Chapter 37
Vehicle Extrication and Special Rescue

Unit Summary
After students complete this chapter and the related course work, they will be able to describe and apply, in context, EMS rescue operations to include vehicle extrication and its 10 phases. Additionally, they will be able to describe various specialized components of EMS operations to include tactical EMS, trench rescue, high-angle rescue, and the EMT’s role in these operations. The safety aspects of these operations and are also discussed.

National EMS Education Standards Competencies

EMS Operations
Knowledge of operational roles and responsibilities to ensure patient, public, and personnel safety.

Vehicle Extrication
- Safe vehicle extrication (pp 1368–1376)
- Use of simple hand tools (pp 1372–1376)

Knowledge Objectives
1. Explain the responsibilities of an EMT in patient rescue and vehicle extrication. (pp 1368–1370)
2. Discuss how to ensure safety at the scene of a rescue incident, including scene size-up and the selection of the proper personal protective equipment and additional necessary gear. (pp 1367–1372)
3. Provide examples of vehicle safety components that may be hazardous to both EMTs and patients following a collision, and explain how to mitigate their dangers. (pp 1367–1368)
4. Define the terms extrication and entrapment, and explain how they differ. (p 1368)
5. Describe the 10 phases of vehicle extrication and the role of the EMT during each one. (pp 1368–1376)
6. Discuss the various factors related to ensuring situational safety at the site of a vehicle extrication, including controlling traffic flow, performing a 360° assessment, stabilizing the vehicle, dealing with unique hazards, and evaluating the need for additional resources. (pp 1368–1371)
7. Describe the special precautions the EMT should follow to protect the patient during a vehicle extrication. (pp 1371–1376)
8. Explain the different factors that must be considered before attempting to gain access to the patient during an incident that requires extrication. (pp 1371–1373)
9. Discuss patient care considerations related to assisting with rapid extrication, providing emergency care to a trapped patient, and removing and transferring a patient. (pp 1373–1376)
10. Explain the difference between simple access and complex access in vehicle extrication. (pp 1372–1373)
11. Give examples of situations that would require special technical rescue teams, and describe the EMT’s role in these situations. (pp 1376–1380)

Skills Objectives
There are no skills objectives for this chapter.
I. Introduction

A. You will usually not be responsible for rescue and extrication.
   1. Rescue involves many different processes and environments.
   2. Rescue requires training beyond the EMT level.
   3. This chapter teaches basic extrication concepts.

II. Safety

A. Extrication requires mental and physical preparation.
   1. Consider the safety of yourself and your team.
      a. Safety begins with the proper mind-set and the proper personal protective gear.
   2. The equipment that you use and the gear that you wear will depend on the hazards you expect to encounter, as well as what you observe during your scene size-up.
      a. Protective gear may include:
         i. Turnout gear
         ii. Helmets
         iii. Hearing protection
         iv. Fire extinguisher
         v. Blood- and fluid-impermeable gloves
         vi. Leather gloves over disposable gloves

III. Vehicle Safety Systems

A. Vehicle safety systems can become hazards after a collision.
   1. Shock-absorbing bumpers may be compressed or "loaded" following a front- or rear-end collision.
      a. They can release and injure your knees and legs.
      b. Approach vehicles from the side.
   2. Manufacturers are required to install supplemental restraints or air bags in all new cars.
      a. Air bags fill with a nonharmful gas on impact and quickly deflate after the collision.
      b. Air bags are located in the steering wheel and the dash in front of the passenger.
         i. Additional air bags may be located in the doors or seats.
      c. Air bags should be deployed and deflated by the time you arrive.
         i. Air bags have occasionally inflated while EMTs provided care.
         ii. You should maintain at least 5” clearance around side impact air bags that have not deployed.
         iii. You should maintain at least 10” clearance around driver air bags that have not deployed.
         iv. You should maintain at least 20” clearance around passenger-side air bags that have not deployed.
      d. Use eye protection to protect your eyes from the cornstarch or talc that is used on air bags by manufacturers.

IV. Fundamentals of Extrication

A. Your primary concern is safety.
   1. Your primary roles are to:
      a. Provide emergency medical care.
b. Prevent further injury to the patient.
2. You may provide care as extrication goes on around you.
   a. Extrication is the removal from entrapment or from a dangerous situation or position.
   b. Entrapment is a term used when a person is caught within a closed area with no way out or has a limb or other body part trapped.
   c. For the purposes of this chapter, extrication means the removal of the patient from a wrecked vehicle.

B. Preparation
1. Preparing for an incident requiring extrication involves training for the various types of rescue situations your team may face.
2. Rescue personnel must routinely check the extrication tools and the response vehicle.
   a. Such preparations reduce the possibility of equipment failure at an emergency scene.

C. En route to the scene
1. Procedures and safety precautions similar to those in the phases of an ambulance call are used when responding to a rescue call.

D. Arrival and scene size-up
1. Position the unit at a safe location upon arrival.
   a. Activate emergency lights.
   b. At a hazardous materials incident, park uphill and upwind from the hazard.
2. Make sure the scene is properly marked and protected.
   a. Ensure the road is closed or traffic flow is diverted.
      i. Use cones, flares, or tape.
   b. It is a good idea to designate a traffic control person.
3. Look for passing cars before exiting your vehicle.
4. Size-up is the ongoing process of information gathering and scene evaluation to determine appropriate strategies and tactics to manage an emergency.
   a. Pay attention to downed electrical lines, leaking fluids, fire, and broken glass.
   b. It is important to identify any additional resources that will be needed.
      i. May include additional EMS units and personnel
5. Situational awareness is the ability to recognize any possible issues and act proactively to avoid a negative impact.
6. You can evaluate the hazards and determine the number of patients by doing a 360° walk-around of the scene.
   a. Look for the following:
      i. Mechanism of injury
      ii. Downed electrical lines
      iii. Leaking fuels or fluids
      iv. Smoke or fire
      v. Broken glass
      vi. Trapped or ejected patients
   b. Evaluate the need for additional resources such as:
      i. Extrication equipment
      ii. Fire suppression
      iii. Law enforcement
      iv. HazMat units
      v. Utility companies
      vi. ALS units
vii. Aeromedical transport

c. Look for spilled fuel and other flammable substances.
   i. Sometimes postcrash fires are started when sparks ignite spilled fuel.

d. An electrical short or a damaged battery may also cause a postcrash fire.

e. Rain, sleet, or snow can present an added hazard for rescue.

f. Crashes that occur on hills are harder to handle than those that occur on level ground.

g. Some crash scenes may present threats of violence.
   i. Intoxicated people or people who are upset may pose a threat to you or others.
   ii. Be alert for weapons.

7. Coordinate your efforts with rescue teams and law enforcement.
   a. Communicate with members of the rescue team throughout extrication.
      i. Start talking to the rescue team leader as soon as you arrive.
      ii. You become a member of the rescue team and will enter the vehicle and provide care for the patient(s) when approved by the extrication leader.

b. The rescue team is responsible for:
   i. Properly securing and stabilizing the vehicle
   ii. Providing safe entrance and access to the patients
   iii. Extricating any patients
   iv. Ensuring that patients are properly protected during extrication or other rescue activities
   v. Providing adequate room so that patients can be removed properly

c. EMS personnel are responsible for:
   i. Assessing and providing medical care
   ii. Triaging and assigning priority to patients
   iii. Packaging patients
   iv. Providing additional assessment and care as needed once patients are removed
   v. Providing transport to the emergency department

E. Hazard control

1. Law enforcement personnel are responsible for:
   a. Traffic control and direction
   b. Maintaining order at the scene
   c. Investigating the crash or crime scene
   d. Establishing and maintaining lines so that bystanders are kept at a safe distance and out of the way of rescuers

2. Fire fighters are responsible for:
   a. Extinguishing any fire
   b. Preventing additional ignition
   c. Ensuring scene safety
   d. Removing any spilled fuel

3. Downed electrical lines are a common hazard at vehicle crash scenes.
   a. Never attempt to move downed electrical lines.
   b. If power lines are close to a vehicle involved in a crash, instruct the patient to remain in the vehicle until power is removed.
   c. Remain in the safe zone, outside of the danger zone (hot zone).
      i. A hot zone is an area where individuals can be exposed to sharp metal edges, broken glass, toxic substances, lethal rays, or ignition or explosion of hazardous materials.
4. Family members and bystanders can become a hazard themselves.
   a. The rescue team will set up an off-limits danger zone.
      i. You should help set up and enforce this zone.

5. The vehicle also can be a hazard.
   a. An unstable automobile on its side or roof can be a danger to you.
      i. Rescue personnel can stabilize the car with a variety of jacks or cribbing.
   b. Ensure that the car is in park with the parking brake on and the ignition turned off.
      i. The battery should also be disconnected, negative side first, to minimize the possibility of sparks or fire.

6. Alternative fuel vehicles
   a. Vehicles may be powered by electricity and electricity/gasoline hybrids, or fuels such as propane, natural gas, methanol, or hydrogen.
      i. One common feature is the need for responders to disconnect the battery to prevent further fire or explosion.
      ii. In more than 40% of today’s alternative fuel vehicles, the batteries are located in the truck or under the seats, not in the engine compartment.
      iii. There may be more than one battery present.

F. Support operations
   1. Support operations include:
      a. Lighting the scene
      b. Establishing tool and equipment staging areas
      c. Marking helicopter landing zones
   2. Fire and rescue personnel will work together on these functions.

G. Gaining access
   1. Gaining access to the patient is a critical phase of extrication.
      a. Make sure that the vehicle is stable and hazards are controlled.
      b. Check with the rescue leader and enter the scene only after these conditions are met.
   2. The exact way to gain access to a patient depends on the situation.
      a. It is up to you to identify the safest, most efficient way to gain access.
      b. If there are multiple patients, you should locate and rapidly triage each patient to determine who needs urgent care.
   3. To determine the exact location and position of the patient, consider the following questions:
      a. Is the patient in a vehicle or in some other structure?
      b. Is the vehicle or structure severely damaged?
      c. What hazards exist that pose a risk to the patient and rescuers?
      d. In what position is the vehicle? On what type of surface? Is the vehicle stable or is it apt to roll or tip?
   4. As patients’ conditions change, you may have to change your course of action.
      a. Do not try to access the patient until you are sure that the vehicle is stable and that hazards have been identified and rendered safe.
   5. Rapid vehicle extrication may be needed to quickly remove a patient who needs cardiopulmonary resuscitation.
      a. Cardiopulmonary resuscitation is not effective if the patient is sitting upright or is lying on a soft car seat.
      b. In rapid vehicle extrication, you and your team may have to move a patient from inside of a vehicle to a supine position on a long backboard.
      c. Use the rapid extrication technique only as a last resort.
   6. While you are gaining access to the patient and during extrication, you must make sure that the patient remains safe.
      a. Always talk to the patient and explain the steps you are taking.
b. All EMS personnel should wear proper protective gear.

c. A heavy nonflammable blanket can be used to protect the patient or EMS personnel from flying glass or other objects.
   i. A long backboard may also be used as a shield.

d. Try to keep heat, noise, and force to a minimum.

7. Simple access
   a. Your first step is simple access, trying to get to the patient as quickly and simply as possible without using any tools or breaking any glass.
   b. Automobiles are built for easy entry and exit.
      i. It may be necessary to use tools or other forcible entry methods.
      ii. Enter through the doors when there is no danger to the patient.
      iii. Gain access by trying to use all door handles or by rolling down the window, before breaking any windows or using other methods of forced entry.
   c. The rescue team should provide the entrance you need to gain access to the patient.
   d. If the rescue team has not yet arrived, use tools like hammers, center punches, pry bars, and hacksaws.
      i. Available on the ambulance

8. Complex access
   a. Complex access requires special tools, such as hand, pneumatic, and hydraulic devices.
      i. Requires special training
      ii. Includes breaking windows or other means of forcible entry

H. Emergency care

1. Providing medical care to a patient who is trapped in a vehicle is principally the same as for any other patient.
2. Once entrance and access to the patient have been provided and the scene is safe, perform a primary assessment and provide care before further extrication begins.
   a. Provide manual stabilization to protect the cervical spine.
   b. Open the airway.
   c. Provide high-flow oxygen.
   d. Assist or provide for adequate ventilation.
   e. Control any significant external bleeding.
   f. Treat all critical injuries.

3. Good communication among team members and clear leadership are essential to safe, efficient provision of proper emergency care.
   a. One member must be clearly in charge.
      i. The team leader’s assessment will dictate how medical care, packaging, and transport will proceed.
      ii. Customarily, the senior medical person takes this role.
   b. A lack of identifiable leadership at the scene hinders the rescue effort and patient care.
      i. Leaders should be identified as part of a larger incident command system.
      ii. Leaders should be medically trained and qualified to judge the priorities of patient care.
      iii. They must be experienced in extrication.

I. Removal of the patient

1. Rescue personnel should coordinate with you to determine the best removal route.
   a. Removal of a patient from a motor vehicle is a multistep process that requires many rescuers, equipment, and time.
      i. Requires the use of a variety of complex hand and power tools
      ii. Specialized education is required.
2. You should participate in the preparation for patient removal.
   a. Determine how urgently the patient must be extricated.
   b. Determine where you should be positioned to best protect the patient.
   c. After the patient has been extricated, determine how you will move the patient to the backboard and then to the stretcher.
   d. Carefully examine trapped patients or limbs to determine the extent of injury.
      i. If possible, evaluate sensation in the trapped area.
   e. Your input is essential to the rescue team to ensure that the patient’s injuries are considered.
      i. Reevaluate whether the patient needs rapid extrication.
   f. In most cases, it is impractical to apply extremity splints within the vehicle.
      i. Extremity injuries can generally be supported and immobilized while the patient is being removed.
      ii. Secure a fractured arm to the patient’s side.
      iii. Secure a fractured leg to the other leg.
   g. Once the plan is in place, you should determine how best to protect the patient.

3. Often you will be placed in a vehicle alongside the patient.
   a. Be sure to wear proper protective equipment.
   b. Your safety and the patient’s safety are paramount.
      i. Both should be covered by a thick, flame-resistant blanket.
      ii. Appropriate hearing protection should be worn.

J. Transfer of the patient
1. Perform a complete primary assessment once the patient has been freed and any other previously inaccessible patients have been freed.
   a. Make certain that the spine is manually stabilized.
   b. Apply a cervical collar if this has not already been done.
2. Move the patient in a series of smooth, slow, controlled steps, with designated stops to allow for repositioning and adjustments.
   a. Position each EMT for a smooth, controlled transfer.
   b. One person should be in charge of the move.
      i. Choose a path that requires the least manipulation of the patient and equipment.
      ii. Make sure that sufficient personnel are available.
      iii. Make sure everyone knows to move on your command.
      iv. Move the patient as a unit.
      v. Resist the temptation to move the immobilization device.
      vi. Continue to protect the patient from any hazards.
3. Once the patient has been placed on the stretcher, continue with any additional assessment and treatment that was deferred.

K. Termination
1. Termination involves returning emergency units to service.
   a. All equipment used on the scene must be checked before reloading them on the apparatus.
   b. Check and clean the ambulance thoroughly, replacing used supplies.
   c. Rescue and medical units are required to complete all necessary reports.

V. Specialized Rescue Situations
A. Sometimes a patient can only be reached by teams trained in special technical rescues.
   1. Specialized skills of these teams include the following:
a. Cave rescue  
b. Confined space rescue  
c. Cross-field and trail rescue (park rangers)  
d. Dive rescue  
e. Lost person search and rescue  
f. Mine rescue  
g. Mountain-, rock-, and ice-climbing rescue  
h. Ski slope and cross-country or trail snow rescue (ski patrol)  
i. Structural collapse rescue  
j. Special weapons and tactics (SWAT) team  
k. Technical rope rescue (low- and high-angle rescue)  
l. Trench rescue  
m. Water and small craft rescue  
n. White-water rescue

B. Technical rescue situations

1. A technical rescue situation may contain hidden dangers.  
a. Personnel need special technical skills to safely enter and move around.  
b. It is not safe to include personnel who have not been trained.

2. A technical rescue group is trained and on call for certain types of technical rescues.  
a. Made up of individuals from one or more departments  
b. Many members of technical rescue groups are also trained as emergency medical responders (EMRs) or EMTs.

3. Check with the incident commander to make sure the technical rescue group has been summoned and is en route.  
a. The incident commander is the individual who has overall command of the scene in the field.  
   i. If no incident commander is present, follow local guidelines.

4. If the rescue site is a long distance from the ambulance, take a long backboard and/or a basket stretcher.  
a. Be sure to take all of the carry-in kits and other equipment you may need to treat and immobilize the patient.  
b. Set up your equipment at a stable location where you will be able to treat the patient.  
c. Perform a primary assessment as soon as the rescue team brings the patient to you.  
d. Packaging and carrying the patient back to the ambulance requires a joint effort between EMTs and the technical rescue team.  
   i. Consider using an air medical unit if the patient will need to be carried or transported an extensive distance.

C. Lost person search and rescue

1. An ambulance is usually summoned to the incident command post when a person is lost outdoors and a search effort is initiated.  
a. Your job is to stand by at the command post until the lost person or people have been found.

2. As soon as you are briefed on the situation, isolate and prepare the equipment you may need.  
a. Leave the prepared equipment in the back of the ambulance to protect it from the weather.

3. You may be asked to stay with family members of the lost individual.  
a. Gather any medical history and communicate to those in charge.  
b. Only the incident commander should communicate any news or progress of the search to the family.  
   i. Set your radio at a discreet volume.
4. Once the lost person is found, you will be instructed where and when to meet up with the search team to provide treatment.
   a. Ensure that the carry-in equipment is evenly distributed among providers.
   b. Ensure that a pace is maintained that all can keep up with.
   c. Time and effort can sometimes be eased by relocating the ambulance or by using an all-terrain vehicle.

D. Trench rescue
   1. Many cave-ins and trench collapses have poor outcomes for victims.
      a. Collapses usually involve large areas of falling dirt that weigh approximately 100 lb per cubic foot.
      b. Victims with thousands of pounds of dirt on their chests cannot fully expand their lungs and may become hypoxic.

   2. The risk of a secondary collapse is a concern to rescue personnel and EMTs.
      a. Safety measures can reduce the potential for injury.
      b. Response vehicles should be parked at least 500' from the scene.
      c. All vehicles should be turned off to avoid a secondary collapse caused by vibration.
      d. All road traffic should be diverted from the 500' safety area.

   3. Other hazards include downed electrical wires and broken glass or water lines.
      a. Construction equipment at the collapse site may be unstable and could fall into the cave-in or trench site.

   4. Witnesses to the incident should be identified.
      a. May be valuable in providing information on the number of victims and their locations

5. Nontrapped individuals should be assisted from the area.

6. At no time should medical or rescue personnel enter a trench deeper than 4' without proper shoring in place.

7. During the extrication of any live victims, medical personnel trained in cave-in and trench collapse rescue will provide most medical care.
   a. You should be prepared to receive patients once they have been extricated from the site.

E. Tactical emergency medical support
   1. A steady increase in violence throughout the country has resulted in EMTs taking precautions to ensure personal safety.

   2. Normally, when the potential for violence exists, responding units should wait until the scene is secured by law enforcement personnel.
      a. Sometimes a special weapons and tactics (SWAT) team is needed to secure an area.
         i. Hostage incidents
         ii. Barricaded subjects
         iii. Snipers
      b. Many communities have incorporated specially trained EMTs, paramedics, nurses, and even physicians into police SWAT units.
         i. Provide a special level of care to the sick and injured
         ii. Their training goes well beyond the practices seen in standard emergency medical care.

   3. When called to the scene of a law enforcement tactical situation, determine the location of the command post and report to the incident commander for instructions.
      a. Lights and siren should be turned off, and outside radio speakers should not be used when nearing the scene.
      b. The command post is usually located in a safe zone.
         i. Do not stray far from this safe zone.
      c. Organization is key in these situations.
         i. Have the incident commander identify the specific location of the incident.
         ii. Plan a location to meet up with SWAT members if an injury occurs.
         iii. Designate primary and secondary helicopter landing zones if your region uses aeromedical evacuation.
iv. The quickest route to the closest hospital, burn center, and trauma center should be identified.

F. Structure fires
1. Generally, an ambulance is dispatched with the fire department apparatus to any structure fire.
   a. A fire in a house, apartment building, office, school, plant, warehouse, or other building is considered a structure fire.
   b. Determine whether an alternate route is needed because of the fire.
   c. Ask the incident commander where the ambulance should be staged.
      i. The ambulance should be far enough away from the fire to be safe.
      ii. It cannot block or hinder other arriving equipment.
      iii. It cannot be blocked in.
      iv. It should be close enough to be visible so patients can be brought to it easily.
   d. Determine if there are any injured patients or whether you have been called to stand by.
      i. One or more ambulances may have been dispatched to the scene.
2. Search and rescue in a burning building requires special training and equipment.
   a. Operations are performed by teams of fire fighters wearing full turnout gear and self-contained breathing apparatus (SCBA).
      i. They carry tools and hose lines.
      ii. These teams will bring patients out of the burning building to the area where the ambulance is.
      iii. You should always remain with the ambulance unless otherwise instructed.
      iv. After the fire is out, do not leave the scene because you may have to treat an injured fire fighter.
   v. The ambulance should leave only if transporting a patient or if the incident commander has released it.
3. Sometimes a scene may be further complicated by the presence of hazardous materials.
   a. A hazardous material is any substance that is toxic, poisonous, radioactive, flammable, or explosive and can cause injury or death with exposure.
   b. Hazardous materials pose a threat to you and to others at the scene, as well as a much larger area and population.
   c. Follow additional procedures outlined in Chapter 38, Incident Management.

VI. Summary

A. You must be prepared, mentally and physically, for any incident that requires rescue or extrication.

B. Vehicle safety systems, such as shock-absorbing bumpers and air bags, protect your patients but also have the potential to injure rescuers.

C. The 10 phases of extrication are:
   1. Preparation
   2. En route to the scene
   3. Arrival and scene size-up
   4. Hazard control
   5. Support operations
   6. Gaining access
   7. Emergency care
   8. Removal of the patient
   9. Transfer of the patient
   10. Termination

D. The rescue team is responsible for securing and stabilizing vehicles, providing safe entrance and access to patients, extricating patients, and protecting patients during extrication.
E. EMS personnel are responsible for assessment, medical care, triage, packaging, and transport of patients.

F. In some situations, the patient can only be reached by teams trained in special technical rescues. Teams include:

1. Cave rescue
2. Confined space rescue
3. Cross-field and train rescue (park rangers)
4. Dive rescue
5. Lost person search and rescue
6. Mine rescue
7. Mountain-, rock-, and ice-climbing rescue
8. Ski slope and cross-country or trail snow rescue (ski patrol)
9. Structural collapse rescue
10. Special weapons and tactics (SWAT)
11. Technical rope rescue (low- and high-angle rescue)
12. Trench rescue
13. Water and small craft rescue
14. White-water rescue
Post-Lecture

Unit Assessment

1. What is entrapment?

2. What are the responsibilities of EMS personnel at the scene of an automobile extrication?

3. List examples of simple access.

4. List six things that should be done for a patient trapped in a vehicle where there is no risk to your safety.

5. How will the removal of a patient differ if he or she is unstable?

6. List three vehicle extrication techniques.

7. Explain the process of termination as it relates to extrication emergencies.

8. What is the role of an incident commander?

9. What is the role of the EMT who arrives at a lost person search and rescue emergency with an ambulance?

10. At no time should medical or rescue personnel enter a trench deeper than _____ without proper shoring in place.