Rescue Awareness and Operations

- **Rescue work requires training and expertise so that medical and mechanical skills are carefully balanced.**
  - Helps to ensure that patients receive both effective treatment and timely extrication
  - Success of any rescue depends on a coordinated effort between medical care and specialized rescue efforts

- **Role of the Paramedic in Rescue Operations** (cont.)
  - Primary role of paramedic in rescue operations is to have proper training and appropriate personal protective equipment (PPE) that allow for safe access to the patient and treatment at the site and throughout the incident.
    - Have the following abilities:
    - Understand the rescue process and know when certain techniques are indicated or contraindicated.
    - Be skilled in patient packaging techniques to allow safe and efficient extrication and medical care.

- **Safety**
  - Paramount because of the potential for associated risks.
    - Initial scene assessment for hazards, use of personal protective measures, and constant monitoring throughout the operation are essential for every rescue response.

- **Safety** (cont.)
  - The priorities for safety in any rescue are:
    - Personal safety
    - Safety of the crew
    - Safety of the bystanders
    - Rescue of the trapped and injured

- **Phases of a Rescue Operation**
  - A rescue operation has seven phases:
    - Arrival and scene size-up
    - Hazard control
    - Gaining access to the patient
    - Medical treatment
    - Disentanglement
    - Patient packaging
    - Transport
  - Do not enter a scene until it has been secured and made safe by trained personnel.

- **Arrival and Scene Size-up**
  - The first phase of a rescue is the arrival and scene size-up.
    - Requires the paramedic to determine what is needed at a specific emergency event
    - Involves quickly gathering facts about the situation, analyzing the problems, and determining the appropriate response
    - EMS crew must focus on concerns

- **Arrival and Scene Size-up** (cont.)
  - Scene size-up is an ongoing evaluation of the emergency scene.
  - **Response**
    - En route, the EMS crew and the dispatcher should gather as much detail about the situation as possible.
    - Weather conditions can affect rescue attempts, the patient's status, and the need to expedite the operation.

- **Arrival and Scene Size-up** (cont.)
  - Standardized dispatch protocols guide the initial emergency response.
    - This predetermined system is based on the level of the reported emergency.
  - **Other Factors**
    - Other factors to be considered in determining the type of response needed are the description of the scene and the time of day.
    - An emergency in a highly populated area may call for special vehicles and equipment for extrication and fire suppression.

- **Arrival and Scene Size-up** (cont.)
  - **Resources**
    - The ability to assess an emergency quickly and correctly requires preplanning as well as the development of a systems approach to response.
    - Available resources are a crucial part of any response, because responding crew may not always have the personnel, training, or expertise to handle event.

- **Hazard Control**
  - Phase of rescue in which on-scene dangers are quickly identified and managed by the first-arriving crew.
    - Involves minimizing risks from uncontrollable hazards, making sure the scene is as safe as possible, and ensuring that all personnel are equipped with PPE appropriate for the incident

- **Gaining Access to the Patient**
  - Ability to rapidly access an ill or injured patient who requires extrication or rescue can be crucial to the patient's eventual outcome.
    - Determine the best method of reaching patient, deploy appropriate personnel to the patient, and stabilize the patient's physical location.

- **Gaining Access to the Patient** (cont.)
  - Specialty rescue tools and equipment can cause injuries.
    - Least amount of force needed, clear area of unnecessary people.
    - Remain alert to stress of operation on rescuers as well as potential safety hazards for bystanders and victims.
  - Paramedics have the chief responsibility for patient care.

- Hydraulic Rescue Tools

- **Medical Treatment**
  - After the team has gained access to the patient, medical treatment can begin.
    - May be able to initiate some stabilization procedures, such as spinal immobilization, airway management, oxygen administration, and intravenous (IV) fluid therapy.

- **Disentanglement**
  - Involves making a pathway through wreckage of an incident and removing wreckage from patient.
    - The main responsibilities are to release the patient from entrapment and to perform a risk–benefit analysis.
    - Driven by the needs of the patient.
    - Disentanglement often is time-consuming

- **Patient Packaging**
  - Stabilizing a patient physically and preparing the person for transport is known as patient packaging.
  - It is the paramedic's responsibility to ensure the patient is ready to be removed from the scene.
  - For minimum packaging for transport, the patient's airway and cervical spine must be stabilized, IV lines and oxygen tubing must be secured, and spinal motion restriction should be employed when indicated.

- **Patient Packaging** (cont.)
  - Use of other patient care equipment should be considered as the patient is removed from the area of entrapment.
  - During disentanglement and patient packaging, the paramedic should consider the patient's emotional needs.

- **Transport**
  - If transported immediately, a wheeled stretcher, basket stretcher, scoop stretcher, soft stretcher, or long backboard should be available.
    - Ambulance should be appropriately warmed or cooled, based on the patient's needs and setting.
  - The rescue is considered complete once the patient is en route to the hospital.

- **PPE for EMS personnel historically has been adapted from other fields (e.g., the fire service).**
  - Standards for protective clothing and PPE established by the NFPA1 and the federal Occupational Safety and Health Administration (OSHA) have been adopted by many fire and EMS agencies, including a number of municipal and industrial fire services throughout the United States.

- **PPE for EMS personnel historically has been adapted from other fields (e.g., the fire service).** (cont.)
  - Boots with steel insoles and steel toe protection
    - Adequate protection depends on the level of rescuer involvement and the nature of the incident.

- **Personal Protection from Bloodborne Pathogens**
  - OSHA established criteria for workplace protection from bloodborne and airborne diseases.
  - Measures should be observed whenever the potential exists for exposure to a patient’s body fluids or to communicable diseases.

- Surface water rescue is the rescue of a patient who is afloat on the surface of a body of water.
  - Water rescue is very dangerous and requires special training and skills
    - Should never be attempted by a single rescuer

- **Obstructions to Flow**
  - Water that moves over a uniform obstruction can create recirculating currents (“drowning machines”) that can trap victims and make escape difficult.
  - Strainers are obstructions (e.g., trees, grating wire, mesh) that allow current to flow through but can trap objects such as boats or people.
    - The force of the water against the victim makes escape difficult.

- **Foot or Extremity Entrapment**
  - Generally considered unsafe to walk in fast-moving water that is more than knee-high in depth.
    - If a foot or extremity entrapment, it is crucial to remember that the body part must be extricated in the same way it became trapped.

- **Flat Water**
  - Approximately 3,500 deaths occur each year in the United States in flat (static) water (e.g., lakes, ponds, marshes) as a result of drowning.
    - Factors that contribute to these deaths include alcohol or other drug use as well as a cool water temperature, which can lead to hypothermia.

- **Flat Water** (cont.)
  - Most people who drown never planned on being in the water.
    - For all responders, PFDs are required during water rescue operations.
    - Type I or type II PFDs are preferred for water rescue work, while specialty types III, IV (not worn by responders, but used in the rescue), and V are suitable for some rescue situations.

- **Water Temperature**
  - Immersion in water with a temperature less than 98°F (36.7°C) can cause hypothermia.
    - Water causes heat loss 25 times faster than does exposure to air at the same temperature.
  - Sudden immersion in cold water may trigger laryngospasm, can lead to aspiration, severe hypoxia, and unconsciousness.
    - In water cold enough to produce reflexive gasping termed cold shock, loss of hand coordination may occur within 60 seconds and loss of the ability to use arms within 5 minutes.

- **Cold-Protective Response**
  - The cold-protective response, also known as the mammalian diving reflex increases a person's chance of survival in cold water.
    - This protective response includes parasympathetic stimulation from immersion of the face in cold water.
    - This leads to bradycardia, peripheral vasoconstriction that shunts blood to the core, and hypotension.
    - The effectiveness of this protective response depends on the person's age, posture in the water, and lung volume, as well as the water temperature

- **Cold-Protective Response** (cont.)
  - The rapid development of hypothermia some-times can improve brain viability in patients who suffer prolonged submersion.

- **Rescue Versus Body Recovery**
  - Rescue versus body recovery refers to the chance to save a human life (rescue) versus recovering a body without the goal of saving a human life.
    - In addition to temperature, other factors affect the outcome of a patient who has been submerged in water: the length of time the victim has been submerged, known or possible trauma, environmental conditions, the victim's age and physical condition, and the time until rescue or removal is achieved.

- **In-Water Spinal Immobilization**
  - Routine stabilization of the cervical spine is indicated only in patients with a known or suspected mechanism of injury
    - Only rescuers trained in water rescue should enter the water.
    - General guidelines include providing manual support of the patient's head in a neutral position and limiting angular movement, providing rescue breathing if indicated and if it does not delay removal of the patient from the water, placing a buoyant backboard under the patient, securing the patient with straps, and rapidly extricating the patient from the water.

- **Overview of Rescue Techniques**
  - As previously stated, rescuers should never underestimate the power of moving water.
    - They should never attempt water rescue without highly specialized training.
    - Recommended water rescue model:
      - Reach
      - Throw
      - Row
      - Go

- **Self-Rescue Techniques**
  - If paramedics inadvertently enter dangerous water, they should use self-rescue techniques as follows:
    - Cover your mouth and nose during entry.
    - Protect your head and keep your face out of the water.
    - If in flat water, assume the HELP position.
    - If in moving water, do not attempt to stand up.
    - Float on your back with your feet downstream and your head pointed toward the nearest shore at a 45° angle.

- Hazardous atmospheres are oxygen-deficient environments that may occur in confined spaces.
  - Confined spaces have limited access or egress and are not designed for human occupancy or habitation.

- **Hazards Associated With Confined Spaces**
  - According to OSHA, there are six major hazards associated with confined spaces:
    - Oxygen-deficient atmospheres
    - Chemical/toxic exposure or explosion
    - Engulfment
    - Machinery entrapment
    - Electricity
    - Structural concerns.

- **Oxygen-Deficient Atmospheres**
  - Not a visible hazard, so rescuers must not presume that an atmosphere is safe based on the appearance of the air
    - May be displaced by other neutral or toxic gases that are also colorless and often odorless—and, therefore, undetectable by human senses

- **Chemical/Toxic Exposure or Explosion**
  - Oxygen can be removed from the atmosphere by certain chemical reactions.
    - They also may pose a high risk of explosion.
    - Some dusts and particulate materials found in grain bins, silos, and storage tanks can be highly explosive when mixed with air.

- **Engulfment**
  - Mechanical entrapment can occur when earth, grain, coal, or any other dry material that can flow engulfs a person in a confined space.
    - Engulfment can lead to an oxygen-deficient atmosphere and subsequent suffocation.
    - In addition, those trapped by engulfment may be victims of physical (crushing) injury

- **Machinery Entrapment**
  - Some structures, such as grain bins and silos, have augers, screws, conveyors, and other machinery to move the material stored in them.

- **Electricity**
  - Electrical hazards from the power supply of motors and materials-management equipment may be present in some situations.
- **Structural Concerns**
  - The supporting structures of a confined space must be identified before rescuers' entry to ensure safe rescue and extrication.

- **Crush Compartment Syndromes Secondary to Entrapment**
  - Compartment syndrome can be caused by crushing mechanisms, which lead to ischemic muscle damage, tissue necrosis, and crush syndrome.
    - These injuries are associated with rupture of internal organs, major fractures, and hemorrhagic shock.
    - Massive crush injury to vital organs may cause immediate death.

- **Crush Compartment Syndromes Secondary to Entrapment** (cont.)
  - Patients with crush syndrome of significant duration are victims of compressive forces that crush tissue, causing prolonged hypoxia.
    - The patient may appear stable for hours or days, as long as the compressive forces remain in place.
    - When the patient is released from the entrapment, however, the reperfusion of the trapped body part may lead to detrimental processes.
    - These events occur simultaneously and may ultimately lead to death.
    - If the patient's condition or the mechanism of injury is suspicious for compartment syndrome or crush injury, the paramedic should consult with medical direction.

- **Emergencies in Confined Spaces**
  - OSHA requires a permit to be issued before workers may enter a confined space.
    - Sites without permits at which no atmospheric monitoring is performed are likely locations for emergencies.
    - At these sites, rescuers often may en-counter oxygen-deficient atmospheres.
    - Other types of emergencies can occur in confined spaces.

- **Safe Entry for Rescuers**
  - Safe entry for rescuers in a confined-space operation requires specialized training.
    - Safe entry cannot be made without measures being put in place.

- **Safe Entry for Rescuers** (cont.)
  - Supplied-Air Breathing Apparatus.
    - Close quarters make access and extrication difficult
    - Use of the typical “bottle on back” self-contained breathing apparatus (SCBA) is not practical
    - Supplied-air (air-line) breathing apparatus (SABA) is preferred
  - Lightweight devices provide a nearly unlimited supply of air from a device located outside the confined space, along with an “escape bottle”
  - Potential complications include equipment malfunction, damaged or entangled air lines, and limitations imposed by the length of the air hose.

- **Arriving at the Scene**
  - An EMS crew that arrives at the scene of a confined-space emergency should proceed as follows:
    - Perform a scene size-up and determine the nature of the emergency Request specialized rescue teams.
    - Establish a safe perimeter away from the incident.
    - Assist workers at the site with any remote retrieval devices they may be using without entry into the confined space.

- **Rescue From Trenches and Cave-Ins**
  - Most trench collapses occur in trenches less than 12 feet (4 m) deep and 6 feet (2 m) wide.
    - Federal law requires either shoring or a trench box for evacuations that are 5 feet (3 m) or deeper.
    - Often these types of collapses occur when contractors forsake safety measures because of the increased cost of providing them.
    - Various factors can contribute to collapse

- **Arrival at the Scene**
  - On arrival at the scene of a collapse that has resulted in burial, paramedics keep in mind that a second collapse is likely and should not approach the lip.
    - Should not attempt a rescue unless the trench is less than waist deep
  - Access to the patient should be attempted by trained personnel only after proper shoring is in place.

- Traffic flow is a major hazard in EMS highway operations.
  - Factors associated with highway hazards include emergency responses to limited- and unlimited-access highways, emergency vehicle crashes, and the backup of traffic that impedes flow to and from the scene.
  - Position an apparatus (pumper, rescue, or other emergency vehicle) across the traffic direction in the fend-off position (a vehicle angled toward the opposing traffic to protect the scene and deflect drivers away from the incident).

- **Fuel and Fire Hazards**
  - Gasoline spills from crashes are a common fire hazard encountered by EMS providers.
  - The vehicle involved in the incident should be put in park, and the engine stopped immediately after gaining access to it. Disconnecting of the battery needs to be evaluated for each accident.

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- **Fuel and Fire Hazards** (cont.)
  - Vehicle fires associated with crashes usually are caused by ruptured fuel tanks and fuel lines ignited during the crash.
    - If the victims are trapped and the vehicle is not fully engulfed by flames, an attempt should be made to stop the fire from spreading, by using fire extinguishers.

- **Fuel and Fire Hazards** (cont.)
  - Burning vehicles present very serious potential hazards.
    - May explode with deadly force at any time.

- **Alternative Fuel Systems**
  - Some vehicles operate with alternative fuel systems.
    - Examples include cars that are powered by natural gas, high-voltage electrical storage cells, ethanol and flex fuel, biodiesel, and dimethyl ester.
    - Hybrid vehicles

- **Alternative Fuel Systems** (cont.)
  - Each vehicle manufacturer has specific guidelines for emergency personnel to follow when working at a crash scene involving a vehicle using an alternative fuel.
  - Always assume the vehicle is powered up
    - High-voltage capacitors can store a voltage current for up to 10 minutes, even after the vehicle is shut down.
    - Never touch, cut, or open any orange cable or components protected by orange sleeves. Always consider a high-voltage cable to be live or hot.

- **Electrical Power**
  - Downed electrical wires are dangerous in any setting, including highway operations.
    - Modern transformers are programmed to retest broken circuits at certain time intervals, so the supposedly “dead” lines can suddenly surge with lethal current.
    - Only utility workers and trained rescuers using proper equipment should secure downed electrical wires.

- **Electrical Power** (cont.)
  - Never approach patient until the scene is safe.
    - Rescuers who experience tingling sensations in the soles of the feet, legs, or thorax as they enter an area should not proceed, but rather should retreat from the area.
    - Victims inside a vehicle that is in contact with downed wires should be advised to remain inside unless they are at additional risk of injury

- **Electrical Power** (cont.)
  - When absolutely necessary to touch a patient in contact with a source of electricity, trained personnel may use nonconductive equipment such as leather gauntlets, wooden poles, polypropylene rope, and other specially designed equipment.
    - None of these measures provides absolute safety from electrical injury.

- **Unstable Vehicles**
  - Unstable vehicles are a common hazard in rescue events.
    - All unstable vehicles must be stabilized before access is gained.
  - Even a car on its wheels that appears to be stable may be unstable from possible movement of the tires and swaying of the vehicle’s suspension system.

Vehicle stabilization with a strut

Equipment used to stabilize vehicles

- **Unstable Vehicles** (cont.)
  - Standard methods of stabilizing vehicles include supporting the vehicle with wooden cribbing, wheel chocks, and air bags, and securing the vehicle with ropes, cables, and chains to poles, trees, and other vehicles and structures
    - Specialized training is required.

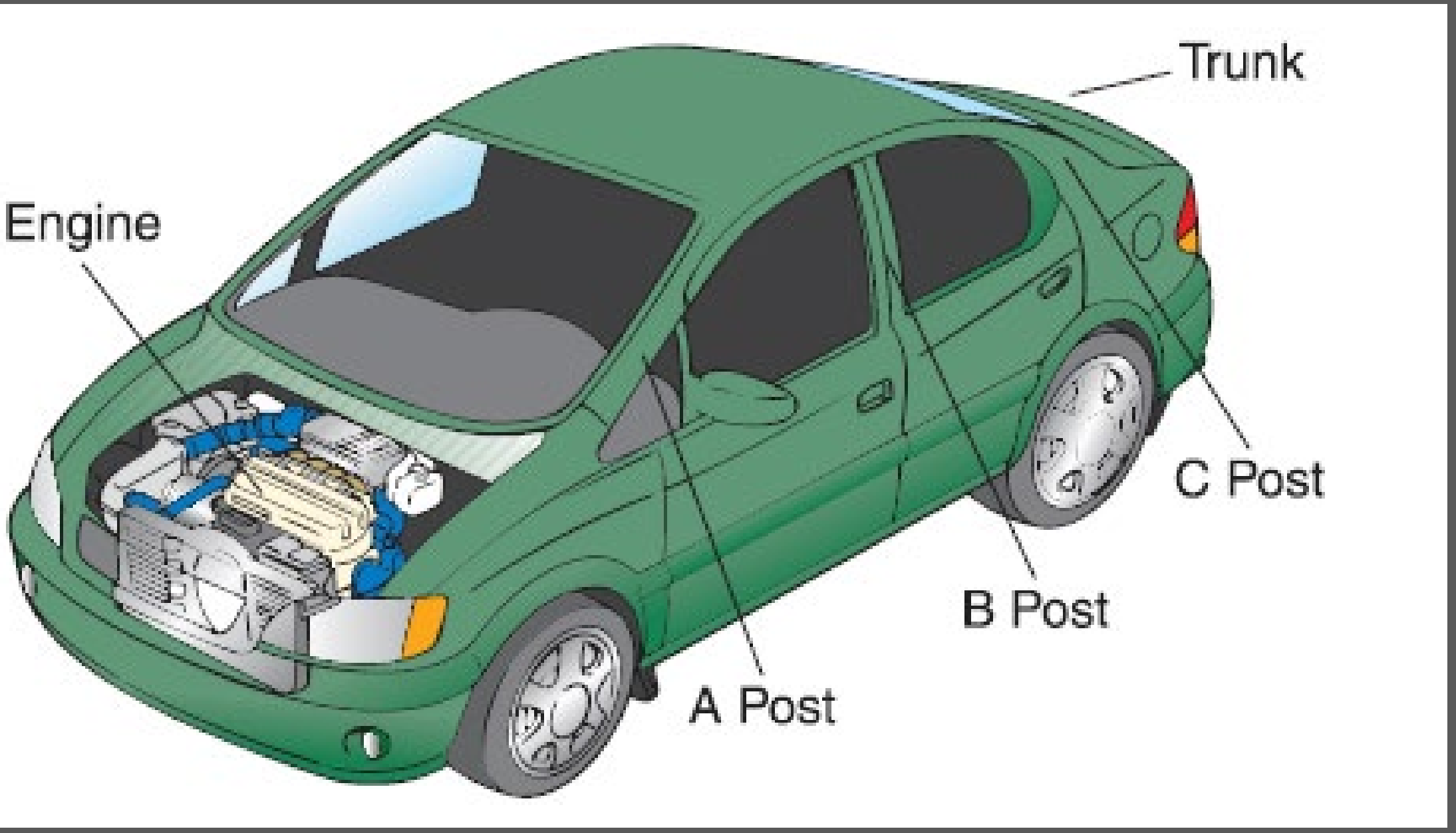
- **Unstable Vehicles** (cont.)
  - Standard methods of stabilizing vehicles include supporting the vehicle with wooden cribbing, wheel chocks, and air bags, and securing the vehicle with ropes, cables, and chains to poles, trees, and other vehicles and structures
    - Specialized training is required.

- **Airbags and Supplemental Restraint Systems**
  - Airbags that serve as a supplemental restraint system are required safety features in all cars manufactured in the United States.
    - Three main types of airbags are frontal-impact, side-impact, and head protection bags.

- **Airbags and Supplemental Restraint Systems** (cont.)
  - Once deployed, airbags are not dangerous, although they do produce a residue that can cause minor, temporary skin or eye irritation.
    - This irritation can be avoided.
  - Emergency personnel should be trained in detection of supplemental restraint systems and management of these scenes.

- **Hazardous Cargoes**
  - Most hazardous substances transported in the United States travel by road, so paramedics should be suspicious of crashes that involve commercial vehicles.
    - Methods can be used to identify carriers of hazardous cargoes.
      - Examples:
        - United Nations class identification number
        - North American number [UN/NA number]
        - Placards

- **Vehicle Anatomy**
  - Vehicle rescue operations require a basic understanding of the anatomy of vehicles
    - Several important features
      - Construction, roof, and support posts.
      - Firewall and engine compartment.
      - Glass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- **Vehicle Anatomy** (cont.)
  - Doors
    - Most car doors contain a reinforcing bar; thus, they are designed to provide structural integrity to the vehicle and protection to the occupants during front-impact and side-impact collisions.
    - Doors also have a case-hardened steel “Nader” pin or latch that is designed to prevent car door from opening during impact.

- **Vehicle Anatomy** (cont.)
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- **Rescue Strategies**
  - Rescue strategies for vehicle crashes should be.g.in during the initial scene size-up.
    - Sometimes based on the details provided by dispatching center before arrival.
    - On arriving at the scene, be.g.in hazard control, establish command, and call for appropriate backup.

- **Rescue Strategies** (cont.)
  - Assess the degree of entrapment and determine the fastest means of extrication.
  - Paramedics involved in the rescue or who are near the site should wear PPE that provides adequate hand, eye, and body protection.
    - Clothing with reflective striping improves safety during day and night operations

- Hazardous terrain can pose major difficulties during rescue operations.
  - Low angle, high angle, and flat terrain with obstructions
    - Highly specialized training and equipment are required for rescues in both low-angle (weight supported by ground) and high-angle (weight supported by rope) environments.

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- Hazardous terrain can pose major difficulties during rescue operations. (cont.)
  - Term low angle (steep slope) refers to terrain that can be walked on without the use of the hands.
  - The term high angle (vertical) typically describes terrain that is so steep the hands must be used to maintain balance
    - This terrain has a slope of more than 60°

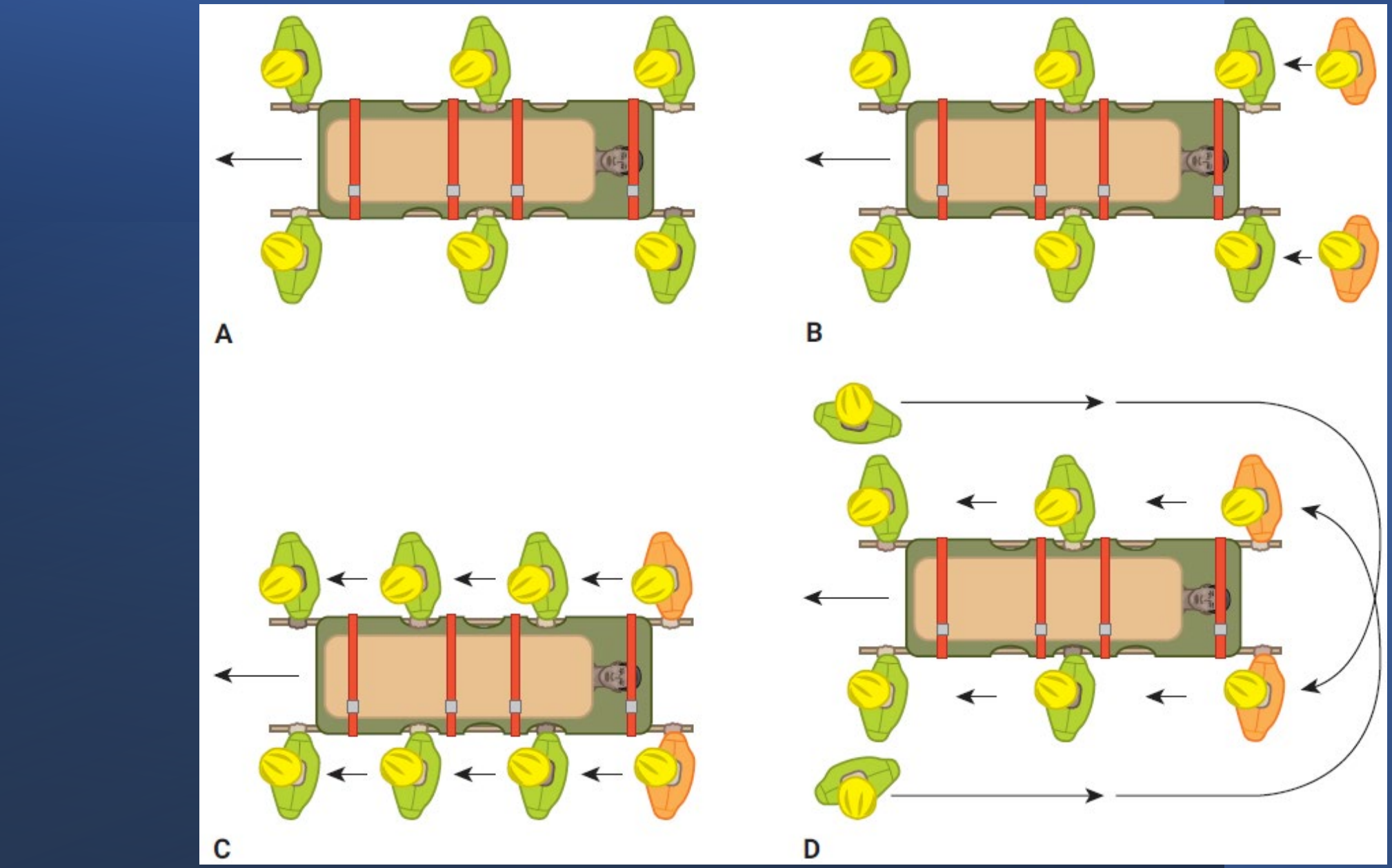
- Hazardous terrain can pose major difficulties during rescue operations. (cont.)
  - Rescuers are completely dependent on rope or aerial apparatus for litter movement.
    - High-angle rescue may require rappelling by trained personnel to retrieve victims.
  - Flat-terrain rescue may include various obstructions that can make rescue difficult.
    - Level land with large rocks, loose soil (loose small rocks), and beds of water or creeks.

- **Patient Packaging With Litters**
  - The basket stretcher is the standard for rough-terrain evacuation.
    - The rigid frame of this device offers protection for the victim.
    - Relatively easy to carry with adequate personnel.
    - Patients generally are secured on a long backboard and strapped in the basket.

- **Patient Packaging With Litters** (cont.)
  - Basket stretchers have two basic designs:
    - Wire mesh (Stokes)
    - Plastic

- **Patient Movement**
  - Methods of moving may include evacuation and litter-carrying over flat terrain.
    - Special rescue equipment may be required for low-angle and high-angle evacuation.
    - Equipment may include load-lifting straps, anchors, and rope-lowering and rope-hauling systems.
    - Use of aerial apparatus may be required in some high-angle rescue operations.
    - Moving a patient during low-angle and high-angle evacuations requires specialized knowledge and skills.

- **Litter-Carrying Procedures**
  - Carrying a litter across rough, flat terrain requires a minimum of six rescuers: four to carry the litter and two to observe or “scout” for potential hazards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- **Helicopter Use in Hazardous-Terrain Rescue**
  - Used for transport and rescues.
    - When they are used for rescue, the helicopter team is geared toward performing the rescue rather than providing medical care and transport.
    - Special rescue techniques that these helicopters use may include cable hoisting to extract people from the ground and short-haul (sling load) operations that allow personnel and equipment to be carried beneath the helicopter as an external load.

Assessment Procedures During Rescue

- Patient assessment during rescue operations often is complicated by factors such as weather and temperature extremes, patient access challenges, equipment limitations, patient entrapment, and cumbersome PPE that affects rescuer mobility.

- **Specific Assessment and Management Considerations**
  - During rescues, paramedics may need to downsize the medical equipment they carry
    - In addition to ensuring adequate lighting to perform assessment and treatment, paramedics should have access to the equipment.

- **Exposure of Patients**
  - Patients who need to be rescued may be at high risk for developing hypothermia.
    - They should be covered to ensure thermal protection.

- **Advanced Life Support Measures**
  - Advanced life support (ALS) measures should be provided only if necessary.

- **Patient Monitoring**
  - Monitoring of the patient's vital signs and level of consciousness is necessary throughout
  - Paramedics should create and maintain a rapport with the patient when possible.

- **Improvisation**
  - Because of space and equipment limitations, some patient care may have to be improvised during a rescue.
    - Upper-extremity fracture can be temporarily stabilized by tying it to the patient's torso; a lower-extremity fracture can be tied to the patient's uninjured leg.

- **Pain Control**
  - Pain control for patients who require rescue may include drug therapy (sedatives, anxiolytics, analgesics, antiemetics) and other methods.