Chapter 33, Environmental Emergencies

Table of Contents

1. Introduction to Environmental Emergencies

environmental emergencies occur when the body cannot cope with surrounding factors like temperature and atmospheric pressure . These situations can lead to medical emergencies . Certain groups are more vulnerable, including **children**, **older people**, those with **chronic illnesses**, and young adults who overexert themselves . environmental emergencies often happen alongside other injuries or illnesses . Examples of these emergencies include **heat and cold-related issues**, **water emergencies**, **pressure-related injuries** from diving or altitude, and injuries from **lightning strikes** and **venomous bites/stings** .

2. Cold-Related Emergencies: Physiology and Types

When the body or a part of it is exposed to cold, the temperature regulation is overwhelmed . Cold exposure can injure the hands, feet, ears, nose, or the whole body .

Mechanism of Heat Loss	Description
Conduction	Transfer of heat by direct contact with a colder object
Convection	Transfer of heat to circulating air moving across the body
Evaporation	Conversion of liquid to gas
Radiation	Transfer of heat by radiant energy
Respiration	Heat loss as warm air is exhaled and cool air is inhaled

hypothermia happens when the body's core temperature falls below 95 degrees . The body loses its ability to regulate temperature and generate heat . To protect against heat loss, blood vessels in the skin constrict, causing **blue lips or fingertips** . The body shivers to generate heat . If these mechanisms fail, body functions slow, mental status declines, and vital organs like the heart slow down, which can lead to death . hypothermia can develop quickly, such as with cold water immersion . It can occur even when air temperature is not below freezing . **Higher risk** populations include homeless individuals, those without home heating, swimmers, geriatric and ill patients, and patients with specific medical conditions like burns, shock, head injury, stroke, generalized infections, spinal cord injuries, diabetes, and hypoglycemia .

Local cold injuries are usually confined to exposed body parts . **frostnip** and **immersion foot** (trench foot) occur when parts are very cold but not frozen . **frostbite** occurs when tissues are frozen . Severity depends on exposure duration, temperature, and wind velocity . Factors like wet conditions, inadequate insulation, restricted circulation, fatigue, poor nutrition, alcohol/drug abuse, hypothermia, diabetes, cardiovascular disease, and age also play a role . Patients with hypothermia should be checked for frostbite and other local cold injuries .

- **frostnip**: Cold skin freezes, but deeper tissues are unaffected. It often affects the ears, nose, and fingers and is usually not painful. Patients may not realize the injury has occurred.
- **immersion foot**: Occurs after prolonged exposure to cold water. Signs include pale, cool skin, wrinkled skin (sometimes remaining soft), and loss of feeling in

the injured area.

- **frostbite**: The most serious local cold injury as tissues are frozen. Freezing causes permanent cell damage, and **gangrene** may require surgical removal of dead tissue. Affected parts become inflamed and tender to touch. Frostbitten parts are often hard and waxy. Blisters and swelling may be present. In superficial frostbite, only the skin is frozen; in deep frostbite, deeper tissues are frozen.

3. Assessment and Management of Cold-Related Emergencies

Assessing cold injuries involves noting environmental conditions like wind chill and wetness . Ensure scene safety, identify hazards, and use standard precautions . In the primary assessment, form a general impression and perform a rapid scan for life threats . Quickly assess core temperature if the chief complaint is coldness . Evaluate mental status using AVPU .

Stages of Hypothermia	**Core Temperature (Fahrenheit)**	**Signs and Symptoms**
Mild	> 93.2 but < 98	Alert, shivering, rapid pulse/respirations, skin red/pale/cyanotic
Moderate	86 to 93.2	Shivering stops, decreased muscle activity, deteriorating mental status
Severe	< 86	Lethargic, stops fighting cold, stiff/rigid appearance
Core Temp < 80	< 80	Pulse slows/weakens, respirations slow/absent, cardiac dysrhythmias possible, pupillary action slow, may appear dead

If cardiac arrest is suspected, begin chest compressions . Ensure an adequate airway and breathing; assist with BVM if breathing is slow or shallow . Warm, humidified oxygen helps rewarm the patient internally . Palpate for the carotid pulse for up to 60 seconds . CPR is recommended for patients with no detectable pulse or breathing .

Perfusion may be compromised, and bleeding may be hard to find . All hypothermic patients require immediate transport due to complications like cardiac dysrhythmias and blood clotting issues . Handle patients gently to avoid causing a cold heart to fibrillate . If transport is delayed, protect the patient from further heat loss .

History taking includes investigating the chief complaint and obtaining medical history . Note the duration of exposure, medications, and underlying medical problems . Secondary assessment involves focusing on hypothermia severity and affected areas . Pay attention to skin temperature, texture, and turgor . Vital signs indicate severity . Slow, shallow respirations can cause low oxygen . Low blood pressure and slow pulse may indicate moderate to severe hypothermia . Evaluate mental status using AVPU . Use a hypothermia thermometer based on local protocol . Reassessment involves repeating the primary assessment, checking vitals and chief complaint, and monitoring consciousness and vital signs . Rewarming can cause cardiac dysrhythmias .

Management of cold emergencies starts with moving the patient from the cold environment . Remove wet clothing and cover the patient with dry blankets . Provide warm, humidified oxygen if available . Handle gently; do not massage extremities . Do not allow the patient to eat or use stimulants .

- **Mild hypothermia**: Passive rewarming is appropriate. Place the patient in a warm environment and remove wet clothing. Apply heat packs/hot water bottles to groin, axillary, and cervical regions. Increase ambulance compartment heat. Give warm fluids by mouth if the patient can swallow.
- **Moderate/Severe hypothermia**: Do not actively rewarm. Rewarming can cause fatal cardiac dysrhythmias. The goal is to prevent further heat loss. Remove the patient immediately from the cold and remove wet clothing. Cover with blankets and transport. Handle very gently to decrease ventricular fibrillation risk. If unable to move immediately, shelter the patient from wind and contact with cold objects. Cover with blankets and a waterproof cover, including the head and neck.

Emergency care for local cold injuries includes removing the patient from the cold . Handle the injured part gently and protect it . Remove wet or restrictive clothing . Consider active rewarming if there is no risk of re-injury or if transport is significantly delayed, and if local protocols allow . Consult medical control .

- **frostnip**: Contact with a warm object may be sufficient.
- **immersion foot**: Remove wet footwear, gradually rewarm the foot, and protect it from further cold. Cover loosely with a dry sterile dressing. Never

rub or massage injured tissues as this can cause more damage. Do not re-expose the injury to cold.

- **frostbite**: Remove clothing from the injured part. Cover loosely with a dry sterile dressing. Do not break blisters or rub the area. Do not apply heat or rewarm the part. Do not allow the patient to stand or walk on a frostbitten foot. If hospital care is delayed and medical control advises field rewarming, use a warm water bath immersion at 102-104 degrees. Dress the area with a sterile dry dressing, including between injured fingers/toes. Expect severe pain. Never attempt rewarming if there is any chance the part might freeze again.

4. Heat-Related Emergencies: Physiology and Types

In hot environments or during vigorous activity, the body tries to eliminate heat through sweating and dilation of blood vessels . Removing clothing and moving to a cooler environment also helps . **hyperthermia** is a core temperature at or above 101 degrees Fahrenheit .

Risk Factors for Heat Illness
High air temperature reduces radiation
High humidity reduces evaporation
Lack of acclimation to heat
Vigorous exercise causes fluid and electrolyte loss
Children, especially newborns and infants
Geriatric patients
Patients with heart disease, COPD, diabetes, dehydration, obesity, or limited mobility
Alcohol and certain drugs cause dehydration and decrease sweating

There are three forms of heat emergencies: **heat cramps**, **heat exhaustion**, and **heat stroke** . All three can be present in the same patient . High-risk individuals are similar to those at risk for cold illnesses .

- **Heat Cramps**: Painful muscle spasms occurring after vigorous exercise. They don't only occur when it's hot. The exact cause is unclear. They occasionally occur in leg or abdominal muscles.
- **heat exhaustion** (Heat Collapse): Caused by hypovolemia from losing water and electrolytes through heavy sweating. High humidity and exertion in poorly ventilated areas contribute. Signs and symptoms include dizziness, weakness, fainting, nausea, vomiting, headache, cold clammy skin with ashen pallor, dry tongue, and thirst. Vital signs are usually normal, pulse may be rapid and weak, and body temperature is normal or slightly elevated (up to 104°F).
- **heat stroke**: The least common but most serious heat emergency. It happens when the body is subjected to more heat than it can handle, and normal cooling mechanisms are overwhelmed. Untreated heat stroke is always fatal. Typical situations include vigorous activity outdoors, poorly ventilated hot indoor spaces, heat waves without air conditioning, and children left in hot locked cars. Signs and symptoms include hot, dry, or flushed skin (sweating may still occur). There is a rapid rise in body temperature (up to 106°F). Changes in behavior, unresponsiveness, seizures, rapid weak pulse, increased respiratory rate, and cessation of perspiration can occur.

5. Assessment and Management of Heat-Related Emergencies

Scene size-up for heat emergencies involves an environmental assessment . A heat emergency might be secondary to a medical or trauma emergency . Consider calling advanced life support for unconscious patients, altered mental status, or those needing IV fluids . Look for mechanism of injury indicators, protect yourself from heat/biological hazards, stay hydrated, and use standard precautions .

Signs and Symptoms of Heat Emergencies	**Heat Cramps**	**Heat Exhaustion**	**Heat Stroke**
Muscle Spasms	Yes	No	No
Dizziness, Weakness, Syncope	No	Yes	No (often unresponsive)

Nausea, Vomiting, Headache	No	Yes	Yes
Skin Appearance	Normal	Cold, clammy, ashen pallor	Hot, dry/flushed (may still sweat)
Body Temperature	Normal	Normal or slightly elevated (up to 104°F)	Rapid rise (up to 106°F)
Mental Status	Alert	May be altered	Altered, unresponsive, seizures
Pulse	Normal	Rapid, weak	Rapid, weak (becomes weaker)
Respirations	Normal	Normal	Increased
Perspiration	Yes	Yes (heavy)	May stop

Primary assessment starts with a general impression and observing patient interaction . Assess mental status using AVPU . Ensure a patent airway in responsive patients; position unresponsive patients to protect the airway . Insert an oral airway and provide BVM ventilations for unresponsive patients . Assess perfusion and bleeding . Assess skin condition and treat for shock by removing from heat and positioning . If bleeding, manage according to protocol . Transport rapidly for heat stroke signs .

History taking includes investigating the chief complaint, obtaining medical history, and noting factors predisposing to dehydration or heat problems . Determine heat/humidity exposure and activities before symptom onset . Secondary assessment involves a full body exam for unresponsive patients or a focused exam for conscious patients . Assess for muscle cramps, confusion, mental status, and vital signs . Pay attention to skin temperature, turgor, and moisture . Perform a careful neurologic exam . Vital signs may be altered; hyperthermic patients may be tachycardic and tachypneic . Falling blood pressure indicates shock . Skin

temperature can be normal/cold/clammy in heat exhaustion and hot in heat stroke . Check temperature with a thermometer and pulse oximetry .

Reassessment involves repeating the primary assessment and watching for deterioration . Transport heat stroke patients immediately in a cool ambulance . Passively cool by removing clothing and actively cool by spraying water and fanning . Monitor vital signs every five minutes and evaluate interventions . Avoid overcooling . Notify the receiving facility early about a heat stroke patient . Document environmental conditions and prior activities .

Management of heat emergencies:

- **Heat Cramps**: Remove the patient from the hot environment and loosen clothing. Administer high-flow oxygen. Have the patient sit or lie down until cramps subside. Replace fluids by mouth. Cool the patient with water spray/mist and fan. Activity can resume when cramps are gone. Hydration by drinking water is the best prevention and treatment. Transport if cramps persist.
- **heat exhaustion**: Treat according to specific steps (skill drill 33-1).
- **heat stroke**: Recovery depends on treatment speed. The objective is to lower body temperature by any means. Move the patient out of the hot environment and into the ambulance. Set AC to maximum cooling and remove clothing. Administer high-flow O2 and assist ventilations if needed. Provide cold water immersion if possible. Spray with cool water and fan aggressively to evaporate moisture. Exclude other causes of altered mental status and check blood glucose if possible. Transport immediately and notify the hospital. Do not overcool. Call for advanced life support if the patient shivers.

6. Water-Related Emergencies: Drowning and Diving

Drowning is respiratory impairment from submersion or immersion in liquid . Risk factors include alcohol, seizure disorders, geriatric patients with cardiovascular disease, and unsupervised access to water for children . Drowning often follows panic in the water, leading to fatigue and sinking . It can happen in shallow water . A laryngospasm (spasm of larynx and vocal cords) may occur, meant to prevent water from entering the lungs . Severe cases lead to progressive hypoxia and unconsciousness .

Spinal injuries in submersion incidents should be suspected if the submersion resulted from a diving mishap or fall, the patient is unconscious with no information to rule out neck injury, or the conscious patient complains of weakness, paralysis, or

numbness in arms/legs . Most spinal injuries in diving incidents affect the cervical spine . Stabilize suspected injuries while the patient is still in the water .

Diving emergencies can be serious, occurring with or without gear . They are categorized into **descent**, **bottom**, and **ascent** emergencies .

- **Descent Emergencies**: Caused by increased pressure as a person dives deeper. Commonly affected areas are lungs, sinus cavities, middle ear, teeth, and area under the mask. Pain ("squeeze problems") usually forces divers to return to the surface to equalize pressure. Pain persisting after returning to the surface, especially in the ear, requires transport as a ruptured eardrum may have occurred. Cold water entering the middle ear through a ruptured eardrum can cause loss of balance and orientation. The diver may shoot to the surface, leading to ascent problems.
- **Bottom Emergencies**: Rarely occur and are usually due to faulty gear connections or accidental carbon monoxide in the air supply. They can cause drowning or necessitate rapid ascent.
- **Ascent Emergencies**: The most serious and often require aggressive resuscitation.
  - **Air Embolism**: The most dangerous and common scuba diving emergency. Air bubbles enter blood vessels. It happens when a diver holds their breath during rapid ascent. Air pressure in the lungs stays high while external pressure decreases, causing alveoli to rupture, potentially leading to pneumothorax or air embolism. Signs and symptoms include blotching of the skin, froth at the nose/mouth, severe pain in muscles/joints/abdomen, dyspnea/chest pain, dizziness, nausea, vomiting, difficulty speaking, cough, cyanosis, vision problems, paralysis/coma, irregular pulse, and cardiac arrest.
  - **Decompression Sickness** (The Bends): Gas bubbles (especially nitrogen) obstruct blood vessels. It results from rapid ascent, diving too long/deep, or repeated dives. Nitrogen breathed dissolves in blood and tissues. Complications include blockage of tiny blood vessels, depriving parts of the body of blood supply, and severe pain in tissues/spaces. Signs include abnormal joint pain causing the patient to "double up". Distinguishing between air embolism and decompression sickness can be difficult. Air embolism usually occurs immediately upon reaching the surface, while decompression sickness signs may appear hours later. Emergency treatment for both involves basic life support and recompression in a hyperbaric chamber.

7. Assessment and Management of Water-Related Emergencies

Assessment of diving and drowning emergencies begins with scene size-up and safety . Use standard precautions like gloves and eye protection . Never attempt a water rescue without proper training and equipment . Call for additional resources early . Consider trauma and spinal immobilization .

Assessment Steps for Water Emergencies
Scene Size-Up: Scene safety, standard precautions, call for additional resources, consider trauma/spinal immobilization, look for mechanism of injury indicators
Primary Assessment: Form general impression, assess chest pain, dyspnea, sensory changes (diving emergency), determine level of consciousness (AVPU), be suspicious of drug/alcohol use
Airway and Breathing: Open airway, assess breathing, consider spinal trauma, suction vomit, provide BVM ventilations if inadequate, high-flow oxygen for responsive patients, auscultate breath sounds
Circulation: Difficult to find pulse, begin CPR/AED, evaluate for shock/perfusion, assess for bleeding if trauma suspected
Transport Decision: Always transport to hospital, inhalation of any fluid can cause delayed complications, decompression sickness/air emboli need recompression chamber
History Taking: Investigate chief complaint, medical history, injury-specific signs/symptoms, pertinent negatives, depth/duration/time of dive, previous diving activity
Secondary Assessment: Examine lungs/breath sounds (responsive), look for hidden life threats/trauma (unresponsive), check for decompression sickness/air emboli, signs of hypothermia, peripheral pulses, skin color/discoloration/itching/pain/paresthesia
Vital Signs: Check pulse rate/rhythm/quality (peripheral and central), listen for heartbeat, check respiratory rate/quality/rhythm, listen for lung sounds, assess pupil size/reactivity, oxygen saturation (may be false low)

Reassessment: Repeat primary, monitor for deterioration, assess mental status/vitals every 5 minutes, document circumstances (submersion time, water temp/clarity, spinal injury possibility), bring dive equipment to hospital

Emergency care for drowning or diving emergencies starts with rescue and removal from water . Immobilize and protect the spine if a fall or diving injury is suspected . Artificial ventilation should begin as soon as possible, even before leaving the water . Remove vomit from the airway . Assist ventilations with BVM or pocket mask . Provide chest compressions and use the AED if in cardiac arrest . Administer oxygen if the patient is breathing spontaneously . Treat for hypothermia .

For conscious patients suspected of air embolism or decompression sickness: Remove from water and keep calm . Administer oxygen and consider pneumothorax . Monitor breath sounds . Provide prompt transport to the emergency department or nearest recompression facility . Treat hypothermia from cold water immersion the same way as hypothermia from cold exposure . **Breath-holding syncope** in shallow water can lead to loss of consciousness due to decreased stimulus for breathing and results in drowning . Treatment is the same as for a drowning patient .

Prevention is key . Pools should be fenced, and lack of adult supervision is a common cause of child drownings . Alcohol is associated with half of teenage and adult drownings .

8. High Altitude Sickness

Dysbarism injuries are caused by differences between atmospheric pressure and gas pressure in body tissues, fluids, and cavities . **Altitude sickness** occurs when unacclimated people are exposed to diminished oxygen pressure at high altitudes . Illnesses affect the central nervous and pulmonary systems . They range from **acute mountain sickness** to **high altitude cerebral edema (HACE)** and **high altitude pulmonary edema (HAPE)** .

- **Acute Mountain Sickness**: Can occur above 5,000 feet due to diminished oxygen pressure and hypoxia. It results from ascending too high, too fast, or not being acclimated. Signs and symptoms include headache, light-headedness, fatigue, loss of appetite, nausea, difficulty sleeping, shortness of breath during exertion, and possibly a swollen face. Treatment is stopping the ascent and descending.

- **High Altitude Pulmonary Edema (HAPE)**: Can happen above 8,000 feet. Fluid collects in the lungs, hindering oxygen passage into the bloodstream. Signs and symptoms include shortness of breath, a cough with pink sputum, cyanosis, and rapid pulse.
- **High Altitude Cerebral Edema (HACE)**: Can happen above 12,000 feet and may accompany HAPE. It can quickly become life-threatening. Signs and symptoms include a severe, constant, throbbing headache, lack of muscle coordination and balance, extreme fatigue, vomiting, and loss of consciousness.

Treatment for HAPE and HACE involves descending to a lower altitude, providing oxygen, and rapid transport . Provide positive pressure ventilation with a BVM for inadequate respirations . CPAP may help patients with respiratory distress from HAPE .

9. Lightning Strikes

An estimated 25 million cloud-to-ground lightning strikes occur annually in the US . Lightning is the fifth most common cause of death from isolated environmental phenomena . Direct strikes target those in outdoor activities or large open areas . Many are indirectly struck near a struck object . The cardiovascular and nervous systems are most commonly injured . Respiratory and cardiac arrest are the most common causes of lightning-related deaths . Tissue damage usually occurs over the skin as the strike duration is short . Skin burns are typically superficial .

Categories of Lightning Strikes	**Characteristics**
Mild	Loss of consciousness, amnesia, confusion, tingling, non-specific signs, superficial burns
Moderate	Seizures, respiratory arrest, dysrhythmias (resolve spontaneously), superficial burns
Severe	Cardiopulmonary arrest

Emergency care and treatment: Protect yourself from being struck . Move the patient to a sheltered area . Use **reverse triage**: prioritize anyone in cardiac or respiratory

arrest first . Stabilize the spine and open the airway with a jaw thrust . If pulses are present, assist ventilation . If in cardiac arrest, use the AED as soon as possible . Control bleeding and transport . Patients with signs/symptoms but no obvious life threats should be transported for evaluation .

10. Bites and Envenomations: Spiders and Insects

In the US, only the **female black widow** and the **brown recluse spider** deliver serious, life-threatening bites .

Characteristics of Venomous Spiders in the US	**Black Widow**	**Brown Recluse**
Size	~2 inches (legs extended)	~1 inch long
Color	Usually black	Dull brown
Markings	Bright red/orange hourglass on belly	Violin-shaped mark (brown to yellow) on back
Habitat	Dry, dim places around buildings, wood piles, debris	Dark areas like corners of old buildings, under rocks, wood piles
Bite Pain	Sometimes overlooked (site may become numb), but usually causes localized pain	Not painful at first, becomes so within hours
Venom Type	Neurotoxic (nerve tissue damage)	Cytotoxic (severe local tissue damage)
Local Effects	Localized pain, agonizing muscle spasms (especially in abdomen)	Swelling, tenderness, pale/mottled/cyanotic center, possibly small blisters. Scab forms, creating a large ulcer.

Systemic Symptoms	Dizziness, sweating, nausea, vomiting, rashes, chest tightness, difficulty breathing, severe cramps. Usually subside in 48 hours.	Rarely cause systemic symptoms.
Antivenom	Available, reserved for severe bites due to side effects	Not mentioned as a common treatment
High-Risk Groups	Older people, children < 5	Not specified as distinctly different from general population
Emergency Care	BLS for respiratory distress, rapid transport, bring spider if possible	BLS, rapid transport, bring spider if possible

Stings from **bees, wasps, yellow jackets, and ants** are usually painful but not a medical emergency . Remove the stinger and venom sac by scraping with a firm edge . Use ice packs for pain control . Anaphylaxis can occur if the patient is allergic . Signs of anaphylaxis include flushed skin, low blood pressure, difficulty breathing, wheezes, hives, or swelling of the throat/tongue . Be prepared to assist with an EpiPen auto-injector and support airway/breathing .

11. Bites and Envenomations: Snakes and Scorpions

Snake bite fatalities in the US are rare, about 15 per year . Only 19 of approximately 115 native US species are venomous . Venomous species include rattlesnakes, copperheads, cottonmouths (pit vipers), and coral snakes . Snakes usually bite when provoked or accidentally injured, except for the aggressive cottonmouths . Protect yourself with caution and proper gear . One-third of bites from venomous snakes don't result in significant injury . Venomous snakes have hollow fangs that inject poison . Poisonous snake bites typically leave **two small puncture wounds** with discoloration, swelling, and pain . Non-venomous snakes leave a horseshoe of tooth marks . Fang marks indicate a poisonous bite .

- **Pit Vipers**: Include rattlesnakes, copperheads, and cottonmouths. They have triangular, flat heads and heat-sensing pits near their nostrils. Fangs are hollow teeth connected to venom sacs.
  - **Rattlesnakes**: Most common pit viper, often with diamond patterns, can grow large.
  - **Copperheads**: Two to three feet long, red copper color with brown/red bands. Inhabit wood piles and abandoned dwellings. Account for most venomous bites in the eastern US. Bites are rarely fatal but venom causes significant tissue damage in extremities.
  - **Cottonmouths** (Water Moccasins): About four feet long, olive brown with black bands. Aggressive water snakes. Fatalities are rare, but tissue destruction can be severe.
  - **Signs of Pit Viper Envenomation**: Severe burning at the site followed by swelling and blue discoloration (ecchymosis) within 5-10 minutes, spreading over 36 hours. Venom interferes with clotting, causing bleeding at distant sites. Other symptoms may include weakness, nausea, vomiting, sweating, fevers, fainting, vision problems, altered consciousness, and shock if swelling occurs. Mark the edges of swelling with a pen.
  - **Treatment for Pit Viper Bites**: Calm the patient and place in a supine position. Clean the bite area. Apply ice. Consider pressure immobilization bandage on an arm/leg. Keep the affected extremity below the heart. Be alert for anaphylaxis and treat with Epi auto-injector if appropriate. Do not give anything by mouth. Be alert for vomiting. If bitten on the trunk, keep supine and quiet, transport quickly. Monitor vital signs and mark swelling progression. Treat for shock if signs appear. Bring the killed snake or a photo. Notify the hospital and describe the snake. Transport appropriately. If no envenomation signs, perform BLS, apply a sterile dressing, and immobilize the site. All suspected snake bite patients should go to the ED. Treat the wound like a deep puncture to prevent infection.
- **Coral Snakes**: Small reptiles with bright red, yellow, and black bands around the body. "Red on yellow will kill a fellow, red on black, venom will lack" helps identify venomous coral snakes. They inject venom by chewing, leaving puncture or scratch wounds. Due to small mouth/teeth, they usually bite small areas like fingers/toes. Venom is a powerful neurotoxin causing nervous system paralysis. Within hours, bizarre behavior and progressive paralysis of eye movements and respiration can occur. Successful treatment relies on snake identification and respiratory support. Antivenom is available but not widely stocked. Emergency care is the same as for a pit viper bite.

Scorpions are arachnids with a venom gland and stinger . They are rare in the US, mostly in the Southwest deserts . With one exception, stings are painful but not dangerous, causing localized swelling/discoloration . A specific type of scorpion's venom can cause severe systemic reactions: circulatory collapse, severe muscle contractions, excessive salivation, hypertension, convulsions, and cardiac failure . Notify medical control, administer BLS, and transport rapidly if this type of sting is suspected .

12. Bites and Envenomations: Ticks and Marine Animals

Ticks are tiny insects that attach to the skin . Found in brush, shrubs, trees, sand dunes, and on animals . Bites are not painful, but infectious diseases can spread through tick saliva .

Diseases Transmitted by Ticks	**Characteristics**
Rocky Mountain spotted fever	Occurs 7-10 days after bite. Symptoms: nausea, vomiting, headache, weakness, paralysis, cardiorespiratory collapse.
Lyme disease	Reported across the US except Hawaii. First symptoms: fever, flu-like symptoms, bull's-eye rash spreading over days/weeks. Painful joint swelling (especially knees) can occur and may cause permanent disability if untreated. Responds to prompt antibiotic treatment. Most common in summer.

Provide supportive care and transport . If access to care is delayed, remove the tick by grasping the head with fine tweezers and pulling straight out . Clean the area with antiseptic and save the tick for identification . Do not handle the tick with fingers . Patients should follow up with a healthcare provider .

Marine animal envenomations are common . Stinging cells (nematocysts) are found in fire coral, Portuguese man-of-war, sea wasps, sea nettles, true jellyfish, sea anemones, and coral . Signs and symptoms include painful red lesions, lesions extending in a line, headache, dizziness, muscle cramps, and fainting . Treatment: Remove from water . Scrape off tentacles with a stiff object like a credit card . Do not

manipulate remaining tentacles . Treat for anaphylactic shock if a systemic allergic reaction occurs . Give BLS and transport immediately .

Toxins from spines of **sea urchins, stingrays, and spiny fish** (lionfish, scorpion fish, stone fish) are heat sensitive . Treatment: Immobilize the affected area and soak in hot water for 30 minutes . Transport the patient . Be familiar with local marine life if working near the ocean .

General emergency treatment for marine envenomations: Limit further discharge by avoiding fresh water, wet sand, showers, or careless handling . Keep the patient calm and reduce motion of the affected extremity . Remove remaining tentacles by scraping . Immersion in vinegar may help alleviate symptoms . Provide transport to the emergency department .

13. Conclusion and Review

This chapter covered environmental emergencies, including cold exposure, hypothermia, frostbite, heat emergencies, drowning, diving emergencies, and lightning strikes . Review questions help reinforce understanding of heat loss mechanisms, indicators of hypothermia, rewarming techniques, treatment for local cold injuries, management of heat emergencies, and recognizing diving-related conditions . The concept of reverse triage in lightning strikes is also reviewed, prioritizing those in cardiac arrest . Understanding these environmental emergencies and their appropriate management is crucial .