Chapter 48 Vehicle Extrication and Special Rescue

Unit Summary

Upon completion of this chapter and related course assignments, students will be able to explain the three levels of training in technical rescue as well as discuss guidelines for special rescue teams. There are specific steps of special rescue, as well as specific hazards that may be encountereed, and paramedics must ensure safety at every scene. For example, certain vehicle components may be hazardous to responders and patients after a crash, and situational safety at the site of a vehicle extrication should be ensured. EMS responders must understand simple methods to gain access to a patient whether or not technical extrication is required.

National EMS Education Standard Competencies

**EMS Operations**

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

***Vehicle Extrication***

• Safe vehicle extrication (pp 2227-2237)

• Use of simple hand tools (p 2230)

Knowledge Objectives

1. Explain the three levels of training in technical rescue. (p 2222)

2. Discuss guidelines for assisting special rescue teams. (p 2222)

3. Discuss the steps of special rescue, including preparation, response, arrival and scene size-up, stabilization of the scene, access, disentanglement, removal, and transport of the patient. (pp 2223-2227)

4. Discuss specific hazards that may be encountered and identified during the arrival and scene size-up of a technical rescue incident. (p 2223)

5. Explain the importance of the incident management system during technical rescue incidents. (pp 2224-2225)

6. 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 2223-2227)

7. Provide examples of vehicle components that may be hazardous to responders and patients following a crash, and explain how to mitigate their dangers. (pp 2228-2230)

8. Discuss how to ensure 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 2229-2237)

9. Explain the simple methods used to access the patient during an incident that requires extrication. (pp 2232-2234)

10. Discuss disentanglement methods and considerations, including air bag safety, displacing the seat, removing the windshield, removing the roof, and displacing the dash. (pp 2234-2237)

11. Give examples of situations that would require special technical rescue teams, and describe the paramedics’ role in these situations. (pp 2238-2246)

Skills Objectives

1. Demonstrate how to stabilize a vehicle using wood cribbing. (pp 2230-2231)
2. Demonstrate how to gain access to the patient by opening the door. (p 2232)
3. Demonstrate how to gain access to the patient by breaking tempered glass using a spring-loaded center punch. (pp 2232-2234, ***Skill Drill 1***)
4. Demonstrate how to gain access to the patient and provide initial medical care. (pp 2232-2234)
5. Describe how to remove or cut battery cables. (p 2235)
6. Demonstrate how to cut away the upholstery of the front seat in order to expose the metal frame and the areas of attachment. (p 2236)
7. Demonstrate how to stabilize a suspected spinal injury in the water. (pp 2242-2243, ***Skill Drill 2***)

Readings and Preparation

• Review all instructional materials including Chapter 48 of *Nancy Caroline’s Emergency Care in the Streets*, Seventh Edition, and all related presentation support materials.

• Consider reading these articles ahead of time and summarizing for students or using for further discussion of the issues surrounding special rescue.

* “Patient Care During Extrication” by K. Owens: http://www.fireengineering.com/articles/print/volume-162/issue-110/departments/fire-service\_ems/patient-care-during.html
* “A Walk in the Park: Preparation and training are the keys to effective high-angle rescue” by J. Pellitteri: http://firechief.com/high-angle-rescue/walk-park
* “Harrowing and Then Some (with Related Videos)” by G. Bischoff: http://firechief.com/confined-space/harrowing-and-then-some-related-videos

Support Materials

• Lecture PowerPoint presentation

• Case Study PowerPoint presentation

• Skill Drill PowerPoint presentations

* Skill Drill 48-1, Breaking Tempered Glass Using a Spring-Loaded Center Punch
* Skill Drill 48-2, Stabilizing a Suspected Spinal Injury in the Water

• For case studies, as well as safety and rescue tips, consult *Fundamentals of Technical Rescue*, available at www.jblearning.com, ISBN: 9780763738372.

• For more in-depth information on vehicle extrication techniques, knowledge on how to safely operate extrication tools and machinery, and information on modern technology found in newer vehicles, consult *Vehicle Extrication Levels I and II: Principles and Practice*, available at www.jblearning.com, ISBN: 9781449648824.

• For case studies and protocols to assist rescuers in performing essential skills in the wilderness environment, consult *Wilderness and Rescue Medicine*, Sixth Edition, available at www.jblearning.com, ISBN: 9780763789206.

• Contact your local EMS agency to obtain protocols related to patient care during extrication or participation in technical rescues. Prepare to share these with the class.

Enhancements

• Direct students to visit the companion website to *Nancy Caroline’s Emergency Care in the Streets*, Seventh Edition, at http://www.paramedic.emszone.com for online activities.

• Contact your local fire department to determine who is responsible for primary extrication in the community. Ask if there are special rescue technicians who can come to the classroom to speak on the topics introduced throughout the chapter. Also, if the agency has an extrication vehicle available, ask if it can be brought to a scheduled class period for students to examine extrication devices and become familiar with how they are operated.

**Content connections:** This is a good time to consider refreshing students on patient assessment and traumatic injuries. Special attention should be paid to how the assessment may need to be modified depending on the paramedic’s ability to access the patient.

Patient packaging following extrication or during special technical rescues requires that additional consideration be given to the location and position the patient is found. Review patient packaging techniques with students and ask that they consider what may need to be modified, as well as consider which devices offer the best options depending on location and position of the patient.

**Cultural considerations:** The elderly and pediatric patient requires special considerations for regular patient assessment and packaging. Remember to review what modifications are typically made based on anatomical or physiological differences with these two age groups.

Language barriers can pose a significant problem during extrication and rescue efforts. Remind students of the importance of identifying how to address these barriers before these situations arise. Consider encouraging them to learn basic phrases in the language(s) most prevalent in their communities to allow them to communicate emergently with patients.

Teaching Tips

• Depending on the local public safety role, EMS may not be an active participant in vehicle extrication or special technical rescue techniques in your area. Remind students that although they may not be the rescuer operating these tools and machinery or physically removing the patient during a rescue, it is essential that they understand how these tools and devices can impact patient care.

• Be cautious when using videos and pictures that display rescue techniques in order to avoid reinforcing unsafe or inappropriate methods. Consider having a local extrication or technical rescue specialist review clips before use if you are not sure that what is presented is most accurate.

Unit Activities

**Writing activities:** Assign each student a technical rescue technique to be researched. Ask that the student prepare a paper that outlines the purpose of the technique, what training and/or certification is required to perform the technique, common situations where the technique is used, and identification of special equipment required to perform the rescue.

**Student presentations:** Assign students simple extrication techniques that may be used to gain access to a patient that may or may not be entrapped. Have students present the tools that are needed to perform the technique and demonstrate how the tool is used.

**Group activities:** Divide students into groups of four or five. Assign each group a patient packaging skill using various patient packaging equipment. Allow each group time to practice the skills and then have them demonstrate appropriate skill performance to the class.

**Visual thinking:** Using pictures of common extrication tools, have students practice identifying the tool or machine and describing what it is used for.

**Medical terminology:** Prepare documents with outlines or plans for a variety of vehicles. Due to the necessity of using standardized terminology during an extrication or technical rescue, have students identify components and areas of cars and trucks, including demonstration of the actual location of the component or area.

Pre-Lecture

### You are the Medic

“You are the Medic” is a progressive case study that encourages critical-thinking skills.

### Instructor Directions

Direct students to read the “You are the Medic” scenario found throughout Chapter 48.

• You may wish to assign students to a partner or a group. Direct them to review the discussion questions at the end of the scenario and prepare a response to each question. Facilitate a class dialogue centered on the discussion questions and the Patient Care Report.

• You may also use this as an individual activity and ask students to turn in their comments on a separate piece of paper.

Lecture

I. Introduction

A. EMS departments must be prepared to respond to a variety of special rescue situations.

1. Types of special rescue incidents include:

a. Vehicle extrication

b. Confined space

c. Trench

d. Water

e. Wilderness rescue

2. Paramedics are often first on the scene.

3. “Rescue” means to deliver from danger or imprisonment.

II. Awareness

A. All EMS providers must have some formal education or training in rescue techniques.

1. Education and training focus on awareness, enabling paramedics to identify hazards and secure the scene.

2. The function of a paramedic on scene at a rescue incident depends on the company.

a. Safety is the primary concern.

b. Providers must wear personal protective equipment (PPE).

3. A technical rescue incident (TRI) is a complex rescue incident.

a. Involves:

i. Vehicle extrication

ii. Water/ice rescue

iii. Trench collapse

iv. Confined spaces

v. Structural collapse

vi. High-angle rescue

vii. Hazardous materials incidents

viii. Wilderness search and rescue

b. TRIs require specially trained personnel and special equipment.

c. Three levels of TRI training:

i. Awareness: Introductory-level training focused on identifying hazards and securing the scene

(a) No actual use of rescue skills

ii. Operations: More intensive training focused on working in the immediate area surrounding the hazard (the “warm zone”)

(a) Teaches the paramedic to directly assist those conducting the operation

iii. Technician: Advanced-level training focused on direct involvement in the rescue operation, including use of equipment, patient care, and incident management

III. Guidelines for Rescue Operations

A. There are guidelines for assisting rescue team members.

1. Be safe.

a. Be awareness of hidden hazards, such as combustible fuels or strong water currents.

2. Follow orders.

a. Rescue teams are experts with specialized knowledge. If you do not understand their orders, ask for clarification.

3. Work as a team.

a. Even though the rescue team is trained in specific tasks, they still require the support of others.

4. Think.

a. Constantly assess and reassess the scene.

b. Bring safety concerns to your incident commander (IC) or safety officer.

c. Pay special attention to broken equipment.

5. Follow the golden rule of public service.

a. Do not forget to focus on the patient.

b. Stay with the patient whenever possible, providing updates about the rescue actions.

IV. Steps of Special Rescue

A. Regardless of the rescue circumstances, all rescuers should perform the same eight steps to ensure safety, effectiveness, and efficiency.

1. Preparation

2. Response

3. Arrival and scene size-up

4. Stabilization of the scene

5. Access

6. Disentanglement

7. Removal

8. Transport

B. Preparation

1. Training with fire departments and special rescue teams allows you to:

a. Be prepared to respond to mutual aid calls.

b. Learn the skill level of other departments’ personnel and their equipment.

c. Practice using key terminology to communicate better in the field.

2. Assess the following issues before responding to TRIs:

a. Does the department have the personnel and equipment needed to handle a TRI?

b. Who will respond to the call, and with what equipment?

c. Are department personnel familiar with the hazard areas in their response area?

i. Have personnel visited those areas with local representatives?

C. Response

1. If your department has its own technical rescue team, it will usually respond with:

a. Rescue squad

b. Ambulance

c. Fire engine company

d. Fire chief

2. Otherwise, the department will respond with:

a. Medic unit

b. Engine company

c. Chief

3. In many EMS units, the rescue squad will come from an outside agency.

a. It is often necessary to contact utility companies for assistance with electricity, sewer pipes, or other circumstances requiring special equipment.

D. Arrival and scene size-up

1. Information received during the initial dispatch call is critical to the success of the rescue operation.

a. May include:

i. Location and nature of the incident

ii. Condition and position of the patient

iii. Number of patients trapped or injured

iv. Specific injuries

v. Hazard information

vi. Name of the person calling and number to be reached

2. Not all information is available going into a TRI. Responders must:

a. Identify life-threatening hazards.

b. Take measures to mitigate hazards.

c. Inform the incident commander (IC) of any additional specialized resources needed.

d. Determine whether the situation is a search, rescue, or recovery.

3. Scene size-up includes the initial evaluation of:

a. Scope and magnitude of the incident

b. Risk and benefit analysis

c. Number of known and potential patients

d. Hazards

e. Access to the scene

f. Environmental factors

g. Available and necessary resources

h. Establishment of a control perimeter

4. Properly evaluate the situation before approaching the patient or the accident area.

a. Consider risks of utilities and environmental conditions.

b. Consider hazards that are immediately dangerous to life and health (IDLH).

c. If hazards are identified, call for additional resources.

E. Stabilization of the scene

1. Be sure you have identified all hazards.

a. Observe geographic area.

b. Note routes of access and exit.

c. Observe weather and wind conditions.

d. Consider evacuation problems and transport distances.

2. The first arriving responder assumes command.

a. Begins using the incident management system (IMS)

b. The IC will:

i. Establish objectives.

ii. Coordinate additional resources.

iii. Unify command between agencies.

c. It is critical to follow the IC’s orders.

d. Three guidelines should be followed at every rescue scene:

i. Approach the scene cautiously.

ii. Position apparatus properly.

iii. Assist specialized team members as needed.

3. Emergency vehicles

a. When determining where to locate your vehicle, take into account the safety of emergency workers, patients, and other motorists.

i. Disrupting traffic flow creates a hazard.

ii. Request road closures as necessary.

b. Large emergency vehicles can be positioned to provide a barrier against unobservant motorists.

i. Place apparatus at an angle to the crash to ensure that it is pushed to the side of the event if it is struck from behind.

c. Use only essential warning lights.

i. Too many lights tend to distract or confuse drivers.

d. Law enforcement can coordinate traffic control.

4. Control zones

a. Set up an outer perimeter as a barrier to the public and media, with a smaller perimeter surrounding the incident site.

b. The IC should coordinate with law enforcement and the fire department to secure the scene.

c. Establish three controlled zones:

i. Hot zone

(a) For entry and rescue teams only

(b) Immediately surrounds dangers

ii. Warm zone

(a) For properly trained and equipped personnel only

(b) Area where decontamination and hot zone support take place

iii. Cold zone

(a) For staging vehicles and equipment

(b) Contains the command post

5. Specific hazards

a. Use the Emergency Response Guidebook (ERG) to identify IDLH environments and determine preliminary actions.

i. Provides information on approximately 4,000 chemicals that may be encountered

b. Maintain distance from utility hazards such as downed lines, which require the assistance of specially trained personnel.

i. Do not touch any electrical sources until they have been deenergized.

ii. The IC should ensure that utilities are shut off in the rescue area.

6. Protective equipment

a. Specialized teams should use devices approved for the rescue environment.

b. Considerations include:

i. Visibility of PPE

ii. Footwear designed for the environment

iii. American National Standards Institute (ANSI)-approved safety glasses or goggles

iv. Puncture- or cut-resistant gloves

v. Flame- or flash-protective clothing

c. Other useful items include:

i. Binoculars

ii. Chalk or spray paint

iii. Compass

iv. First aid kits

v. Whistle

vi. Handheld global positioning system

vii. Cyalume-type light sticks

7. Accountability

a. The accountability system tracks personnel on the scene.

i. Identity

ii. Assignment

iii. Location

b. Ensures that only rescuers given a specific task are operating in the rescue area

c. An IC can use the accountability system in tandem with the IMS to:

i. Track resources.

ii. Task assignments.

iii. Ensure personnel safety.

8. Patient contact

a. TRIs can last for hours, and patients may be alone.

i. Attempt communication via radio, cell phone, or yelling.

ii. If possible, stay in communication with the patient throughout the rescue.

b. The patient is likely injured or sick and scared. Calm the patient by:

i. Maintaining eye contact

ii. Being truthful

iii. Communicating at a level that can be understood

iv. Being aware of your own body language

v. Speaking in laymen’s terms

vi. Addressing the patient properly (ie, Mr. or Ms.)

vii. Giving the patient time to respond to questions

viii. Making the patient comfortable and relaxed whenever possible

F. Access

1. Once the scene is stabilized, focus on how to access the patient.

a. Simple access requires hand tools (eg, a hammer, glass handsaw, center punch).

b. Complex access requires special tools (eg, a hydraulic ram, spreader, cutter).

2. Monitor patients for stability throughout a rescue incident, and be prepared to assist other team members in treating patients.

3. Gaining access to a patient depends on the type of incident and the nature and severity of the patient’s injuries.

i. Means of access may change during the rescue.

G. Disentanglement

1. Emergency medical care should begin as soon as the patient is accessed.

2. A team member should stay with the patient while they are being disentangled in order to direct the rescuers.

a. Unless there is an immediate threat of danger, perform a primary assessment before disentanglement begins.

3. Disentanglement involves freeing a patient from whatever is trapping them (eg, cutting the vehicle away from the patient in vehicle extrication)

H. Removal

1. Preparing a patient for removal involves:

a. Maintaining control of life-threatening problems

b. Dressing wounds

c. Immobilizing suspected fractures and spinal injuries

i. If unable to use standard splints in a confined space, stabilize:

(a) Arms to patient’s trunk

(b) Legs to each other

2. Expedite removal if:

a. Patient is deteriorating rapidly.

b. Hazards are present.

3. Packaging: Preparing the patient for movement as a unit

a. Often accomplished with a backboard or similar device

4. Using a basket stretcher (“Stokes litters” or “Stokes baskets”) helps move patients to safety.

a. This method is used in a variety of situations.

b. Baskets can be lifted by rope, carried by vehicles, or hand carried.

c. Carrying by hand is efficient and comfortable for the patient.

i. Requires a team of six to eight rescuers

ii. Three or four to a side

iii. Person at front left directs team

d. Hand-carrying can be physically demanding for rescuers.

i. Use team leapfrogging to cover large distances.

(a) Two teams take turns carrying the patient.

e. The caterpillar or lap pass is a good option when footing is unstable.

i. Team members sit down in two rows facing each other.

ii. Rescuers pass the stretcher down the lines.

iii. As the stretcher moves down the line, team members move in the direction of travel.

I. Transport

1. Transport varies depending on:

a. Severity of the patient’s injuries

b. Distance to the medical facility

V. Vehicle Extrication

A. Vehicle anatomy and structural parts

1. Use standardized terminology when referring to specific vehicle parts.

a. Refer to left and right as they relate to the vehicle, not to you

i. Left side is the driver’s side.

ii. Right side is the passenger’s side.

2. Roof posts (pillars) add vertical support to the roof.

a. Typically labeled alphabetically (A-B-C)

i. A posts: Located at the front of the vehicle, forming sides of the windshield

ii. B posts: Located between front and rear doors (if present)

iii. C posts: Located behind rear doors (if present)

iv. D posts: Found on larger vehicles with windows behind the rear doors

3. There is an engine compartment and a passenger compartment.

a. The hood covers the engine compartment.

b. The bulkhead divides the engine and passenger compartments.

c. The firewall protects passengers from engine fire.

4. There two common frame types.

a. Body-over-frame construction

i. Uses two large beams tied together with cross member beams to fabricate the load-bearing vehicle frame.

ii. Found primarily in trucks and sport utility vehicles

iii. Provides structurally sound base for stabilization and an anchor point to attach cables or tools

iv. Potential for splitting in half is low

v. In a crash, force distribution from impact is greater on occupants.

b. Unibody construction

i. Combines vehicle body and frame into one component

ii. Allows for lighter weight vehicles

iii. When impact occurs, crumple zones redirect energy away from the passenger compartment

iv. Lack of frame means that the vehicle could split in half in a severe crash

B. Alternative powered vehicles

1. May be powered by:

a. Electricity

b. Electricity/gasoline hybrids

c. Fuels such as propane, natural gas, methanol, hydrogen

2. Make sure to secure these vehicles as soon as possible when working around them.

a. Turn off the ignition key.

b. Set the parking brake.

c. Put the vehicle in park.

3. Vehicles are identified by special markings.

4. Do not approach until you are properly trained and equipped.

a. Be aware of differences in batteries.

i. Location may be different than traditional vehicles (trunk, underneath seats)

ii. There may be more than one battery.

C. Hazardous materials

1. Vehicle extrication incidents may require specialized teams to manage hazardous materials.

2. A car wreck may have additional hazards from the vehicle(s) involved.

a. Possible ignition sources include:

i. Fire hazards

ii. Electrical hazards

iii. Fuel sources

iv. Fuel runoff

3. Follow a proper size-up and evaluation process.

a. Responders trained at the awareness level may assist operations- and technician-trained responders by:

i. Gathering information from placards, product labels, numbers

ii. Sealing off the site perimeter

iii. Consulting the ERG to identify pertinent data

D. Hand tools

1. Hand tool: Tool or equipment that operates from human power

a. Have a working knowledge of the hand tools used in a TRI.

2. Categories include:

a. Striking tools (eg, a hammer)

b. Leverage/prying/spreading tools (eg, a pry saw)

c. Cutting tools (eg, trauma sheers)

d. Lifting/pushing/pulling tools (eg, hooks)

E. Vehicle stabilization

1. Cribbing

a. The most basic tool for vehicle stabilization

b. Several designs are used, including:

i. Step chocks: Specialized assemblies made of wood or plastic/composite blocks in a step configuration

ii. Wedges: Objects used to snug loose cribbing under the load or fill a void space

iii. Shims: Similar to a wedge but smaller in size

iv. Sections of timber

c. Can be used regardless of the vehicle’s position

d. A vehicle may still move after cribbing is in place.

i. Types of movement include:

(a) Horizontal movement

(b) Vertical movement

(c) Roll movement

(d) Pitch movement

(e) Yaw movement

ii. Movement during extrication may cause further injuries.

2. After the vehicle is completely stabilized:

a. Put the vehicle in park.

b. Set the parking brake.

c. Turn the vehicle off.

F. Gaining access to the patient

1. Opening the door

a. Try all doors first, even if they appear damaged.

b. Ensure the locking mechanism is released.

i. It may be possible to manually release the locking mechanism by breaking a window and manually releasing the lock.

2. Breaking tempered glass

a. Do not try to enter through the windshield.

i. Made of laminated glass, which is difficult to break.

b. Side and rear windows are made from tempered glass and will break more easily.

c. Try to break a window that is not in close proximity to the patient.

i. Place a blanket over the patient prior to breaking the glass if possible.

d. Wear proper PPE when breaking windows, including:

i. Dust mask

ii. Gloves

iii. Safety glasses/goggles

e. Lower the windows as far as possible before breaking the glass.

i. Always aim for a low corner.

ii. Give other EMS personnel a verbal warning, “Breaking glass.”

iii. After the window is broken, use a hand tool to clean out the remaining glass.

f. To properly break tempered glass using a spring-loaded center punch, refer to ***Skill Drill 48-1***.

g. Once glass is removed, try to unlock the door again.

i. Release the locking mechanism and use the inside and outside door handles at the same time.

h. The rear window may provide a large enough opening to reach a patient if no other means is possible.

i. If you cannot gain access, heavier tools and trained personnel are required.

3. Providing initial medical care

a. Initial care includes:

i. Spine immobilization

ii. Assessment and management of the ABCs

b. Care should occur simultaneous with extrication.

G. Disentangling the patient

1. Goal = remove the sheet metal and plastic from around the patient

a. Do not “cut the patient out of the vehicle.”

2 Study the scene before taking action.

a. Perform only procedures necessary to disentangle the patient.

b. The order of procedures will be determined by the specifics of the incident.

c. The patient should be protected, with a blanket or backboard, before being disentangled.

d. Make sure the patient knows what is being done.

3. Main objective = maintain spinal alignment and immobilization.

4. Air bag safety

a. Identify undeployed air bags through the air bag badging or labeling system.

i. Markings consist of acronyms located near the air bag inflator

ii. Never assume an air bag is dead just because the power is disconnected.

(a) Energy can be stored for up to 30 minutes in some models.

b. Disable airbags by disconnecting power.

i. Remove key from ignition.

ii. Turn on an electrical component (eg, emergency flashers) to determine if power is still connected.

iii. Remove or cut battery cables (starting at the negative side).

(a) Avoid cables reconnecting with a terminal or a vehicle frame.

(b) Main 12-volt DC battery may not be located in traditional location.

(c) Verify that only one battery is present.

c. Remember the following:

i. Most recently manufactured vehicles contain an air bag.

ii. If the air bag has deployed, it is not a hazard for rescuers.

(a) Otherwise, it may deploy if wires are cut or it becomes activated during the rescue operation

iii. If the air bag did not deploy, disconnect the battery and allow the air bag capacitor to discharge.

iv. Some newer vehicles have a switch near the dash that allows shutting off of the air bags

v. Do not place a hard object (eg, a backboard) between the patient and an undeployed air bag.

vi. Do not cut a steering wheel if the air bag has not deployed.

vii. Never get in front of an undeployed air bag.

viii. Check for side-mounted air bags or curtains.

5. Displacing the seat

a. Can relieve pressure on the driver and give rescuers more room to work

b. Try simple steps to displace a seat backward.

i. Move the seat backward on its track.

(a) First provide spinal immobilization.

(b) Manual seats: Release the self-adjusting lever, and slide the seat back.

(c) Electrically operated seats: Check for power, and engage the lever

c. It can be helpful to remove the back of the seat.

i. Cut upholstery away to expose frame and points of attachment.

ii. A reciprocating saw may be used to cut supports.

iii. Technical rescuers on scene may possess other tools that can be used.

6. Removing the windshield

a. Allows for better communication between rescue personnel inside and outside the vehicle.

b. Try rolling down a window before breaking glass.

c. Windshields are made of plastic laminated glass and will not break easily.

i. Remove windshields in one large piece.

d. Essential step before removing the roof

e. Provides extra space when emergency medical care is administered.

f. A trained rescuer may remove a windshield using a glass hand saw.

7. Removing the roof

a. Allows equipment to be passed in to the rescuer

b. Increases space for medical care and disentanglement

c. Helps reduce the feeling of panic by the confined space

d. Provides a large exit route

e. Protect the patient and rescuers inside the vehicle.

i. Support the roof when cutting posts.

ii. Roof removal must be done by a trained technical rescuer.

8. Displacing the dash

a. Use the dash roll technique to lift the dash and move it forward if it is entrapping a patient.

i. Roof must first be removed.

ii. Requires a hydraulic cutter and a hydraulic ram

iii. Cribbing maintains the opening created by tools.

iv. Must be done by a trained technical rescuer

VI. Additional Specialized Rescue Situations

A. Confined spaces

1. Location surrounded by a structure that is not designed for continuous occupancy

a. Have limited openings for entrance and exit

b. Can occur in farm, commercial, and industrial settings

i. Examples include:

(a) Grain silos

(b) Industrial pits

(c) Tanks

(d) Below-ground structures

(e) Automobile trunks

(f) Cisterns

(g) Well casings

(h) Septic tanks

c. Limited ventilation presents special hazards.

i. Test atmosphere for safety, and use proper breathing apparatus before entering.

ii. High risk of fire and explosion because flammable mixtures may be trapped

d. The potential for stored electrical energy must be considered.

e. Scene safety must be considered before entering a confined space.

2. Oxygen deficiency and poisonous gases

a. Hydrogen sulfide (H2S)

i. Colorless, toxic, flammable gas

ii. Found in swamps, standing water, sewers, volcanic gases, natural gas, wells

iii. Heavier than air and has a pungent odor

b. Carbon monoxide (CO)

i. Colorless, odorless, tasteless gas that cannot be detected by normal senses

ii. A small amount can prevent oxygen from transporting to parts of the body

iii. Signs of CO poisoning include headache, nausea, disorientation, and unconsciousness

c. Carbon dioxide (CO2)

i. Colorless gas associated with asphyxiation risk

ii. Found in fire distinguishers

iii. Produces sour taste and stinging sensation in the nose and mouth

d. Methane (CH4)

i. Not toxic but will cause burns if ignited

ii. Used as a fuel from natural gas fields and can be made from fermented organic matter

e. Ammonia (NH3)

i. Toxic and corrosive chemical with pungent odor

ii. Rises in the upper atmosphere in confined spaces

f. Nitrogen dioxide (NO2)

i. Reddish-brown gas with sharp, biting odor

ii. Prominent in air pollution

iii. Toxic by inhalation

3. Safe approach

a. Gathering information from bystanders while waiting for the technical rescue team saves time.

b. Assume an IDLH atmosphere at any confined-space call.

c. Do not make an entry prior to atmospheric monitoring.

4. Assisting other rescuers

a. First responding rescuers should share whatever information is discovered with the arriving crew.

b. Compare observed conditions with those reported.

c. Share with the rescue team:

i. Information from the scene size-up

ii. Description of any rescue attempts

iii. Exposures

iv. Hazards

v. Extinguishment of fires

vi. Facts and probabilities of the scene

vii. Situation and resources of the fire company

viii Identification of any hazardous materials present

ix. Progress evaluation

d. You may be asked to assist by:

i. Bringing rescue equipment to the scene

ii. Maintaining a charged hose line

iii. Providing crowd control

B. Trenches

1. Collapse sites are unstable and prone to further collapse.

a. Patients should be dug out after shoring has stabilized the excavation site.

b. Vibrations or additional weight may cause secondary collapse.

c. Safe removal requires a special rescue team.

2. Safe approach

a. Stay away from the edges of the site to avoid triggering secondary collapse.

b. Shut off all heavy equipment.

c. Stop or divert nearby traffic if needed.

d. Avoid disturbing the spoil pile.

i. Soil removed from the excavation and placed in a pile

e. When attempting to make verbal contact with the trapped person, prioritize your personal safety.

f. Let the trapped person know that a rescue team is on the way.

g. Size-up the scene, and question workers to determine the location of trapped patients.

C. Water

1. Almost all EMS departments potentially may be called to a water rescue.

a. Sites vary, ranging from small streams to the ocean to a swimming pool.

2. Be aware of self-rescue techniques.

a. Minimum PPE includes:

i. Personal flotation device (PFD)

ii. Thermal protection

iii. Helmet

iv. Cutting device

v. Whistle

vi. Contamination protection

b. If immersed in fast-moving water, adopt the self-rescue position.

i. Roll into a face up, arched position.

ii. Keep feet together in the direction of travel; arms to the side.

iii. Use hands to change direction.

iv. Tuck chin to protect head, face, and lower back from striking objects.

3. Cold water rescue

a. Water temperature of less than 98.6°F (37°C) will cause hypothermia.

i. Hypothermia can quickly progress to loss of consciousness and death.

b. To maintain body temperature, keep head and face above water, assuming the heat-escape-lessening position (HELP).

i. Helps keep heat to core of body

ii. Victims should minimize movement.

iii. In a group, victims should huddle together.

c. In water colder than 70ºF (21ºC) patients may benefit from the cold protective response.

i. Heat is conducted from the body to the water.

ii. Hypothermia can protect vital organs from lack of oxygen.

iii. Cold water exposure can activate primitive reflexes that preserve body functions.

iv. Provide full resuscitative efforts until the patient recovers or is pronounced dead by a physician

d. The mammalian diving reflex occurs when a person dives or jumps into cold water.

i. Heart rate slows and bradycardia followed by loss of consciousness may occur.

ii. Patient may survive for long periods of time under water because of:

(a) Lowering of metabolic rate

(b) Decreased oxygen demand and consumption

4. Other water rescue situations

a. Most common swift water rescue scenario involves people driving a vehicle through water.

i. Vehicle may be swept away.

ii. Special danger presented by difficulty in determining water depth

b. Special hazards of surface water rescues include:

i. Hydraulics created by moving water

ii. “Strainers” (objects such as trees or debris)

iii. Dams and hydroelectric sites

(a) Dam height is not indicative of the level of danger.

(b) Currents may trap victims or rescuers.

5. Safe approach

a. Wear appropriate PPE.

i. Approved PFD within 10 feet of water

ii. Shoes with traction

b. Do not exceed your level of training.

i. Currents can challenge even trained lifeguards.

ii. Keep bystanders from attempting rescue efforts.

c. Use the reach-throw-row-go approach.

i. Attempt to reach out with an object (such as a branch or paddle).

ii. If reaching out fails, throw an object (such as a rope).

iii. If other means fail, row out to the drowning person in a small boat or canoe.

iv. Go into the water to save the victim as a last resort.

d. Specialized equipment exists for ice rescues.

i. Ladders distribute the weight of the rescuer on ice-covered water.

ii. Special flotation devices and rescue suits are available.

iii. Ice rescues require specialized training.

6. Recovery situations

a. Occur when the victim is not visible in the water upon arrival at the site

b. Requires trained personnel with equipment, including:

i. Snorkels

ii. Masks

iii. Scuba gear

c. A grappling hook can be used as a last resort

D. Spinal injuries in submersion incidents

1. Assume spinal injury has occurred in these conditions:

a. Diving mishap or fall

b. Unconscious patient with no information to rule out neck injury

c. Conscious patient reporting weakness, paralysis, or numbness in arms and/or legs

d. You have any other reason to suspect spinal injury.

2. When spinal injury is suspected, the neck must be protected while the patient is in water.

a. To properly stabilize a suspected spinal injury in the water, refer to ***Skill Drill 48-2***.

E. Rope Rescue

1. Types of rope rescue

a. Low-angle operations: Situations where the slope of the ground over which rescuers are working is less than 45º.

i. The ground provides primary support; rope provides secondary support.

ii. Usually necessary when adequate footing is not present

(a) Rope is tied to rescuer’s harness, and rescuer climbs embankment, using rope to keep from falling

iii. Rope can be used to help raise or lower basket stretchers.

(a) Frees rescuers up from carrying heavy weight over rough terrain.

iv. Rope can be controlled through belay.

(a) Rope is controlled as it is fed out to climbers to protect against falls.

(b) Belays rely on the angle of operations, sometimes dangerously shifting weight.

v. When the angle is severe, climbers may descend by rappelling.

(a) Descending on a fixed rope

vi. Scrambling can be used to ascend rocky ridges.

(a) A cross between hill climbing and rock climbing

b. High-angle operations: Situations where the slope of the ground is more than 45º

i. Rescuers and patients are dependent on the rope for support, not a fixed surface.

ii. Use technique only when other means of raising and lowering are unavailable.

iii. These rescues are demanding and dangerous.

2. Safe approach

a. Take time to set up equipment properly.

b. Protect yourself by putting distance between you and any loose materials.

c. Move bystanders out of the way.

F. Wilderness search and rescue

1. Search and rescue (SAR) missions are two parts:

a. Search (looking for lost persons)

b. Rescue (removal of the patient from a hostile environment)

2. Many situations that initiate SAR, including:

a. Small children wandering off and becoming lost

b. Older adults with Alzheimer disease becoming confused and disoriented

c. People hiking or engaging in other outdoor activities

3. Safe approach

a. Be aware that terrain and environmental factors will vary, and extraction time is variable.

b. Terrain hazards include:

i. Cliffs

ii. Steep slopes

iii. Caves

iv. Wells

v. Mines

vi. Avalanches

vii. Rivers

viii Streams

ix. Valleys

x. Beaches

xi. Rock slides

c. Bring drinking water, food, suitable clothing, and PPE.

d. Use a handheld strobe light for additional visibility.

e. Be aware of your physical limitations.

i. Call in a special wilderness rescue team if necessary.

G. Lost person search and rescue

1. When a person is lost outdoors, it is standard protocol to set up a search base with an ambulance.

a. Prepare equipment so that no time is wasted when the patient is found.

i. Include a backboard and other equipment to immobilize the patient.

ii. Store equipment in the ambulance to protect against weather.

b. Monitor progress via radio tuned to a search frequency.

i. Use relatives at the scene to obtain relevant medical information about the patient.

ii. Keep volume low (only the IC is authorized to update family).

2. Safe approach

a. Once the patient is found, distribute equipment evenly between responding personnel.

b. Keep to pace that allows personnel to stick together.

c. Consider relocating ambulance closer to the patient.

3. Cooperation between EMS and the search team ensures safe delivery of the patient back to the base.

H. Structure fires

1. Ambulances may be dispatched along with the fire department to structure fires

a. A structure fire is any fire occurring in a building.

i. Examples include:

(a) House

(b) Apartment buildings

(c) Schools

(d) Offices

b. Determine whether any special route is needed.

2. The IC will determine an appropriate parking spot for the ambulance.

a. Far enough from the fire to be safe

b. Should not block arriving equipment (or become blocked in)

c. Close enough to be visible and available

3. The next step is to determine if there are injured patients at the scene or if you are on standby.

4. Safe approach

a. Stay with the ambulance.

b. Remain present even after the fire is out.

i. A fire fighter may become injured during salvage and overhaul.

ii. Do not leave the scene unless you are transporting a patient or have been released by the IC.

I. Agricultural and industrial rescue

1. Tractors and other powerful machines used in agricultural and industrial settings put workers at tremendous risk.

a. Rescue personnel should visit their local farms and industrial plants and learn about:

i. Equipment that is used

ii. How it operates

iii. How an operator can become entrapped

2. Over time, protective shields and guards may be damaged or removed, causing hazards at:

a. Pinch points

b. Wrap points

c. Shear points

d. Crush points

e. Pull-in points

3. The majority of U.S. farms are not subject to inspection by the Occupational Safety and Health Association (OSHA).

4. Safe approach

a. It is critical to master cribbing in order to stabilize a vehicle or equipment.

i. Large voids will need to be shored up.

ii. A suitable platform for lifting will be necessary.

b. Keep in mind that farm machines made of strong steel and cast metal may be taken apart more readily than cut.

i. Tools designed for vehicle extrication may not work.

ii. If necessary, call for a special agricultural rescue team.

c. Isolate the injury site.

i. Ensure that parts of the machine on either sides of the entrapped patient are secured.

ii. Prevents movement during extrications

d. Determine alternative methods of disentangling the patient.

e. Assess the patient while rescue personnel plan for disentanglement

i. Determine an index of suspicion based on mechanism of injury and length of entrapment.

f. Be aware of differences between industrial and farm settings.

i. Industrial: Coworkers may be able to halt the machinery and begin extrication.

ii. Farm: Farmers typically work alone; there is no one to call EMS

(a) Lag time between time of injury and medical treatment

J. Tactical emergency medical support

1. If an incident develops into a tactical situation (eg, hostage situation), law enforcement may call in the special weapons and tactics (SWAT) team.

2. It is a growing trend to add medical personnel to the tactical team.

a. Tactical paramedics receive additional training.

b. They must be able to provide medical care under adverse circumstances.

c. They don the same PPE as law enforcement officers, including:

i. Body armor

ii. Ballistic helmet

iii. Eye protection

d. Tactical EMS personnel carry a special compact medical kit into the hot zone.

i. Equipment is designed to handle traumatic injuries, such as bleeding.

ii. Complete set of ALS medical gear is available in the warm zone.

e. The main duty of the tactical paramedic is to provide immediate medical care to persons who become injured during an incident.

i. Often this will occur before the scene is declared safe for other personnel to enter.

f. When not responding to an incident, the tactical paramedic will be responsible for:

i. Maintaining medical records of team members

ii. Conducting basic first aid training to team members

iii. Providing suggestions for training

VII. Patient Care

A. Many medical and trauma conditions are assessed during the rescue process.

1. Crush syndrome may occur in confined-space or trench incidents .

a. Large muscle groups are compressed for a prolonged period of time (2 to 4 hours)

b. When human tissue is deprived of oxygen-enriched blood, cells metabolize anaerobically, producing lactic acid.

c. When compressed areas are reperfused, this by-product is released into circulation, causing respiratory and metabolic acidosis.

2. Treat with high-flow oxygen therapy or positive pressure ventilations and administration of:

a. Sodium bicarbonate

b. Calcium chloride

c. Fluid bolus

B. Pain management

1. Use nonpharmacologic methods in the prehospital environment, such as:

a. Splinting

b. Gentle handling

c. Talking to patients to create a distraction during assessment

2. Pharmacologic treatment options are controversial.

a. Consult with medical directors.

b. All medications contraindicated in patients with known sensitivities.

c. Analgesics have potential negative side effects and should be administered carefully to prevent:

i. Nausea

ii. Vomiting

C. Medical supplies

1. Basic medical supplies should be carried in an off-road medical pack.

D. Patient packaging

1. Basket stretcher (Stokes basket)

a. Rigid framed structure that the patient is set into and then secured.

b. Two types:

i. Wire basket (most common type): Rigid metal frame with chicken-wire mesh attached

ii. Plastic/fiberglass basket: Steel or aluminum frame with rigid plastic or fiberglass basket

(a) Both available as one or two-piece units

c. Wire basket is more suitable for water rescue and helicopter hoist situations

i. Allows water or air to pass through

d. Plastic or fiberglass basket is more suitable for most other evacuation types

i. More easily slides over the top of surfaces

e. Similarity between types:

i. Wheel device to facilitate movement over trails and low-level debris

ii. Minimal (or no) belts or straps

(a) Packaging systems are used instead.

(1) Goal is to secure the patient’s pelvis into the basket.

2. Packaging obstacles include:

a. Patients with fractured pelvises will be caused great pain by basket packaging.

i. Secure the patient to a full-body vacuum mattress to reduce pain.

b. Packaging spine-immobilized patients in a basket stretcher

i. Place the patient in a Kendrick Extrication Device (KED) instead of on a backboard.

(a) Allows passage through narrow spaces

ii. Lift the patient up and lower him or her into the basket, using it as an immobilization device.

3. Consider all patient needs when packaging

a. Set up portable oxygen tank.

b. Maintain IV lines.

c. Keep the patient warm.

d. Provide head and eye protection.

e. Consider using a KED or KED/SKED combination in narrow spaces.

i. KED: Narrow spinal immobilization device that captures the three planes of the spinal column (head, shoulder, and pelvis)

ii. SKED: Drag sheet made from heavy duty plastic that can be wrapped around the patient and used to slide them.

VIII. Summary

A “Rescue” means to deliver from danger or imprisonment.

B. The most difficult process in any rescue is neither the rescue nor the treatment process, but rather the coordination and balance of both.

C. A technical rescue incident (TRI) is a complex rescue incident involving vehicles, water, trench collapse, confined spaces, or wilderness search and rescue that requires specially trained personnel and special equipment.

D. Technical rescue training occurs on three levels: awareness, operations, and technician. Most of the training and education EMS providers receive is aimed at the awareness level, enabling them to identify the hazards and secure the scene to prevent additional people from becoming patients.

E. When you are assisting rescue team members, the following guidelines will prove useful:

**1. Be safe.**

**2. Follow orders.**

**3. Work as a team.**

**4. Think.**

**5. Follow the golden rule of public service.**

F. Although special rescue situations may take many different forms, all rescuers should perform the following steps to perform these rescues in a safe, effective, and efficient manner:

**1. Preparation**

**2. Response**

**3. Arrival and scene size-up**

**4. Stabilization of the scene**

**5. Access**

**6. Disentanglement**

**7. Removal**

**8. Transport**

G. At a technical rescue incident, it is critically important to slow down and properly evaluate the situation. Consider the potential general hazards and risks of utilities, confined spaces, and environmental conditions, as well as hazards that are immediately dangerous to life and health.

H. The first arriving officer at a rescue scene should immediately assume command and start using the incident management system. This step is critically important because many technical rescue incidents will eventually become complex and require a large number of assisting units.

I. Whenever possible, park emergency vehicles in a manner that will ensure safety and not disrupt traffic any more than necessary. Traffic flow is the largest single hazard associated with any operation that takes place on a highway.

J. Accountability should be practiced at all emergencies, no matter how small.

K. Basket stretchers facilitate moving patients to a place of safety and can be used in a variety of situations. The manner in which a patient is packaged in a basket stretcher depends on his or her medical condition, the environment, and the manner in which the patient will be evacuated.

L. In 2009, an estimated 5,505,000 police-reported motor vehicle traffic crashes occurred. Vehicle extrication is therefore commonly necessary.

M. Vehicles may be powered by electricity and electricity/gasoline hybrids, or fuels such as propane, natural gas, methanol, or hydrogen. There are many hazards associated with alternative powered vehicles.

N. You should have a thorough working knowledge of the basic simple hand tools. Hand tools can be categorized as striking tools, leverage/prying/spreading tools, cutting tools, and lifting/pushing/pulling tools.

O. The most basic physical tool used for vehicle stabilization is cribbing. Cribbing should be used regardless of the position of the vehicle.

P. Simple vehicle extrication techniques include opening the door, breaking tempered glass, and providing initial medical care to the patients.

Q. During disentanglement, responders need to be mindful of undeployed air bags.

R. Many vehicle extrication techniques require the use of specialized skills and training, as well as hydraulic or pneumatic tools.

S. A confined space is a location surrounded by a structure that is not designed for continuous occupancy. Confined spaces have limited openings for entrance and exit.

T. Confined spaces present a special hazard because they may have limited ventilation to provide air circulation and exchange, which can make them an oxygen-deficient atmosphere, or they may contain poisonous gases.

U. Trench rescues may become necessary when earth is removed for placement of a utility line or for other construction and the sides of the excavation collapse, trapping a worker.

V. Because almost all EMS providers have the potential to be called to a water rescue situation, you should know how to properly don a personal flotation device as well as how to use the self-rescue position.

W. Rope rescue incidents are divided into low-angle and high-angle operations.

* **Low-angle operations are situations where the slope of the ground over which the rescuers are working is less than 45°. Low-angle operations are used when the scene requires ropes to be used only as assistance to pull or haul up a patient or rescuer.**
* **High-angle operations are situations where the slope of the ground is greater than 45°, and rescuers or patients are dependent on a life safety rope and not a fixed surface of support such as the ground.**

X. Wilderness search and rescue (SAR) missions consist of two parts: search (looking for a lost or overdue person) and rescue (removing a patient from a hostile environment).

Y. During lost person search and rescue, your role is to stand by at the search base until the lost person or people have been found.

Z. You should always stay with your ambulance during a structure fire. Search and rescue during a fire is performed by trained personnel.

AA. If an incident develops into a tactical situation, law enforcement agencies may deploy use of specialized law enforcement tactical units or the SWAT team.

BB. Pain control in rescue situations should take the form of nonpharmacologic methods, such as splinting to minimize movement, and gentle handling. Pharmacologic treatment in the prehospital setting remains controversial, and providers should consult with their medical directors on issues related to pain management.

CC. A number of special patient packaging tools are available to help extricate patients out of their situation and up, down, or out to the ambulance. The basket stretcher is an example of a packaging tool.

Post-Lecture

This section contains various student-centered end-of-chapter activities designed as enhancements to the instructor’s presentation. As time permits, these activities may be presented in class. They are also designed to be used as homework activities.

## Assessment in Action

This activity is designed to assist the student in gaining a further understanding of issues surrounding the provision of prehospital care. The activity incorporates both critical thinking and application of paramedic knowledge.

### Instructor Directions

**1.** Direct students to read the “Assessment in Action” scenario located in the Prep Kit at the end of Chapter 48.

**2.** Direct students to read and individually answer the quiz questions at the end of the scenario. Allow approximately 10 minutes for this part of the activity. Facilitate a class review and dialogue of the answers, allowing students to correct responses as may be needed. Use the quiz question answers noted below to assist in building this review. Allow approximately 10 minutes for this part of the activity.

**3.** You may wish to ask students to complete the activity on their own and turn in their answers on a separate piece of paper.

### Answers to Assessment in Action Questions

1. **Answer:** D. All of the above

**Rationale:** You will encounter a wide variety of scene hazards when responding to any emergency setting. Being dispatched to a scene requiring special rescue, extrication, or both will add a few more challenges to the mix. Examples of potential scene hazards include downed electrical lines, gasoline or other vehicle fluids, chemicals, air bags, fire, smoke, debris, and weather.

2. **Answer:** B. Traffic flow

**Rationale:** Although limited visibility, debris or other obstructions preventing access to the scene, and the presence of bystanders can be serious hazards while you are working at the scene of an event on the highway, traffic flow is considered the largest hazard. It is your responsibility to ensure your personal safety as well as the safety of other crew members and the patient. Use whatever resources are necessary, including requesting a road closure to provide a safe environment for you to rescue and remove the patient from the scene.

3. **Answer:** D. Cribbing

**Rationale:** The most basic physical tool used for vehicle stabilization is cribbing. Cribbing is commonly made from wood or other composite materials. Examples of cribbing designs used for extrication include step chocks, wedges, shims, and sections of timber cut at various lengths.

4. **Answer:** B. Spring-loaded center punch

**Rationale:** The side and rear windows of a vehicle are made of tempered glass, or “safety glass.” Sharp, pointed hand tools such as a spring-loaded center punch can be used to break the glass. The spring-loaded center punch is the most basic and common glass removal tool.

5. **Answer:** A. Disconnect the battery, and allow the air bag capacitor to discharge

**Rationale:** An air bag does not always deploy at the time of impact. Remember, safety first. Take the time to disconnect the battery and allow the air bag capacitor enough time to discharge. An air bag system comes equipped with an energy capacitor that can store a charge for up to 30 minutes depending on the make and model of the vehicle. If you are not sure, ask for assistance. Assuming an air bag is dead because there is no longer power going to it can create an unsafe situation for both you and the patient.

6. **Answer:** D. Simultaneously with extrication

**Rationale:** Emergency medical care should begin as soon as you achieve access to the patient. Unless there is an immediate threat of fire, explosion, or other danger you should perform a primary assessment and perform any critical interventions prior to disentanglement.

7. **Answer:** B. Technician

**Rationale:** Training in technical rescue areas is conducted at three levels. The first level is awareness. Training at the awareness level provides introductory information on the topic with emphasis on identifying scene hazards, securing the scene, and calling for appropriate assistance. The next level is operations. Operations-level training is focused on preparing you to work in the “warm zone” or area directly surrounding the hazard area and to assist those who are conducting the rescue operation. The technician level provides the highest level of training and prepares you to be directly involved with the rescue operation. Technician-level training includes the use of specialized equipment, care of patients during the rescue, and the management of the incident and of all personnel at the scene.

## Assignments

A. Review all materials from this lesson and be prepared for a lesson quiz to be administered (date to be determined by instructor).

B. Read Chapter 49, *Hazardous Materials*, for the next class session.

## Unit Assessment Keyed for Instructors

1. What are the three levels of training in technical rescue, and why is it essential that the paramedic have a basic awareness of these techniques?

**Answer:** The paramedic, while not always an active participant or rescuer involved in the specialized technical rescues or extrications, should possess an awareness level of education to identify potential hazards and scenes where these are needed. Awareness is the first level of training in technical rescue and being trained to this level allows you to prevent further risk to the patient, personnel, and bystanders. It also allows the paramedic to identify what type of rescue is needed so that the appropriate resources may be requested. No use of rescue skills is required at the awareness level. The operations level is the next level of training and rescuers trained in this level commonly assist in the technical operation. The highest level of training, the technical level, prepares the rescuer to participate in the operation. Use of specialized equipment, caring for patients during the rescue, and management of the incident and personnel are common responsibilities of those trained in the technician level.

(p 2222)

2. What are some common guidelines that should be followed during a technical rescue?

**Answer:** It is important to remember that there may be hidden hazards at the scenes where technical rescues are required. The paramedic should make safety a priority. Officers and rescue teams performing technical rescues have completed the necessary training to perform these specialized techniques. It is essential that you follow their specific orders to ensure everyone’s safety and mitigate dangers during the operation. Teamwork is important for any task, but during a rescue effort, all members should work as a team to provide support for those performing the operation. Constantly assess and re-assess the scene to consider whether your actions are safe. If you have a question or concern about the safety of a task you are assigned, bring it to the attention of the IC. Do not lose focus on the patient during the rescue. Your patient will need emotional support and encouragement throughout the rescue operation.

(p 2222)

3. What is the difference between simple and complex access? Identify situations when each may be appropriate.

**Answer:** Gaining access to a patient will depend on the incident and circumstances that are found during the scene-size up. The initial method chosen to gain access may change during the effort if the circumstances change. Simple access of the patient should begin with consideration of whether the doors of a vehicle may be unlocked and opened. It may also include the use of hand tools such as a center punch, hammer, glass handsaw, Halligan, or come-along. In comparison, those patients who are not able to be extricated with simple access may require complex access. Specialized tools such as a hydraulic ram, spreader, or cutter may be required. Use of these devices requires additional training.

(pp 2225-2226)

4. Identify and describe the two most common types of vehicle frames, including which types of vehicles these are most commonly seen in.

**Answer:** The body-over-frame type of vehicle construction consists of two large beams tied together with cross member beams to fabricate the load-bearing frame of the vehicle. This construction has a structurally sound base for providing an anchor point to attach cables or extrication tools and to stabilize the vehicle. Force distribution during impact can be greater on the occupants; however, chances of the frame being split in half is low. This type of frame is primarily found in trucks and sport utility vehicles.

The unibody type of vehicle frame has a greater chance of becoming split in half due to the fact that the frame is a single component. The body of the vehicle is merged with the chassis and consists of the braking, steering, and suspension system. The unibody construction allows energy to be redirected during a crash and it typically contains crumple zones so that the energy of the crash can be redirected. This type of frame is often seen in most modern cars.

(pp 2228-2229)

5. What are some concerns related to alternative powered vehicles?

**Answer:** Alternative powered vehicles may pose additional hazards to rescuers. These vehicles may be powered by electricity, a combination of electricity and gas, or with fuels such as propane, natural gas, methanol, or hydrogen. When one of these vehicles is involved in a crash, caution should be exercised. Attempt to secure the vehicle as soon as possible by turning the ignition off, setting the parking brake, and placing the vehicle in park. A spark may trigger explosions, so avoid using flares around these vehicles. Toxic fumes and vapors may be released from electric vehicle batteries. In over 40% of these types of vehicles, the battery is not located under the hood but may be in the truck or under a seat instead; there also may be more than one battery in the vehicle. Avoid contact with any fluids leaking from the vehicle and contact the fire department or HazMat team to establish a safety zone around the vehicle.

(p 2229)

6. Describe concerns associated with air bag deployment and special considerations that should be made when air bags have deployed in a crash.

**Answer:** Prior to initiating patient care at a crash scene, the paramedic should assess the status of the vehicle’s air bag system. Undeployed airbags should be identified and deployed. If undeployed air bags are not disabled prior to initiating extrication, there is a risk of deployment during the rescue. The paramedic should keep in mind that disabling the power to the air bag does not eliminate the risk of air bag deployment. Some vehicle models are capable of storing energy for up to 30 minutes. To disable the air bag system, disconnect the power by first removing the key from the ignition, then turn on an electrical component of the system (such as the warning flashers) to determine if power is still present. To disable the power, remove or cut the battery cables beginning on the negative side. Verify that only one battery is present. Newer model vehicles may have a switch mounted on or under the dash that will allow you to disable the air bag system. Things to avoid doing in the presence of an undeployed airbag include: placing a backboard or other piece of equipment between the patient and an undeployed air bag, cutting the steering wheel if the air bag has not deployed, or placing yourself in front of an undeployed air bag.

(pp 2235-2236)

7. What is meant by a confined space rescue? Identify potential hazards associated with this type of operation.

**Answer:** Confined spaces are those areas with limited entry or exit access that are not designed for continuous occupancy. They include industrial or farming areas such as grain silos, industrial pits, tanks, and below-ground structures. The trunk of a vehicle is considered a confined space and most homes have confined spaces including cisterns, well casings, and septic tanks. Confined spaces present a special hazard associated with limited ventilation and ability to provide for air circulation and exchange. Confined spaces may have an oxygen-deficient atmosphere or may contain poisonous gases. Rescue teams typically use an air sampling device to monitor for safety during the rescue. There is also a risk of fire or explosion as a result of limited ventilation. Rescuers can also become engulfed in grain silos and trenches due to the contents of these areas. Grain augers or screws in silos may also be hazardous to rescuers. Safety must always be considered prior to gaining access and beginning treatment of the patient.

(p 2238)

8. When is water rescue needed? Identify locations where it may be needed and associated challenges.

**Answer:** Water rescue may be needed in a variety of environments, including swimming pools, lakes, rivers, ponds, reservoirs, and the ocean. Water movement will vary depending on whether the location has static water or fast-moving currents. Rescuers must be aware of self-rescue techniques in case they find themselves in a situation where they become immersed in moving water. Minimum PPE in water rescue includes a personal flotation device (PFD), thermal protection, water rescue appropriate helmet, cutting device, whistle, and contamination protection when needed. Cold water rescue is based on the temperature of the water and may be seen year-round. In a cold water rescue, maintaining body heat is essential; rescuers should use the HELP body position to optimize conservation of body heat. Swift water rescue may be particularly hazardous, as vehicles are commonly pulled into fast-moving water and become hazards depending on the depth of submersion. Recirculating currents found in dams and reservoirs can pull rescuers below the surface, then push them back up. This constant pushing and pulling can drown both victims and rescuers.

(pp 2240-2242)

9. What is the difference between low-angle and high-angle rescue? Identify incidents when each would be appropriate.

**Answer:** Rope rescue skills are widely used and very versatile. Incidents are divided into two categories: low-angle and high-angle operations. In a low-angle operation, the slope of the ground where rescuers will be working is less than 45 degrees. The ground is considered to be the rescuer’s primary support. Examples of operations where low-angle rescue is appropriate include rescues in which ropes are used to pull or haul up a patient or rescuer; rescues in which there is inadequate footing and the rope is tied to the rescuer’s harness; and rescues in which lifelines are placed over ice or water. High-angle operations are appropriate when the slope of the ground is greater than 45 degrees and rescuers or patients are dependent on the life-safety rope, as opposed to the ground, for primary support. These techniques may be used to raise or lower a person when no other options are available. High-angle rescue is demanding and dangerous and should only be performed by properly trained personnel.

(pp 2243-2244)

10. Discuss considerations for patient care during and after various types of technical rescue operations.

**Answer:** The patient requiring technical rescue operations is still subject to medical conditions and traumatic injuries. The patient’s condition may worsen over the course of the operation depending on the type of environment and extent of their illness or injury. Patients with pre-existing medical conditions may suffer from exacerbations during the rescue operation. The paramedic should ensure that adequate pharmacological and medical supplies are available to treat patients during and after these rescue operations. Pain management is potentially needed, particularly during an extrication where the patient may have traumatic injuries from the event. Non-pharmacological pain management techniques are preferable. There should also be consideration for crush injuries, particularly crush syndrome. Patients with these types of injuries may require high-flow oxygen, positive pressure ventilations, and/or pharmacological therapy when circulation is restored to the crushed areas and toxins are released into the rest of the body. The paramedic should have a variety of medical supplies including PPE, splints, bandages, hot/cold packs, scissors, flashlights, and blankets. Various types of patient packaging equipment, such as backboards, Stokes basket, KED, vacuum mattress, and SKED litter, should be available to select from based on the type of rescue and environment the patient is to be removed from. In most rescue situations, the paramedic must be able to adapt and improvise when needed.

(pp 2247-2250)

## Unit Assessment

1. What are the three levels of training in technical rescue, and why is it essential that the paramedic have a basic awareness of these techniques?

2. What are some common guidelines that should be followed during a technical rescue?

3. What is the difference between simple and complex access? Identify situations when each may be appropriate.

4. Identify and describe the two most common types of vehicle frames, including which types of vehicles these are most commonly seen in.

5. What are some concerns related to alternative powered vehicles?

6. Describe concerns associated with air bag deployment and special considerations that should be made when air bags have deployed in a crash.

7. What is meant by a confined space rescue? Identify potential hazards associated with this type of operation.

8. When is water rescue needed? Identify locations where it may be needed and associated challenges.

9. What is the difference between low-angle and high-angle rescue? Identify incidents when each would be appropriate.

10. Discuss considerations for patient care during and after various types of technical rescue operations.