. Vital signs, mental status, shivering. (Prolonged observation for 1-2 minutes may be necessary to detect pulse, respirations.)
- B. Temperature – core < 95 degrees Fahrenheit (35 degrees Centigrade) is significant. Note also current temperature of environment.
- C. Evidence of local injury – blanching, blistering, erythema of extremities, ears, nose.
- D. Cardiac rhythm.

### **Treatment**

#### GENERALIZED HYPOTHERMIA

- A. CPR if NO pulse or respirations. Prolonged CPR may be required. (If monitor present, no CPR if organized electrical activity present.)
- B. O<sub>2</sub>, moderate flow (4-6 L/min), warm, humidified if possible. Titrate to pulse oximetry > 90%.
- C. Avoid unnecessary suctioning or airway manipulation.
- D. Remove wet or constrictive clothes from patient. Wrap in blankets and protect from wind exposure.
- E. IV – volume expander (NS or RL), large bore, TKO or as ordered. Solution should be warmed if possible. Do not start IV until patient is moved to transport vehicle.
- F. Test blood for glucose level.
- G. Dextrose 50%, 50 ml IV in secure vein if glucose level < 60 mg/dl
- H. Consider naloxone, 0.4 mg IV for suspected narcotic toxicity.
- I. Monitor cardiac rhythm. Attempt defibrillation, if appropriate, one time only.
- J. Monitor vitals during transport.

#### LOCAL (FROSTBITE)

- A. Remove wet or constricting clothing. Keep skin dry and protected from wind.
- B. Do not allow the limb to thaw if there is a chance that limb may refreeze before evacuation is complete or if patient must walk to transportation.
- C. Rewarm minor "frostnip" areas by placing in rescuer axilla or against trunk under clothing.
- D. Dress injured areas lightly in clean cloth to protect from pressure, trauma or friction. Do not rub. Do not break blisters.
- E. Maintain core temperature by keeping patient warm with blankets, warm fluids.
- F. Transport with frostbitten areas supported and elevated if feasible.

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### **Specific precautions**

#### **HYPOTHERMIA**

- A. Shivering does not occur below 90 degrees Fahrenheit (32 degrees Centigrade). Below this the patient may not feel cold, and occasionally will even undress and appear vasodilated.
- B. The heart is most likely to fibrillate below 85-88 degrees Fahrenheit (29.4-31 degrees Centigrade). Defibrillation should be attempted, but prolonged CPR may be necessary until the temperature is above this level.
- C. ALS drugs should be used sparingly, since peripheral vasoconstriction may prevent entry into central circulation until temperature is restored. At that time a large bolus of unwanted drugs may be infused into the heart. Bradycardias are normal and should not be treated.
- D. Any handling and airway manipulation may induce ventricular fibrillation in the hypothermic patient. Delay intubation if airway can be managed by less invasive means. If time permits, consider administration of prophylactic lidocaine, 1.5 mg/kg IV, approximately one minute prior to intubation.
- E. If patient has even a faint pulse, organized monitor rhythm and occasional respirations, CPR is currently felt to be unnecessary. In general, even very slow rates are probably sufficient for metabolic demands, CPR is indicated for asystole and ventricular fibrillation, though the compression rate can be slower than usual (40/minute).
- F. Patients who appear dead after prolonged exposure to cold air or water should not be pronounced "dead" until they have been rewarmed. Full recovery from hypothermia with undetectable vital signs, severe bradycardia, and even periods of cardiac arrest have been reported.
- G. Rewarming should be accomplished with careful monitoring in a hospital setting whenever possible.
- H. Early recognition of hypothermia is essential when exposed to cooling weather (either wet or cold). Death often occurs because the patient becomes apathetic, confused, and unable to help himself. When medical care is not readily accessible, rewarming may be attempted while someone goes for help. Place the patient with rescuer in sleeping bag and bundle with warm blankets.

#### **FROSTBITE**

- A. Thawing is extremely painful and should be done under controlled conditions, preferably in the hospital. Careful monitoring, pain medication, prolonged rewarming, and sterile handling are required.
- B. It is clear that partial rewarming, or rewarming followed by refreezing, is far more injurious to tissues than delay in rewarming or walking on a frozen extremity to reach help. Do not rewarm prematurely. Indications for field rewarming are few.

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## **SNAKE BITES**

### **Specific information needed**

- A. Type of snake.
- B. Time of bite.
- C. Prior first-aid by patient or friends.
- D. Symptoms – paresthesias, peculiar or metallic taste sensations, local pain; later – chills, headache or nausea, numbness or tingling of mouth, tongue, other areas.

### **Specific objective findings**

- A. Bite wound – location, configuration (1, 2, or 3 fang marks, entire jaw imprint, none).
- B. Signs of envenomation – local edema or swelling, later signs may include fever, vomiting, discoloration around the fang site, hypotension.

### **Treatment**

- A. Remove patient and rescuers from area of snake to avoid further injury.
- B. Remove rings or other bands which may become tight with local swelling.
- C. Immobilize bitten part as for a fracture. Keep area of potential envenomation at or below the level of the heart.
- D. Minimize venom absorption by keeping bite area still and patient quiet.
- E. If signs of envenomation are present, apply light constricting band 1 inch wide, 2-3 inches proximal to bite. It should admit one finger under it with ease.
- F. Transport promptly for definitive observation and treatment.
  - 1. DO NOT USE ICE OR REFRIGERANTS.
  - 2. Do not make incisions or attempt to suction wound.

### **Specific precautions**

- A. Find out the specific poisonous snakes present in your region. Treatment varies; even with rattlesnakes there are regional differences in size and potency of venom. If the snake is dead, bring it in for examination. Be careful – a dead snake may still reflexively bite and envenomate.
- B. At least 25% of poisonous snake strikes do not produce envenomation. Do not overtreat the patient who does not have symptoms.
- C. Fang marks are characteristic of pit viper bites such as the rattlesnake, water moccasin, or copperhead which are native to North America. Jaw prints (without fangs) are more characteristic of nonvenomous species.
- D. Small children and elderly persons are at greatest risk from poisonous bites. Treatment should be more aggressive for these patients.
- E. Ice can cause serious tissue damage.
- F. More dangerous problems can develop from uncontrolled incision of bite wounds than from envenomation itself. Current recommendations are to avoid incisions.
- G. Exotic poisonous snakes, such as those found in zoos, have different signs and symptoms than those of pit vipers. Information should be obtained from zoo or Poison Control Center (PCC) for proper identification and treatment.