First Responder EMS Curriculum for Training Centers in Eurasia

Student Manual

A·I·H·A

American International Health Alliance

Preface

In the region of Central and Eastern Europe (CEE) and Eurasia, deaths resulting from accidents and cardiac incidents are roughly three times greater than in the United States, according to the World Health Organization. Contributing to the higher death rates has been the lack of well-trained first responders which, together with a relatively weak emergency response infrastructure, reduces the ability to successfully respond to unexpected illnesses, accidents, and disasters. To create sustainable capacity within the countries of CEE and Eurasia to effectively respond to a range of emergencies, the American International Health Alliance (AIHA) established 16 national Emergency Medical Services Training Centers (EMSTCs) in 12 nations throughout the region and developed a uniform curriculum adapted to the existing structure of healthcare systems in those countries. These training centers, designed to provide hands-on, practical training in a wide range of first aid and emergency care techniques, have provided training to more than 34,000 physicians, nurses, and others between 1995 and 2002.

This *First Responder EMS Curriculum for Training Centers in Eurasia* is the result of AIHA's efforts to address the need expressed by the EMSTCs for a curriculum more specifically tailored to non-medical personnel, such as police and firefighters, who are often the first ones on the scene of an accident, medical emergency, or disaster. AIHA commissioned partners at Harvard University's Beth Israel Deaconess Medical Center and Emergency Medicine Visions International, Inc. to adapt the U.S. Department of Transportation's *First Responder National Standard Curriculum* for the CEE/Eurasia region. This curriculum represents the current state of the art for first responder training. The adapted curriculum has been reviewed by emergency and disaster medicine experts from several Eurasian countries.

The American International Health Alliance is a not-for-profit, non-governmental organization operating under cooperative agreements with the United States Agency for International Development (USAID), the U.S. government agency that finances programs and projects that promote broad-based, sustainable economic growth worldwide. AIHA's mission is to advance global health through volunteer-driven partnerships that mobilize communities to better address healthcare priorities while improving productivity and quality of care. Created in 1992, AIHA establishes and manages partnerships between healthcare institutions in the United States and their counterparts in CEE and Eurasia.

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Revised First Responder EMS Curriculum/AIHA

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Job Description: First Responder

The First Responder may function in the context of a broader role, i.e., law enforcement, fire rescue, or industrial response. With a limited amount of equipment, the First Responder answers emergency calls to provide efficient and immediate care to ill and injured patients. After receiving notification of an emergency, the First Responder safely responds to the address or location given. The First Responder:

1. Functions in uncommon situations
2. Has a basic understanding of stress response and methods to ensure personal well-being
3. Has an understanding of body substance isolation
4. Understands basic medical-legal principles
5. Functions within the scope of care as defined by state, regional, and local regulatory agencies
6. Complies with regulations on the handling of the deceased, protection of property, and evidence at the scene while awaiting additional EMS resources

Before initiating patient care, the First Responder will size up the scene to determine that the scene is safe, identify the mechanism of injury or nature of illness and the total number of patients, and request additional help if necessary. In the absence of law enforcement, the First Responder creates a safe traffic environment. Using a limited amount of equipment, the First Responder renders emergency medical care to adults, children, and infants on the basis of assessment findings.

Duties include but are not limited to:

1. Opening and maintaining an airway
2. Ventilating patients
3. Administering cardiopulmonary resuscitation
4. Providing emergency medical care of simple and multiple system trauma such as
    - Controlling hemorrhage
    - Bandaging wounds
    - Manually stabilizing injured extremities
5. Providing emergency medical care to
    - Assist in childbirth
    - Manage general medical complaints, altered mental status, seizures, environmental emergencies, behavioral emergencies, and psychological crises
6. Searching for medical identification emblems as a guide to appropriate emergency medical care
7. Reassuring patients and bystanders by working in a confident, efficient manner
8. Avoiding mishandling and undue haste while working expeditiously to accomplish the task

Other Duties

1. Where a patient must be extricated from entrapment, assesses the extent of injury and assists other EMS providers rendering emergency medical care and protection to the entrapped patient.
2. Performs emergency moves and assists other EMS providers in the use of the prescribed techniques and appliances for safely removing the patient.

3. Under the direction and supervision of other EMS providers, assists in lifting the stretcher, placing the stretcher in the ambulance, and seeing that the patient and stretcher are secured.
4. If needed, radios the dispatcher for additional help or special rescue and/or utility services. In cases of multiple patients, performs basic triage.
5. Reports directly to the responding EMS unit or communications center the nature and extent of injuries, the number of patients, and the condition of each patient. Identifies assessment findings that may require communicating with medical oversight for advice.
6. Constantly assesses the patient while awaiting additional EMS resources. Administers additional care as indicated.
7. Orally reports observations and emergency medical care of the patient to the transporting EMS unit. Upon request, provides assistance to the transporting unit staff.
8. After each call, restocks and replaces used supplies, cleans all equipment following appropriate disinfecting procedures, and carefully checks all equipment to ensure availability for next response.
9. Attends continuing education and refresher education programs as required by employers, medical oversight, and licensing or certifying agencies.

Functional Job Analysis

a. *First Responder Characteristics*

The First Responder must be a person who can remain calm while working in difficult and stressful circumstances. He or she also is capable of combining technical skills, theoretical knowledge, and good judgment to ensure the optimal level of fundamental emergency care to sick or injured patients while adhering to specific guidelines within the given scope of practice.

The First Responder is expected to be able to work alone, but must also be a team player. Personal qualities such as the ability to take charge and control the situation are essential, as are maintaining a caring and professional attitude, controlling his/her own fears, presenting a professional appearance, staying physically fit, and keeping his/her skills and abilities up to date. The First Responder must be willing to adhere to the established, ongoing medical control and evaluation required for the maintenance of quality medical care.

Self-confidence, a desire to work with people, emotional stability, tolerance for high stress, honesty, a pleasant demeanor, and the ability to meet the physical and intellectual requirements demanded by this position are characteristics of the competent First Responder. The First Responder also must be able to deal with adverse social situations, which include responding to calls in districts known to have high crime rates. The First Responder ideally possesses an interest in working for the good of society and has a commitment to doing so.

b. *Physical Demands*

Aptitudes required for work of this nature are good physical stamina, endurance, and body condition that would not be adversely affected by having to walk, stand, lift, carry, and balance, at times, in excess of 125 pounds. Motor coordination is necessary because the patient's and the First Responder's well-being, as well as that of other workers, must not be jeopardized while on uneven terrain.

c. Additional Skills

1. Use of the telephone or radio dispatch for coordination of prompt emergency services is essential.
2. Accurately discerning street names through map reading and correctly distinguishing house numbers or business addresses are essential to task completion in the most expedient manner.
3. Concisely and accurately describing orally to dispatcher and other concerned staff one's impression of patient's condition is critical as the First Responder works in emergency conditions where there may not be time for deliberation.
4. The First Responder must also be able to accurately report all relevant patient data, which is generally, but not always, outlined on a prescribed form.
5. Verbal and reasoning skills are used extensively.
6. The ability to perform mathematical tasks is minimal; however, it does play a part in activities such as taking vital signs, making estimates of time, calculating the number of persons at scene, and counting the number of persons requiring specific care.

Introduction to the Emergency Medical Services (EMS) System

Contents

1. Objectives

a. Cognitive Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Define the components of an emergency medical services (EMS) system.
2. Differentiate the roles and responsibilities of the First Responder from other out-of-hospital care providers.
3. Define medical oversight and discuss the First Responder’s role in the process.
4. Discuss the types of medical oversight that may affect the medical care of the First Responder.
5. Identify specific regulations in your region.

b. Affective Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Accept and uphold the responsibilities of a First Responder with the standards of an EMS professional.
2. Explain the rationale for maintaining a professional appearance when on duty or responding to calls.
3. Describe why it is inappropriate to judge a patient on the basis of culture, gender, age, or socioeconomics and to vary the standard of care as a result of that judgment.

c. Psychomotor Objectives

None for this lesson.

2. Overview of the EMS System

The EMS system is a network of trained personnel and resources to provide emergency care and transport to victims of sudden illness and injury. The goals of the EMS system are to educate personnel in the prevention of injury, recognize the occurrence of the event and activation of the system, initiate emergency care, and transport victims safely to the hospital for definitive diagnosis and management of their illness and/or injury. The system begins with the arrival on scene of First Responders, the first vital link in the chain of survival. First Responders include fire and rescue personnel, police, industrial response teams, and individual bystanders trained in the First Responder curriculum. First Responders initiate emergency medical care at the scene until more advanced EMS personnel arrive to transport the patient to a receiving facility (hospital). Transferring patient care to the in-hospital personnel in a safe and timely manner results in the best overall opportunity for patient survival.

3. Components of an EMS System

There are 10 classic components of an EMS system:

1. Regulations and policies that effectively standardize the emergency care provided to all patients
2. Effective use of the resources available
3. Provision of standardized education and training for EMS personnel
4. Provision of safe and timely transport of the patient to the hospital
5. Transfer of care of the patient to hospital facilities
6. Communication between pre-hospital and hospital personnel
7. Public information and education
8. Medical oversight and direction of standardized pre-hospital emergency care
9. Standardized care for the trauma patient
10. Ongoing evaluation of the EMS system and its personnel, with timely recertification and updates in education and training.

4. Access to the EMS System

It is vitally important to be able to communicate with more advanced pre-hospital EMS personnel. Once the First Responder identifies a patient with illness or injury, it is necessary to activate these more advanced personnel to transport patients to the hospital. In the United States. calling 911 connects the First Responder with a trained dispatcher who can then mobilize advanced EMS personnel. A local or regional number may also be used to begin this process.

5. Levels of Training

Pre-hospital EMS personnel are categorized by four levels of training. Each level of training consists of increasingly more advanced emergency care of the patient. Levels of training include: (1) First Responders, (2) EMT-Basic, (3) EMT-Intermediate, and (4) EMT-Paramedic. Each level of increased specialization requires increased numbers of hours of training in emergency medical care and skills. In general, the most effective use of human resources dictates the training of a maximum number of First Responders. These are personnel from all walks of life who can effectively begin identification of medical illness and injury and subsequently begin basic life-saving techniques they have learned through training. With each level of increasing specialization, fewer numbers of trained personnel are needed. The number of personnel trained depends on the needs of the population at risk for illness or injury. This number is determined through the combined efforts of a medical control committee, local industries and businesses, and government officials for the general population. Remember, the First Responder is, in most instances, the first vital link in the chain of survival for a patient at risk. The knowledge and skills they learn can mean the difference between life and death.

6. The In-Hospital Care System

The goal of all pre-hospital EMS personnel is to identify patients with illness or injury and transport them as quickly and safely as possible to facilities where more definitive medical care can begin. Hospitals constitute the final destination for all patients. Hospitals may vary in their capabilities to care for patients with certain medical and traumatic illnesses or injuries. Emergency departments represent the front line of emergency care in the hospital system. Doctors and nurses trained in the emergency care of patients with a vast array of medical and traumatic emergencies continue the care begun by pre-hospital personnel in the field. Transfer of patients to more specialized facilities should be considered as soon as life-threatening problems have been managed and the patient is stabilized. These facilities may include trauma centers, burn centers, pediatric centers, perinatal centers, and poison centers.

7. Overview of the Local EMS System

It is important for local EMS systems to continually evaluate and update their current systems. This effort involves retraining and recredentialing of EMS pre-hospital and in-hospital personnel on a routine basis.

8. Roles of the First Responder

The First Responder is usually the first care provider at the scene of a medical or traumatic emergency. The First Responder plays several important roles at the scene. The first priority is always personal safety, as well as patient and other bystander safety. It is necessary to gain access to the patient without risking personal injury or further injury to the patient. After gaining access to the patient, the First Responder assesses the patient to identify life-threatening conditions. The next step is contacting additional EMS personnel for help and continuation of care. Based on the initial patient assessment, the First Responder then initiates emergency care until further EMS personnel arrive to help. Once more advanced help arrives, the First Responder functions to inform other EMS personnel of the events prior to their arrival and the emergency care already performed. The First Responder acts as liaison with other public safety workers, including local law enforcement, fire departments, and other EMS providers.

9. Responsibilities of the First Responder

To maintain optimum performance, a First Responder must fulfill several responsibilities. Always maintain personal health and safety. You cannot help a patient if you become ill or injured yourself. Always maintain a caring attitude. Reassure and comfort the patient, family, and bystanders while awaiting other EMS personnel. Maintain composure, confidence in your training, and a clean and professional appearance. Make the patient’s needs a priority without endangering yourself or others at the scene. The First Responder should provide *continuity of care* by communicating patient information to the EMS personnel taking over the care of the patient. It is also the responsibility of the First Responder to maintain up-to-date knowledge and skills, including continuing education, refresher courses, and recertification. Maintain current knowledge of local, industrial, and national issues affecting EMS systems.

10. Medical Oversight of the EMS System

Every EMS system consists of a formal relationship between the EMS providers at all levels of training and the physician responsible for providing pre-hospital emergency care in the community. This physician is often referred to as the system medical director. The medical director functions to ensure that pre-hospital EMS providers are trained to a competency level consistent with their level of training. The medical director provides oversight, advice, and further medical direction to pre-hospital providers in the field when necessary. Two types of medical oversight may be used. (1) Direct medical control involves direct communication between the physician and pre-hospital providers at the scene. This communication may be via radio, telephone, or actual contact with a physician on scene. (2) Indirect medical control includes everything that is not direct medical control, including both prospective and retrospective design and evaluation of the EMS system. Medical oversight involves system design, standardized protocol development, continuing education, and quality control management. The First Responder is considered an extension of the medical director's authority in the field.

Introduction to Emergency Medical Services (EMS)

Prepared for AIHA by EMVI
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Goals of the EMS System

- Educate personnel in the prevention of injury
- Recognize an emergency event and activate the system
- Initiate emergency medical care
- Transport victims safely to the hospital for definitive management of their illness or injury
- The first vital link in the chain of survival is the First Responder

Components of an EMS System

1. Policies that standardize the emergency care of all patients
2. Effective utilization of available resources
3. Standardized education and training of EMS personnel
4. Safe and timely transport of the patient to the hospital
5. Transfer of care of the patient to hospital facilities
6. Communication between pre-hospital and hospital personnel

Continued

Components of an EMS System

7. Public information and education
8. Medical oversight and direction of standardized pre-hospital emergency care
9. Standardized care for the trauma patient
10. Ongoing evaluation of the EMS system with timely re-certification and updates in education and training

Access to EMS

- Local or regional number allowing communication with more advanced EMS personnel
- Once a First Responder identifies a patient with illness or injury, activating the EMS system to call for more advanced emergency personnel is vitally important
- In the U.S., this number is 911, which contacts a trained dispatcher, who can then mobilize these more advanced personnel

Levels of Training

1. First Responder
2. EMT-Basic
3. EMT-Intermediate
4. EMT-Paramedic

- Increased specialization requires increased numbers of hours of education and training
- Effective utilization of resources dictates that a maximum number of First Responders be trained
- Each level of increased specialization requires fewer personnel to be trained

Roles of the First Responder

- Personal safety
- Safety of the patient and bystanders
- Patient assessment and care
- Transport and transfer of care
- Maintain personal health and safety
- Reassure and comfort the patient and family
- Provide continuity of care by communicating information to more advanced EMS personnel
- Maintain education and skills for re-certification

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Medical Oversight

- Physician responsible for pre-hospital care delivered
- Ensures that pre-hospital personnel are trained to a competency level consistent with their level of training

- **Direct Medical Control:**
  - Direct communication between the physician and pre-hospital providers at the scene
- **Indirect Medical Control:**
  - System design, standardized protocols, continuing education, quality control

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Well-Being of the First Responder

Contents

1. Objectives

a. Cognitive Objectives

At the completion of this lesson, the First Responder student will be able to:

1. List possible emotional reactions that the First Responder may experience when faced with trauma, illness, death, and dying.
2. Discuss the possible reactions a family member may exhibit when confronted with death and dying.
3. State the steps in the First Responder's approach to the family confronted with death and dying.
4. State the possible reactions that the family of the First Responder may exhibit.
5. Recognize the signs and symptoms of critical incident stress.
6. State possible steps that the First Responder may take to help reduce/alleviate stress.
7. Explain the need to determine scene safety.
8. Discuss the importance of body substance isolation.
9. Describe the steps the First Responder should take for personal protection from airborne and blood-borne pathogens.
10. List the personal protective equipment necessary for each of the following situations:
    - Hazardous materials
    - Rescue operations
    - Violent scenes
    - Crime scenes
    - Electricity
    - Water and ice
    - Exposure to blood-borne pathogens
    - Exposure to airborne pathogens

b. Affective Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Explain the importance of serving as an advocate for the use of appropriate protective equipment.
2. Explain the importance of understanding the response to death and dying and communicating effectively with the patient's family.
3. Demonstrate a caring attitude toward any patient with illness or injury who requests emergency medical services.
4. Show compassion when caring for the physical and mental needs of patients.
5. Participate willingly in the care of all patients.
6. Communicate with empathy to patients being cared for, as well as with family members and friends of the patient.

c. Psychomotor Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Use appropriate personal protective equipment in a scenario with potential infectious exposure. At the completion of the scenario, the First Responder will properly remove and discard the protective garments.
2. Complete disinfection/cleaning and all reporting documentation for the above scenario.

2. Emotional Aspects of Emergency Medical Care

a. Stressful Situations

The First Responder will be called upon to provide emergency medical assistance in a variety of stressful situations. It is important to consider these situations before confronting them. The act of caring for an ill or injured patient is a combination of physical, mental, and emotional preparedness. Examples of stressful situations include mass casualties (the number of ill or injured patients exceeds the capabilities of the system to care for them, i.e., emergency care personnel, equipment and supplies, facilities), pediatric patients, infant and child trauma, amputations, death, abuse of an infant/child/elder/spouse, violence, and death or injury of a co-worker or other public safety personnel. In all of these situations, the First Responder will experience personal stress as well as the stress of the patient and bystanders. Your effectiveness in all situations will depend on your preparedness.

b. Death and Dying

1. Death is a universal experience that we will all face at one time or another. Death affects everyone, including the First Responder, bystanders, and families and friends. Everyone's response to death is individualized. However, most people share a common coping mechanism, which is the normal grieving process. Understanding the five **stages of the grieving process** will better enable you to understand and interact with people who are trying to cope with the death of a loved one, co-worker, or even a stranger. Compassion and understanding result from a familiarity with these five stages of the grieving process.
2. **Denial** is the first stage. Disbelief of a dreadful situation is a natural first response. This defense mechanism allows us to separate ourselves from the shock associated with an illness or injury resulting in death.
3. **Anger**. Bystanders or family will often feel tremendous anger over the death of a loved one. "Why me?" is a common feeling. First Responders may be the initial target of this anger. It is important to exercise calm and compassion. Do not take anger or insults personally. Always try to listen and communicate with bystanders

and family. Do not become defensive. Be tolerant and empathetic. Remain composed.

4. **Bargaining**. An agreement, which in the patient's mind, will temporarily postpone inevitable death. "OK, but first let me…"
5. **Depression**. This is a stage of overwhelming sadness and despair and a feeling of hopelessness.
6. **Acceptance**. This is the final stage of the grieving process. The patient will often reach this stage earlier than family or bystanders. Support, understanding, and compassion remain vitally important.

The First Responder must be able to deal with dying patients and their friends or family. Always remember the needs of the patient: dignity, respect, privacy, control, sharing, and communication. Let the patient know that everything that can be done to help will be done. Comfort the patient and family, reassuring them that all appropriate measures are being taken. Use a gentle, firm voice and a reassuring touch, when appropriate. Listen to, and communicate with, the patient and family. Do not falsely reassure. Allow the patient and family members to express anger, rage, and despair.

c. *Stress Management*

Stress can be managed at several different levels. These range from awareness of warning signs, to making changes in lifestyle and the workplace, and to seeking professional help, if necessary.

1. **Recognize warning signs**. Maintaining an awareness of the way in which stress reveals itself may help prevent emotional and physical injury to an individual or his/her co-workers, family, or friends. These symptoms of stress may include irritability toward others, inability to concentrate, insomnia/difficulty sleeping, anxiety, indecisiveness, guilt, loss of interest in work, loss of interest in sex, loss of interest in previously enjoyed activities, and isolation.
2. **Make changes in lifestyle.** Maintaining a healthy lifestyle will often help maintain a healthy attitude toward work, family, and friends. It may help with "job burnout." Altering your diet to include reduced fat, sugar, caffeine, and alcohol promotes well-being. Exercise and relaxation also are vital to the well-being of the First Responder.
3. **Achieve balance**. Balance work with appropriate amounts of time for recreation, exercise, family, and friends.
4. First Responders and emergency medical services (EMS) personnel should try to share their experiences, questions, and frustrations with other emergency personnel. **Communicate** the stresses of the job with family and friends. Caring for people requires a support network of people.
5. **Make changes in the work environment.** Always consider ways to make the workplace a healthier environment.
6. **Seek/refer professional help, if necessary**. The job of the First Responder involves dealing with a variety of stressful situations. Included in the support network are mental health professionals, social workers, and clergy.

d. *Comprehensive Critical Incident Stress Management*

Critical incident stress management requires a comprehensive approach to best serve the First Responders and other personnel in the EMS system. The first step, as outlined above, is education regarding stressful situations. Other important elements in this comprehensive approach include medical direction support, peer support, follow-up services for workers and families, and community awareness and support programs. Critical incident stress debriefing (CISD) is a discussion among peer emergency and medical direction personnel of the events surrounding a stressful incident. Open communication, recognition of strengths and weaknesses in dealing with a particular medical or traumatic emergency, and peer support will ultimately lead to a more effective and responsive EMS system.

e. Critical Incident Stress

The EMS system should provide effective measures to help emergency workers cope with stressful situations. Stress is a normal response to abnormal situations. Accelerated recovery from the stress of certain critical incidents is a worthwhile goal. This system usually involves peer counselors and mental health professionals. Not every medical or traumatic situation requires a formal debriefing. Certain incidents, however, should warrant in-depth discussion. These situations include line-of-duty death or serious injury, multiple casualty incident, suicide, serious injury or death of a child, events with media interest, victims known to the responding emergency personnel, and any disaster.

Techniques for enhancing the recovery process include:

1. **Defusings**. This technique is shorter, less formal, and less structured than a formal debriefing. Defusing should take place within a few hours after an event and usually will last less than 30 minutes. It offers time for emergency personnel to vent feelings, frustrations, and concerns and to ask questions.
2. **Debriefings**. This is a formal meeting held 24 to 72 hours after a critical incident. Debriefings provide an open discussion of the events, feelings, concerns, and reactions. It is not meant to be an interrogation or investigation. Peer emergency personnel, medical direction, and mental health professionals evaluate the information discussed and offer suggestions on overcoming the stress of the critical incident. All information must be confidential.

3. Body Substance Isolation (BSI)

Emergency medical care for patients with medical and traumatic illness or injury involves certain inherent risks to the First Responder. First Responders must be aware of these risks when approaching all patients and must take the appropriate precautions. Exposure to a patient's bodily fluids, airborne particles, and hazardous materials at the scene may all be limited significantly by the use of appropriate precautions and safety equipment. First Responders are exposed to infectious diseases when treating patients. They should assess the potential risk involved and take appropriate precautions. Personal protective equipment should be used as needed. Barrier devices or ventilation masks should be used when ventilating a patient.

a. Infection Control

The primary goal is prevention of disease transmission. The most important technique to prevent disease transmission is hand washing/personal hygiene. Cleaning, disinfecting, and replacing used equipment also is vitally important.

BSI includes the use of eye protection, gloves, gowns, and masks whenever the First Responder is at risk for transmission of disease.

1. **Eye protection**. Safety glasses may be used. An alternative is prescription glasses with side shields.
2. **Gloves**. Vinyl, latex, or synthetic gloves should be worn whenever contact with a patient's bodily fluids is possible (blood, saliva, vomit, urine). Gloves should be changed between contacts with different patients. Gloves also should be used when cleaning equipment.
3. **Gowns**. Optimally, gowns are used in situations involving large splashing of fluids, including major trauma and childbirth.
4. **Masks**. These help prevent transmission of disease via airborne particles as well as blood splatter.
5. **Recommended immunizations** include tetanus prophylaxis, hepatitis B vaccination, tuberculin testing, as well as regional considerations.

4. Scene Safety

Scene safety begins with an assessment of the scene and surroundings to provide valuable information to the First Responder before rendering care to the patient. Well-being is always the first priority for the First Responder. Always ask…Is it safe to approach the patient? Certain risks relating to a particular scene may make approach difficult or impossible. Special circumstances include exposure to toxic substances (fire/smoke/etc.), crash or rescue scenes involving unstable or heavy vehicles/equipment, and unstable surfaces because of slopes, ice, mud, and water. Crime scenes may also have the potential for violence. The first priority is personal protection. The second priority is patient protection. The third priority is bystander protection. If the scene is unsafe, make it safe. If the scene cannot be made safe, do not enter.

a. Special Situations

Always try to identify any potential hazardous materials that may threaten your safety. Look for any containers labeled with warning signs. Look for any obvious spilled fluids, smoke, or fire. Many hazardous material scenes require specially trained hazardous materials teams. First Responders only provide care after the scene is safe and containment is completed.

Motor vehicle accidents often present several different potential life-threatening situations including electrical injury, fire, explosion, hazardous materials, and other traffic. Local law enforcement and rescue teams should be dispatched. Again, the First Responder should render care only when the scene is safe.

Other special situations include crime and violence scenes. In each case, law enforcement officials should control the safety of the scene before the First Respond enters the scene to provide patient care.

Well-Being of the First Responder

Prepared for AIHA by EMVI
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Stressful Situations

- Mass casualties
- Pediatric patients
- Infant and child trauma
- Amputations
- Infant/child/spouse/elder abuse
- Violence
- Death

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Death and Dying

- 5 Stages of the Grieving Process
  1. Denial
  2. Anger
  3. Bargaining
  4. Depression
  5. Acceptance
- Response to death is individualized
- Always remember the needs of the patient first

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Stress Management

- Recognition of warning signs
- Life-style changes
- Balance
- Communication
- Work environment changes
- Seek/refer professional help, if necessary

Critical Incident Stress Management

- Education regarding stressful situations
- Medical direction support
- Peer support
- Follow-up services for workers and families
- Community awareness and support programs
- Open communication, recognition of strengths and weaknesses
- **Critical Incident Stress Debriefing:** a discussion of the events surrounding a stressful incident

Continued

Critical Incident Stress Management

- **Stressful situations:**
  - Line of duty death or injury, multiple casualties, suicide, injury or death of a child, disasters
- **Techniques for handling stressful situations:**
  - **Defusings:** short discussion of events within a few hours after the event
  - **Debriefings:** formal meeting after a critical incident to discuss feelings, concerns

Body Substance Isolation

- Prevention of the transmission of communicable diseases
- Exposure to body fluids, airborne particles, hazardous materials
- **Hand washing** is the most important technique
- **Eye protection**
- **Gloves**
- **Masks**
- **Gowns**
- **Immunizations**

Scene Safety

- Assessment of the scene and surroundings
- Is it safe to approach the patient?
- **Risks include:** toxic substances, heavy vehicles/equipment, unstable surfaces, crime scenes
- First priority is personal protection
- Second priority is patient protection
- Third priority is bystander protection
- **If the scene is unsafe, make it safe. If it cannot be made safe, do not enter.**

Legal and Ethical Issues

Contents

1. Objectives

a. Cognitive Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Define the First Responder scope of care.
2. Discuss the importance of do not resuscitate advanced directives.
3. Define consent, and discuss the methods of obtaining consent.
4. Differentiate between expressed and implied consent.
5. Explain the role of consent of minors in providing care.
6. Discuss the implications for the First Responder in patient refusal of transport.
7. Discuss the issues of abandonment, negligence, and battery and their implications to the First Responder.
8. State the conditions necessary for the First Responder to have a duty to act.
9. Explain the importance, necessity, and legality of patient confidentiality.
10. List the actions that a First Responder should take to assist in the preservation of a crime scene.
11. State the conditions that require a First Responder to notify local law enforcement officials.
12. Discuss issues concerning the fundamental components of documentation.

b. Affective Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Explain the rationale for the needs, benefits, and use of advance directives.
2. Explain the rationale for the concept of varying degrees of do not resuscitate orders.

c. Psychomotor Objectives

None for this lesson.

2. Introduction

Legal and ethical issues play an important role in the decisions that First Responders, other emergency medical services (EMS) personnel, and medical care providers make whenever they deliver emergency care to patients. Although the legal considerations and consequences vary by state, region, and country, certain basic principles apply from the moment contact is made with any patient. As long as the First Responder is aware of the issues addressed within this lesson, he/she can make correct decisions to benefit the patient at risk of illness or injury and to minimize the legal and ethical risks whenever he/she provides care.

3. Scope of Care

The First Responder has legal duties to the patient, medical director, and the public. These duties are defined by state and local laws and enhanced by the oversight and guidance of the medical director. The scope of care is the accepted range of cognitive and technical skills the First Responder may perform in providing interventions to care for the patient. In other words, the First Responder may only perform those interventions that he/she has been trained to perform under a standardized curriculum to provide for the well-being of the patient. In essence, the First Responder functions as a direct extension of the medical control in the field. The medical director is responsible for the interventions performed in the field. Guidelines and protocols established for the First Responder by the medical director, and outlined in this course, provide the framework for acceptable actions the First Responder can take. Medical oversight and ongoing review and recredentialing are vital elements in providing the best care possible for patients in the community.

Basic ethical responsibilities will guide the First Responder in rendering care to all patients. First, it is the responsibility of the First Responder to make the physical and emotional needs of the patient the first priority. Mastering the necessary skills to function as a First Responder is also a vital component. Performance will be enhanced through continuing education, reviewing performances, seeking ways to improve response time, and improving communication, all of which ultimately result in improved patient outcome. Honesty and integrity in reporting events also is crucial for continuing improvement of patient care.

4. Competence

Competence is defined as the ability of a patient to understand the questions of the First Responder and to understand the implications of decisions made. The First Responder’s first task is to determine whether a patient is competent to consent to or refuse care. In most cases, if the patient understands the nature of his/her illness or injury and the necessity to receive emergency care, he/she is competent to allow or refuse your intended intervention. Certain cases, however, may prevent you from determining competence, including intoxication from alcohol, drug ingestion, serious injury rendering the patient confused or unconscious, and mental incompetence.

5. Consent

Before providing care, the First Responder must obtain consent from the patient, parent, or legal guardian. A competent patient has the right to make decisions regarding care, including refusal of care. The patient must consent to emergency medical care on the basis of the information provided to them by the First Responder and accept the intended interventions being offered.

a. Expressed Consent

Expressed consent is defined as the verbal consent given by a conscious patient to allow the First Responder to render emergency care. Consent must be obtained from a responsive, competent adult. Re-stated, the patient must be competent and of legal age. The patient must be informed of the steps of the procedures/ interventions and all the related risks. Use three simple steps to obtain expressed consent:

1. Identify yourself.
2. Inform the patient of your level of training.
3. Explain the benefits and risks of the procedures to the patient.

b. Implied Consent

Implied consent is based on the assumption that the unresponsive patient would, if responsive, consent to life-saving interventions.

Children and mentally incompetent adults (e.g., because of mental illness, retardation, drug/alcohol intoxication, confusion resulting from serious illness) deserve special consideration. As a general rule, when life-threatening situations exist and the parent or legal guardian is not available for consent, emergency medical care should be provided based on implied consent. Expressed consent must be obtained if the parent or legal guardian is present.

6. Advanced Directives/Do Not Resuscitate Orders

A patient has the right to refuse resuscitative efforts. The legality related to advanced directives may vary from region to region. If there is any doubt regarding the patient's advance directives, however, the First Responder should institute resuscitative efforts.

7. Refusals

A competent adult patient has the right to refuse emergency medical care. The patient may refuse care, even if the First Responder knows this decision is not in the patient's own best interest. The patient may withdraw from emergency care at any time, as long as the patient is believed to be competent. The rules of expressed consent must be followed at all times. In other words, the patient must be informed of and fully understand all the risks and consequences associated with refusal of emergency medical care. While awaiting the arrival of additional EMS personnel, the First Responder should try to persuade the patient to accept care, informing the patient why he/she should accept care and what may happen as a consequence of the refusal. Determine if the patient is able to make a rational, informed decision (e.g., observe for effects of alcohol, drugs, or serious illness or injury). Consult medical oversight if possible. If there is any doubt regarding the patient's competency, provide care to the best of your ability. In all cases, record all assessments and interventions made, as well as the patient's consent or refusal of emergency care. Documentation is vitally important.

8. Assault/Battery

These terms are defined as unlawfully touching a patient without consent, or providing emergency medical care when a competent patient does not consent to this care. The precise definition of assault/battery, however, may differ from region to region.

9. Abandonment

Abandonment is defined as the termination of care given to a patient without ensuring that care will continue at the same level or higher. A First Responder is responsible for the well-being of the patient as soon as he/she acknowledges the need for medical care. A First Responder may discontinue care only if the patient refuses further care, if the First Responder becomes physically incapable of continuing efforts because of exhaustion, or the safety of the First Responder is threatened.

10. Negligence

Negligence is defined as the deviation from the accepted standard of care resulting in further injury to the patient. Four components must be present to meet the definition of negligence.

1. The First Responder has a duty to act, a formal obligation as part of his/her occupation as an emergency care provider. While the legal duty to act may vary among regions, the First Responder has a moral and ethical responsibility to render emergency care to patients in need. As a general guiding principle, the First Responder should always act as another prudent individual with a similar level of training would act. Following the accepted guidelines at this level of training, the First Responder provides the standard of care.
2. Breach of duty implies a failure to act, or a failure to act appropriately within the guidelines for standards of care.
3. Negligence also requires that physical and/or psychological injury has been inflicted by this breach of duty.
4. Finally, the actions, or lack of actions, by the First Responder must be shown to have caused the patient injury.

11. Confidentiality

Remember, confidentiality is a basic right of the patient. Always try to maintain the patient's respect, dignity, and privacy. Confidential information includes the patient's history gained through an interview, assessment findings, and emergency care provided. This important information should only be released to other health care providers, who can use this information to provide further medical care to the patient. Only the patient has the right to authorize release of this information to non-healthcare providers.

12. Special Situations

Be aware that some patients may wear medical identification bracelets, necklaces, or carry cards that indicate pre-existing medical conditions. This information may be helpful in the unresponsive, confused, or critically ill/injured patient. Medical illnesses (diabetes, epilepsy), medication lists, and allergies may give vital history when the patient is unable to do so.

13. Potential Crime Scene/Evidence Preservation

Allow local law enforcement officials to do their job. The responsibility of the First Responder is to provide emergency medical care to the patient. Do not disturb items at the scene unless effective care of the patient requires it. Documentation of the appearance of the scene in relation to the patient may provide useful information.

14. Documentation

Providing written documentation, including events leading to a patient's illness or injury, medical history, physical assessment, emergency care rendered, as well as notations about the status of the scene, is an extremely important function of the First Responder. A written record provides information that can be reviewed for quality improvement in patient care. Local law may require reporting of child/elder/spousal abuse, sexual assault, violent crimes, and infectious disease exposure.

Practical

Evaluate the actions of the First Responder students during role play, practice, and other skill stations to determine their compliance with the cognitive and affective objectives and their mastery of the psychomotor objectives of this lesson.

Legal and Ethical Issues

Prepared for AIHA by EMVI
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Scope of Care

- Defined as the accepted range of cognitive and technical skills the First Responder performs when providing emergency care to a patient
- First Responder is a direct extension of the medical control in the field
- Medical director is responsible for actions of First Responders
- Education, training, established protocols and guidelines, and ethical responsibilities provide the framework for acceptable actions the First Responder takes

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Competence

- Defined as the ability of a patient to understand the questions of the First Responder and to understand the implications of decisions made
- **Situations preventing determination of competence**:
  - Intoxication from alcohol
  - Drug ingestion
  - Serious injury resulting in confusion or unconsciousness
  - Mental disability/incompetence

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Consent

- **Expressed Consent:**
  - Verbal consent from a responsive, competent adult
  - Patient must be informed of interventions and risks
- **Implied Consent:**
  - Based on the assumption that the unresponsive patient would, if responsive, consent to life-saving interventions
- **General Rule:** When life-threatening situations exist and a parent or legal guardian of a child or mentally incompetent person is not available for consent, provide emergency medical care on the basis of implied consent

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Special Considerations

- Advanced Directives/ Do Not Resuscitate (DNR) Orders
- **Refusals:**
  - A competent adult has the right to refuse care
  - In all cases document the First Responder assessment, interventions made, and the patient's consent or refusal of care
- **Assault/Battery:** providing care without consent
- **Abandonment:** termination of care without ensuring that care will continue at the same or higher level

Continued

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Special Considerations

- **Negligence:**
  - Defined as the deviation from the accepted standard of care, resulting in further injury to the patient
- **4 Components:**
  1. Duty to act
  2. Breach of duty
  3. Injury has been inflicted by this breach of duty
  4. The actions, or lack of actions, by the First Responder, must be shown to have caused the patient's injury
- Always remember patient confidentiality

Continued

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Special Considerations

- Some patients may wear medical identification bracelets, necklaces, or cards indicating pre-existing medical conditions
- Allow local law enforcement officials to do their job at potential crime or accident scenes
- Do not disturb items at the scene unless necessary for appropriate patient care

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Documentation

- A written record is important for quality review of patient care delivered
- **Document**:
  - Events leading to a patient's illness or injury
  - Physical assessment
  - Emergency care rendered
  - Appearance of scene in relation to the patient
  - Suspicion of child/spouse/elder abuse
  - Sexual assault or other violent crimes
  - Infectious disease exposure

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The Human Body: A Systems Approach

Contents

1. Objectives

a. Cognitive Objectives

After completing this lesson, the First Responder student will be able to:

1. Describe the anatomy and function of the musculoskeletal system.
2. Describe the anatomy and function of the respiratory system.
3. Describe the anatomy and function of the circulatory system.
4. Describe the components and function of the nervous system.
5. Describe the anatomy and function of the integument (skin) system.

b. Affective Objectives

None for this lesson.

c. Psychomotor Objectives

None for this lesson.

2. Introduction

Understanding the anatomy and function of the human body is the cornerstone of an adequate physical assessment. The First Responder must be familiar with the anatomy and function of the systems of the human body to perform this initial assessment. The primary systems discussed include the musculoskeletal system, respiratory system, circulatory system, nervous system, and integument (skin) system. Other systems not formally discussed in this lesson are the gastrointestinal system, genitourinary system, and endocrine system. All of these systems function together in a complex relationship to make the human body work in a miraculous way. Breaking the human body into a systems approach, however, provides First Responders with a logical, stepwise approach when evaluating patients with a vast array of illness or injury.

3. Body Systems

a. Musculoskeletal System

The skeletal system is made up of multiple bones that function together to give the body shape and to protect the vital internal organs. Understanding the components (bones) of this system gives the First Responder the knowledge of important anatomic landmarks and their relation to important internal structures.

The skull (cranium) houses and protects the brain. The face is made of several bones, the maxilla and mandible being the most prominent. The spinal column (backbone) is composed of 7 cervical vertebrae, 12 thoracic vertebrae, 5 lumbar vertebrae, 5 sacral vertebrae, and the coccyx (fused). These 30 bones allow for the protection of the spinal cord and help us maintain our upright posture. The thorax (chest) is composed of 12 sets of ribs connected to the 12 thoracic vertebrae in the back and the sternum (breastbone) in front. The last two sets of ribs are called *floating ribs* because they do not attach to the sternum. At the lower end of the sternum is the xyphoid process, an important anatomic landmark used during cardiopulmonary resuscitation (CPR).

The pelvis is the cradle upon which the entire upper body rests, and is connected to the lower spinal column posteriorly as well as to the lower extremities. The lower extremities consist of paired bones that function to provide support for an upright posture and allow us to walk. The femur (thigh) is connected to the pelvis at the hip joint. Downward, the bones include the patella (kneecap), tibia and fibula (shin), and multiple bones of the feet and toes. The knee joint is composed of the femur, patella, tibia, and fibula. The ankle joint is composed of the lower tibia and fibula and the talus (most proximal bone in the foot).

The upper extremities consist of the shoulder (clavicle/collarbone and scapula), the humerus (upper arm), the radius and ulna (forearm), the wrist, hands, and fingers. The shoulder joint is the connection of the humerus to the scapula and clavicle. The elbow joint is the connection of the humerus to the radius and ulna. The wrist joint is the connection of the radius and ulna to the multiple bones of the wrist.

The muscular system gives the body shape, movement, and protects internal organs. There are three types of muscle:

1. Voluntary (skeletal) muscles are responsible for movement. They are contracted and relaxed by the will of the patient, under direct control of the brain and nervous system. These skeletal muscles attach to the bones of the skeletal system to provide form and function.
2. Involuntary (smooth) muscle is not under the direct control of the patient’s will. They are controlled by the autonomic nervous system. These muscles are found in blood vessels, bronchi (airways), and the tubular structures of the gastrointestinal and genitourinary tracts.
3. Cardiac muscle is a specialized muscle that is only present in the heart. Its muscle fibers act uniquely as nerve conduction fibers and function to pump blood.

b. Respiratory System

The respiratory system performs the vital functions of delivering oxygen to the tissues of the body and removing carbon dioxide from the body. Oxygen is a vital nutrient to all living human cells, while carbon dioxide is a by-product of cellular metabolism. Impairment of either of these functions will result in cellular injury and, ultimately, death.

The anatomy of the respiratory system begins with the nose and mouth. These are connected to the pharynx, composed of the oropharynx and nasopharynx. Remember that the pharynx performs the dual function as a passageway for both air and food/water. This makes it a site for possible airway obstruction. The tongue is not part of the respiratory system, but may obstruct the airway as well. At the lower portion of the pharynx lies the epiglottis, a leaf-shaped structure that prevents food and water from entering the trachea during swallowing. Below the epiglottis is the entrance to the trachea (windpipe). This entrance houses the vocal cords within the cartilaginous larynx (voicebox). The trachea then divides into smaller and smaller airways (bronchi, bronchioles) before reaching the lungs. The lungs are the site of oxygen and carbon dioxide exchange. The diaphragm is a muscle that separates the thorax from the abdomen. Its primary function, along with the intercostal muscles of the chest wall, is to ventilate the lungs. Ventilation is the process of moving air into and out of the lungs.

The physiology, or function, of the respiratory system is to bring oxygen-rich air into the lungs, exchange oxygen for carbon dioxide, and remove the carbon dioxide–rich air from the lungs. The diaphragm moves down, the chest wall expands, thus drawing air into the lungs (inhalation). Oxygen and carbon dioxide are exchanged in the lungs. The diaphragm then moves up, the chest wall moves inward, and air is moved out of the lungs (exhalation).

Special consideration is given to the respiratory system in infants and children, because the airway is much more easily obstructed in this group of individuals. All of the structures of the respiratory system are smaller in this group, compared with adults. The tongue of infants and children is proportionately larger. The trachea is of smaller diameter and more flexible, allowing this area to collapse or become obstructed more readily. Always remember that the primary cause of cardiac arrest in infants and children is an uncorrected respiratory problem.

c. *Circulatory System*

The circulatory system functions to deliver oxygen and other nutrients to the tissues of the body, as well as remove waste products from these tissues.

The anatomy of the circulatory system is composed of the heart and blood vessels. The heart functions as the pump of the body’s blood supply. The heart is composed of four chambers: two upper atria and two lower ventricles. The right atrium receives oxygen-poor blood returning from the veins of the body. The right ventricle then pumps this blood into the lungs to replenish it with oxygen and remove carbon dioxide. The oxygen-rich blood is then returned into the left atrium, which pumps the blood into the left ventricle. The left ventricle pumps this oxygen-rich blood to the entire body. Valves are located in between the atria and ventricles to prevent back flow of blood. Valves are also located at the exits of the ventricles into the blood vessels.

The blood vessels consist of the arteries, veins, and capillaries. They carry blood throughout the entire body. The arteries are muscular tubes that carry oxygen and nutrient-rich blood away from the heart to the rest of the body. The heart is also supplied by its own special arteries called the coronary arteries. Anatomically, several arteries are very important, because their pulsations can be palpated at the skin surface. Familiarity with these arteries is vital for circulatory assessment. Four major arteries can be readily palpated. The carotid arteries supply the brain and can be palpated on either side of the neck, just lateral to the trachea (windpipe). The femoral arteries supply the lower extremities and can be palpated in the groin area (groove between the abdomen and thigh). The radial arteries supply the distal arms and can be palpated at the palm side of the wrist, thumb side. The brachial arteries supply the upper arms and can be palpated on the inner aspect of the upper arm between the elbow and shoulder. This artery may be especially useful in infants and children.

The capillaries are tiny blood vessels that connect arteries and veins. These thin-walled vessels are the site of the exchange of oxygen and carbon dioxide. The veins are the blood vessels that carry blood rich in carbon dioxide and waste products back to the heart. These byproducts of cellular metabolism are then excreted from the lungs.

d. Nervous System

The nervous system is composed of the brain, spinal cord, and peripheral nerves. The brain provides higher mental functions of thought and emotion and controls the voluntary muscle functions of the body. The nervous system also controls involuntary activities of the body (e.g., digestion).

Basic anatomy of the nervous system can be broken down into two systems: the central nervous system and the peripheral nervous system. The central nervous system is composed of the brain (located in the cranium) and the spinal cord (located in the spinal column). The peripheral nervous system consists of sensory nerves (carry information from the body to the spinal cord and brain) and motor nerves (carry information from the brain and spinal cord to the rest of the body).

e. Integument (Skin) System

The skin performs several important functions. It protects the body from the environmental extremes of heat and cold. It acts as a barrier to bacteria and other organisms, helps regulate the temperature of the body, and prevents dehydration. It also senses heat, cold, touch, pressure, and pain, and transmits this information to the brain and spinal cord.

The Human Body

A Systems Approach

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Objectives

- **<u>Describe the anatomy and function of</u>**:
  - The Respiratory system
  - The Circulatory system
  - The Musculoskeletal system
  - The Nervous system

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The Respiratory System

- Delivers oxygen via blood to the tissues of the body
- The blood carries the oxygen and exchanges it for carbon dioxide
- The carbon dioxide is then eliminated from the body via the lungs
- Vital function of life

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Respiratory System: The Airway

- Mouth and nose
- **Pharynx (throat)**: oropharynx and nasopharynx
- **Epiglottis**: flap that prevents food from entering the trachea during swallowing
- **Larynx (voicebox)**: below the epiglottis, contains the cartilaginous vocal cords
- The Pharynx is the common pathway for food and air: the most common site of airway obstruction

Respiratory System: The Lungs

- **Trachea (windpipe)**: two branches, each leading to one lung
- **Ventilation**: movement of air into and out of the lungs
- **Diaphragm and Intercostal muscles**: ventilate the lungs
- **Inhalation**: diaphragm and intercostal muscles contract
- **Exhalation**: diaphragm and intercostal muscles relax
- **Gas Exchange**: oxygen is exchanged for carbon dioxide at the alveolar sacs of the lungs through small capillaries
- Oxygen is then carried via the blood to cells, which release carbon dioxide into the blood for transport to the lungs

Respiratory System: Infants and Children

- Smaller airway diameter
- Tongue is proportionately larger
- Trachea is softer and collapses more easily
- Airway more easily obstructed
- Cardiac arrest most commonly caused by respiratory arrest

Circulatory System: The Heart

- Pumps blood containing oxygen and nutrients to tissues
- Four chambers
  - Two **Atria**: receive blood from the body and pumps the blood to the ventricles
  - Two **Ventricles**: right pumps blood to the lungs, left pumps blood to the rest of the body
- Specialized conductive tissue and pacemaker cells

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Circulatory System: The Blood Vessels

- **Arteries**: muscular tubes that transport blood from the heart to the organs of the body
  - Aorta
  - Carotid
  - Femoral
  - Radial
  - Brachial
- Arteries branch into smaller vessels and end in thin-walled **capillaries** where the exchange of oxygen and carbon dioxide occurs

Continued

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Circulatory System: The Blood Vessels

- **Veins**
  - Less muscular tubes that carry carbon dioxide-rich blood from the tissues to the lungs for oxygen exchange
  - Superior Vena Cava
  - Inferior Vena Cava
  - Commonly used for intravenous access for administration of fluids and medications

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Circulatory System: The Blood

- 5 to 6 liters in the average sized man
- Delivers oxygen and removes carbon dioxide
- Contains factors that clot blood and fight against infection
- **Perfusion**: process of circulating oxygen and nutrient-rich blood to the tissues and removing waste products
- **Shock**: state of decreased perfusion of the body's tissues

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Musculoskeletal System: The Skeletal System

- Bones give the body shape and protect vital organs
- Muscles, tendons, and ligaments attach to the bones across joints to provide movement
- **Cranium (skull)**: protects the brain
- **Spinal column**: 33 bones that protect the spinal cord and provide attachments for the ribs
- **Thorax**: 12 pairs of ribs, sternum, and xyphoid process that protect the heart and lungs
- **Pelvis**: provides attachment to the lower extremities
- Bones of the upper and lower extremities

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Musculoskeletal System: The Muscular System

- **Three types**: skeletal, smooth, and cardiac
  - **Skeletal muscle**: voluntary muscles for motion
  - **Smooth muscle**: involuntary muscles for circulation, breathing, digestion, and urination
  - **Cardiac muscle**: involuntary muscle that has the ability to contract on its own

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Nervous System

- **Central Nervous System**: cognitive functions as well as voluntary and involuntary body functions
- **CNS**: brain and spinal cord
- **Peripheral Nervous System**: motor and sensory nerves
- Motor and sensory nerves carry information between the CNS and the muscles and organs of the body

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Other Body Systems

- **Skin (Integument)**: protective barrier, sensory organ, temperature regulation
- **Digestive System**: mouth, esophagus, stomach, liver and pancreas, small and large intestines, rectum
- **Endocrine System**: hormones that regulate multiple body functions

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Lifting and Moving Patients

Contents

1. Objectives

a. Cognitive Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Define body mechanics.
2. Discuss the guidelines and safety precautions to follow when lifting a patient.
3. Describe the indications for an emergency move.
4. Describe the indications for assisting in non-emergency moves.
5. Discuss the various devices associated with moving a patient in the out-of-hospital arena.

b. Affective Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Explain the rationale for properly lifting and moving patients.
2. Explain the rationale for an emergency move.

c. Psychomotor Objectives

1. At the completion of this lesson, the First Responder student will be able to:
2. Demonstrate an emergency move.
3. Demonstrate a non-emergency move.
4. Demonstrate the use of equipment to move patients in the out-of-hospital arena.

2. Introduction

Lifting and moving patients are very important, frequent, and often overlooked responsibilities of the First Responder. Many First Responders are injured needlessly because they use improper lifting and moving techniques. The primary goals of this lesson are prevention of personal injury and safety of the patient.

3. Role of the First Responder

The First Responder should always emphasize personal safety first while attempting to care for patients who are ill or injured. The role of the First Responder is moving patients who are in immediate danger of further injury or declining medical status. The First Responder must be able to position patients to prevent further injury and assist other EMS responders in lifting and moving patients.

4. Body Mechanics/Lifting Techniques

Following certain basic safety precautions and technique guidelines can prevent personal injury to the First Responder and result in the safe lifting of patients. When lifting patients, always remember to use your legs, not your back. Always try to keep the weight of the patient as close to your body as possible. Following these safety precautions can minimize the possibility of disabling back injury, the number one injury sustained by First Responders.

Guidelines to follow whenever lifting patients include: (1) always consider the weight of the patient and the need for lifting help; (2) know your personal physical ability and limitations; (3) try to lift without twisting; (4) position feet to approximately shoulder width; and (5) communicate clearly and frequently with lifting partners and other EMS providers. Practicing these lifting techniques with other providers and using the equipment available is the only effective way to minimize the potential for injury to you or the patient.

5. Principles of Moving Patients

a. General Considerations

First, decide whether a patient should be moved immediately or if moving the patient can wait. This decision depends on a number of factors. In general, if there is no immediate threat to life, the patient may be moved when other EMS personnel arrive to transport the patient. A patient should only be moved immediately (emergency move) when:

1. There is an immediate danger to the patient if he/she is not moved. Circumstances that apply here include fire or the threat of fire, explosions or the threat of explosions, inability to protect the patient from other hazards at the scene, or the inability to gain access to a patient who requires life-saving care (e.g., trapped in a motor vehicle).
2. Life-saving care cannot be given because of the patient's position or location. Examples would include a patient who is trapped or a patient in cardiac arrest who is either in the sitting position or lying on a bed. In these instances, effective CPR cannot be performed without the patient a flat, firm surface.

b. Emergency Moves

Only perform emergency moves when the situation meets the preceding criteria. Whenever considering an emergency move, the First Responder should always try to minimize the possibility of aggravating a spine injury. Spine injury is the greatest danger when moving a patient quickly. Therefore, the First Responder should follow certain principles and guidelines. Make every effort to pull the patient in the direction of the long axis of the body to protect the spine as much as possible. Despite all your efforts, however, there may be situations in which this is not possible. The most common example would be trying to remove a patient from a vehicle. If life-saving intervention is required, remove the patient as best you can with as little twisting as possible.

If the patient is on the floor or ground, three techniques have proven to be useful. (1) Pull the patient's clothing in the neck and shoulder area. (2) Put the patient on a blanket and drag the blanket. (3) Put your hands under the patient's armpits (from the back), grasp the patient's forearms (crossing the chest), and drag the patient. Never pull the patient's head away from the neck and shoulders.

c. Non-Urgent Moves

Non-urgent moves are performed only when other responders are present to help move the patient. These moves are carried out when there is no suspected spine injury. A step-by-step description of each non-urgent maneuver follows.

Direct Ground Lift (only use if no suspected spine injury)

1. Two or three rescuers line up on one side of the patient.
2. Rescuers kneel on one knee (preferably the same knee for all rescuers).
3. Place the patient's arms on his/her chest, if possible.
4. The rescuer at the head places one arm under the patient's neck and shoulder and cradles the patient's head. The rescuer places his/her other arm under the patient's lower back.
5. The second rescuer places one arm under the patient's knees and one arm above the buttocks.
6. If a third rescuer is available, he/she should place both arms under the waist, and the other two rescuers slide their arms either up to the mid-back or down to the buttocks as appropriate.
7. On signal, the rescuers lift the patient to their knees and roll the patient in toward their chests.
8. On signal, the rescuers stand and move the patient to the stretcher.
9. To lower the patient, reverse the steps.
10. Communication among rescuers is vitally important.
11. Always remember to use your legs, not your back, to lift the patient.
12. Always remember to keep the patient's weight as close to your body as possible.

Extremity Lift (no suspected extremity injuries)

1. One rescuer kneels at the patient's head and one kneels at the patient's side by the knees.
2. The rescuer at the head places one hand under each of the patient's shoulders while the rescuer at the feet grasps the patient's wrists.
3. The rescuer at the head slips his/her hands under the patient's arms and grasps the patient's wrists.
4. The rescuer at the patient's feet slips his/her hands under the patient's knees.
5. Both rescuers move up to the crouching position.
6. The rescuers stand up simultaneously and move with the patient to the stretcher.
7. Always remember to use your legs, not your back, to lift the patient.
8. Always remember to keep the patient's weight as close to your body as possible.

d. Transfer of a Supine Patient from Bed to Stretcher

Direct Carry

1. Position stretcher/cot perpendicular to the bed with the head end of the stretcher at the foot of the bed.
2. Prepare stretcher by unbuckling the straps and removing other items.
3. Both rescuers stand between the bed and stretcher, facing the patient.
4. The first rescuer slides one arm under the patient's neck and cups the patient's shoulder, sliding the other arm under the patient's back.

5. The second rescuer slides one hand under the hip and lifts slightly, then places his/her arms under the patient's hips and calves.
6. The rescuers then slide the patient to the edge of the bed.
7. The patient is lifted and curled toward the rescuers' chests.
8. The rescuers carefully rotate and place the patient gently onto the stretcher.
9. Always remember to use your legs, not your back, to lift the patient.
10. Always remember to keep the patient's weight as close to your body as possible.

Draw Sheet Method

1. Loosen the bottom sheet of the bed.
2. Position the stretcher next to the bed.
3. Prepare the stretcher by adjusting the height and unbuckling the straps. Lower the rails, if present.
4. Reach across the stretcher and grasp the sheet firmly at the patient's head, chest, hips, and knees.
5. Slide the patient on the sheet onto the stretcher.

e. Patient Positioning

The First Responder also should follow certain guidelines when positioning patients. *The first rule is to always suspect a spine injury in any trauma patient*. Cervical-spine immobilization and full-spine stabilization are the rule. If a patient is suspected of having a traumatic injury to the head or back, or there is a significant mechanism of injury, the patient should not be moved until additional EMS resources arrive (cervical collar, backboard).

In general, an unconscious patient without suspected trauma should be moved into the *recovery position*. The First Responder does this by rolling the patient onto his/her side (preferably the left). This position optimizes airway patency and circulation. A patient who is experiencing pain or discomfort, or difficulty breathing, should be placed in a position of comfort. Most patients having difficulty breathing will try to assume a sitting position. A patient who is nauseated or vomiting also should be allowed to assume a position of comfort. In all cases, the First Responder should be positioned appropriately to manage the patient's airway.

6. Equipment Familiarity

A vast array of EMS equipment may be used to lift and move patients. The First Responder should be familiar with the equipment used in his/her local EMS system. The most common equipment used by EMS systems includes stretchers/cots, portable stretchers, scoop stretchers, stair chairs, and long and short backboards. The First Responder must practice with the equipment used in the EMS system before using it in the field.

Lifting and Moving Patients

Prepared for AIHA by EMVI
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Lifting and Moving Patients

- Positioning
- Lifting
- Transfer
- Equipment

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Lifting and Moving Patients
Slide 1

Cognitive Objectives

- Define body mechanics
- Guidelines and safety precautions when lifting patients
- Indications for an emergency move
- Indications for assisting in non-emergency moves
- Discuss the various equipment utilized in moving patients

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Lifting and Moving Patients
Slide 2

Affective Objectives

- Explain the rationale for properly lifting and transferring patients
- Explain the rationale for an emergency move

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Slide 3

Psychomotor Objectives

- Demonstrate an emergency move
- Demonstrate the use of the equipment used to move out-of-hospital patients

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Lifting and Moving Patients
Slide 4

Role of the First Responder

- It may be necessary for you to move patients rapidly to a safe location before advanced help arrives
- You can minimize sustaining disabling injuries while lifting and moving patients
- Most injuries can be prevented using proper lifting and moving techniques

Continued

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Lifting and Moving Patients
Slide 5

Role of the First Responder

- Three situations that require moving patients:
  1. When there is immediate danger to the patient
  2. When it is necessary to prevent further patient injury
  3. When assisting other responders
- The threat of fire, explosions, or exposure to hazardous materials may necessitate moving the patient
- **Remember**: Never enter a scene until it is safe.
- Your safety is the first priority

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Lifting and Moving Patients Slide 6

Positioning

- Patient's condition determines positioning
- **Unresponsive patients without suspected spine injury** are placed in the **recovery position** for airway protection
- **Recovery position**: patient is rolled onto left side, left arm under the head, left knee bent for balance
- Medical patients with chest pain or shortness of breath should be allowed to maintain a position of comfort
- Patients breathe easier while sitting rather than lying down

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Lifting and Moving Patients Slide 7

Lifting

- **Body mechanics**: principles of effective use of the muscles and joints when lifting and moving patients
- Using appropriate lifting techniques significantly reduces the likelihood of disabling injuries
- **Highest risk: low back injury**
- Chronic back pain limits your lifestyle and work
- **Remember**: applying a few simple techniques can significantly reduce your risk of injury

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Lifting and Moving Patients Slide 8

Lifting Guidelines

- Always keep your back straight
- Use your legs, not your back, to lift
- The closer you hold the patient's weight to your body, the less strain on your back muscles
- Do not twist your torso
- **<u>Remember</u>**: Back straight, use legs, hold patient close

Continued

Lifting Guidelines

- Consider the patient's weight and number and size of other responders
- Two people are required for a successful lift
- Even numbers of people maintains balance of the patient and equipment
- Stand opposite each other on the ends or sides

Continued

Lifting Guidelines

- The more personnel, the easier it is to carry the patient
- One-handed technique may be used for stretchers or backboards with multiple rescuers
- Minimize back strain when reaching or pulling by keeping your back locked straight
- Push, rather than pull, if possible
- Keep the weight of the patient close to your body, back locked, knees bent
- **Risk of injury highest when weight load is below your waist or above your shoulders**

Moving Patients

- Two types of moves:
  1. Emergency move
  2. Non-emergency move
- Deciding to move any patient depends on the seriousness of the patient's condition and the presence of any life-threatening conditions at the scene

Continued

Moving Patients

- **<u>Emergency move</u>:**
- If patient is in immediate danger or when life-saving care cannot be given in the patient's location or position
- Situations for emergency move: fire, explosives, extremes of heat or cold, lightning
- Patients in cardiac arrest must be moved to the floor for effective CPR

Continued

Moving Patients

- **<u>Non-emergency move</u>:**
- No threat to life
- Care can be given safely
- Patient should be moved only when more advanced personnel arrive at the scene
- Position patients for airway control and comfort

Continued

Moving Patients

- **Emergency move**:
- No time to properly immobilize the spine
- In-line spine control: protect spine by pulling the patient in the direction of the long axis of the body with the patient's body in a straight line
- Clothes drag, blanket drag, arm-under-arm
- Always suspect spinal injury in trauma patients
- Never pull the patient's head away from the neck and shoulders

Continued

Moving Patients

- **Non-emergency move**:
- No suspected spinal injury
- Direct ground lift: three personnel cradle the patient in their arms
- Extremity lift: one rescuer under the arms, the other rescuer under the knees
- Transferring from bed to stretcher: direct carry or draw sheet

Equipment

- Wheeled stretcher
- Portable stretcher: can fold in half
- Scoop stretcher: hinged at both head and feet
- Stair chairs: sitting position to carry patient down stairs
- Backboards: Long backboards for full spine immobilization, short backboards for immobilization during extrication
- Cervical collars

Airway

Contents

1. Objectives

a. Cognitive

At the completion of this lesson, the First Responder student will be able to:

1. Name and label the major structures of the respiratory system on a diagram.
2. List the signs of inadequate breathing.
3. Describe the steps in the head-tilt chin-lift.
4. Relate mechanism of injury to opening the airway.
5. Describe the steps in the jaw thrust.
6. State the importance of having a suction unit ready for immediate use when providing emergency medical care.
7. Describe the techniques of suctioning.
8. Describe how to ventilate a patient with a resuscitation mask or barrier device.
9. Describe how ventilating an infant or child is different from ventilating an adult.
10. List the steps in providing mouth-to-mouth and mouth-to-stoma ventilation.
11. Describe how to measure and insert an oropharyngeal (oral) airway.
12. Describe how to measure and insert a nasopharyngeal (nasal) airway.
13. Describe how to clear a foreign body airway obstruction in a responsive adult.

14. Describe how to clear a foreign body airway obstruction in a responsive child with complete obstruction or partial airway obstruction and poor air exchange.
15. Describe how to clear a foreign body airway obstruction in a responsive infant with complete obstruction or partial airway obstruction and poor air exchange.
16. Describe how to clear a foreign body airway obstruction in an unresponsive adult.
17. Describe how to clear a foreign body airway obstruction in an unresponsive child.
18. Describe how to clear a foreign body airway obstruction in an unresponsive infant.

b. Affective Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Explain why basic life support ventilation and airway protective skills take priority over most other basic life support skills.
2. Demonstrate a caring attitude toward patients with airway problems who request emergency medical services.
3. Place the interests of the patient with airway problems as the foremost consideration when making any and all patient care decisions.
4. Communicate with empathy to patients with airway problems, as well as with family members and friends of the patient.

c. Psychomotor Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Demonstrate the steps in the head-tilt chin-lift.
2. Demonstrate the steps in the jaw thrust.
3. Demonstrate the techniques of suctioning.
4. Demonstrate the steps in mouth-to-mouth ventilation with body substance isolation (barrier shields).
5. Demonstrate how to use a resuscitation mask to ventilate a patient.
6. Demonstrate how to ventilate a patient with a stoma.
7. Demonstrate how to measure and insert an oropharyngeal (oral) airway.
8. Demonstrate how to measure and insert a nasopharyngeal (nasal) airway.
9. Demonstrate how to ventilate infant and child patients.
10. Demonstrate how to clear a foreign body airway obstruction in a responsive adult.
11. Demonstrate how to clear a foreign body airway obstruction in a responsive child.
12. Demonstrate how to clear a foreign body airway obstruction in a responsive infant.
13. Demonstrate how to clear a foreign body airway obstruction in an unresponsive adult.
14. Demonstrate how to clear a foreign body airway obstruction in an unresponsive child.
15. Demonstrate how to clear a foreign body airway obstruction in an unresponsive infant.

2. The Respiratory System

a. Function

The function of the respiratory system is to deliver oxygen to the body and to remove carbon dioxide from the body.

b. Components/Anatomy

The functional components of the respiratory system are referred to as the anatomy. The nose and mouth are the two openings through which air is able to enter and leave the respiratory system. The pharynx is the uppermost section of the respiratory system and consists of two parts, the oropharynx and the nasopharynx. The oropharynx is the interior part of the mouth and the nasopharynx is the interior part of the nose. As you move to the back of the mouth to the base of the tongue, you reach the epiglottis — a leaf-shaped structure that prevents food and liquid from entering the trachea during swallowing. The voice box (larynx) lies just underneath the epiglottis and is the location of the vocal cords. This area also marks the beginning of the windpipe (trachea), which is a rigid tube that extends from the larynx into the chest where it divides into a right and left segment (bronchus) that carries air to each of the lungs. The diaphragm is a strong flat muscle that separates the contents of the chest (lungs, heart, etc.) from the contents of the abdomen (liver, stomach, spleen, intestines, etc.).

c. Physiology

The physiology of the respiratory system refers to the way in which all of the anatomic parts work together to perform their intended function. During normal breathing, the diaphragm moves down while the chest moves out. These actions result in air being drawn into the lungs (inhalation). In the lungs, fresh oxygen is absorbed by the blood, while carbon dioxide is released from the blood in order to be exhaled. When the diaphragm moves up and the chest moves in, this causes air to exit the lungs (exhalation).

d. Infant and Child Anatomy and Physiology Considerations

In infants and children, all of the anatomic structures are smaller and more easily obstructed than in adults. Infants' and children's tongues take up proportionally more space in the mouth than do those in adults. The trachea is more flexible in infants and children. The primary cause of cardiac arrest in infants and children is an uncorrected respiratory problem.

3. Opening the Airway

One of the most important actions the First Responder can perform is opening the airway of an unresponsive patient. An unresponsive patient loses muscle tone, and the soft tissue and base of the tongue may fall backwards in the throat and block the airway. The tongue is the most common cause of airway obstruction in an unresponsive patient. Since the tongue is attached to the lower jaw, forward displacement of the jaw will lift the tongue away from the back of the throat.

a. Head-Tilt Chin-Lift

The head –tilt-chin lift is the method of choice for opening the airway in patients with no suspicion of injury to the head or neck. Research has indicated that the head –tilt-chin lift consistently provides the optimal airway. This technique should be used for uninjured, unresponsive patients.

Technique

Place your hand that is closer to the patient's head on his/her forehead, apply firm backward pressure to tilt the head back. Place the fingers of your hand that is closer to the patient's feet on the bony part of his/her chin. Lift the chin forward and support the jaw, helping to tilt the head back.

Precautions

1. Finger must not press deeply into the soft tissues of the chin as this may lead to airway obstruction.
2. The thumb should not be used for lifting the chin.
3. The mouth must not be closed.

b. Jaw Thrust without Head-Tilt

This technique is an alternative method of opening the airway. It is an effective but fatiguing method, which is somewhat more technically difficult. This is the safest approach, however, to opening the airway in the patient with a suspected spinal injury.

Indications

1. Used for trauma patients
2. Used for unresponsive patients

Technique

Grasp the angles of the patient's lower jaw. Lift with both hands displacing the mandible forward. If the lips close, open the lower lip with your gloved thumb.

4. Inspection of the Airway

An unresponsive patient may have fluid or solids in the airway that compromise the airway. The First Responder also should inspect the airways of responsive patients who cannot protect their airway.

Indications

1. All unresponsive patients
2. Responsive patients who may not be able to protect their own airways

Technique

Open the patient's mouth with a gloved hand. Look inside the airway. Determine whether the airway is clear (patent) or blocked (occluded). The airway can be blocked with fluids such as secretions, blood, or stomach contents, or solids such as food or teeth, or foreign bodies such as dentures.

5. Airway Adjuncts

a. Oropharyngeal (Oral) Airways

Oropharyngeal airways may be used to assist in maintaining an open airway in an unresponsive patient without a gag reflex. Patients with a gag reflex may vomit when this airway is placed.

Technique

1. Select the proper size. Measure from the corner of the patient's lips to the tip of the earlobe or angle of jaw.
2. Open the patient's mouth.
3. Insert the airway upside down, with the tip facing toward the roof of the patient's mouth.
4. Advance the airway gently until resistance is encountered.

5. Turn the airway 180 degrees so that it comes to rest with the flange on the patient's teeth.

Alternate Technique for Use with Infants and Children

1. Select the proper size. Measure from the corner of the patient's lips to the bottom of the earlobe or angle of jaw.
2. Open the patient's mouth.
3. Use a tongue blade to press tongue down and away.
4. Insert airway in upright (anatomic) position.

b. Nasopharyngeal (Nasal) Airways

Nasopharyngeal airways are less likely to stimulate vomiting. They may be used on patients who are responsive but need assistance keeping the tongue from obstructing the airway. Even though the tube is lubricated, this is a painful stimulus.

Technique

1. Select the proper size. Measure from the tip of the nose to the tip of the patient's ear.
2. Also consider diameter of airway in the nostril. Nasopharyngeal airway should not be so large that it causes blanching of the nostril.
3. Lubricate the airway with a water-soluble lubricant.
4. Insert it posteriorly. Bevel should be toward the base of the nostril or toward the septum.
5. If the airway cannot be inserted into one nostril, try the other nostril.
6. Do not force this airway.

6. Clearing the Compromised Airway and Maintaining the Open Airway

First Responders can use three methods to clear or maintain an airway. These techniques are not sequential; the situation will dictate which technique is most appropriate.

a. Recovery Position

The first step in maintaining an open airway uses gravity to help keep the airway clear. The airway is likely to remain open in this position. Unrecognized airway obstructions are less likely to occur. Monitor the patient until additional emergency medical services resources arrive and assume care. The recovery position allows fluids to drain from the mouth and not into the airway. This method is used in unresponsive, uninjured patients who are breathing adequately on their own.

Technique

1. Raise the patient's left arm above his/her head and cross the patient's right leg over the left.
2. Support the face and grasp the patient's right shoulder.
3. Roll the patient toward you onto his/her left side.
4. Place the patient's right hand under the side of his/her face.
5. The patient's head, torso, and shoulders should move simultaneously without twisting.
6. The head should be in as close to a midline position as possible.

b. Finger Sweeps

This method involves using your fingers to remove solid objects from the patient's airway. Remember to use body substance isolation. If foreign material or vomit is visible in the mouth, remove it quickly as the patient may inhale the foreign matter into the lungs with the next breath. Do not perform blind finger sweeps in infants or children.

Technique

1. If uninjured, roll the patient onto his/her side.
2. Wipe out liquids or semi-liquids with the index and middle fingers covered with a cloth.
3. Remove solid objects with a hooked index finger.

c. Suctioning

This method uses negative pressure to keep the airway clear. A patient needs to be suctioned immediately when you hear a gurgling sound during breathing or ventilation. Suction is only indicated if the recovery position and finger sweeps are ineffective in draining the airway or trauma is suspected and the patient cannot be placed in the recovery position. The purpose of suctioning is to remove blood, other liquids, and food particles from the airway. Most suction units are inadequate for removing solid objects such as teeth, foreign bodies, and food. Portable suction equipment is available and may be manually or electrically operated.

Principles

1. Observe body substance isolation.
2. A hard or rigid "tonsil sucker" or "tonsil tip" is preferred to suction the mouth of an unresponsive patient.
3. The tip of the suction catheter should not be inserted deeper than the base of the tongue.
4. Because air and oxygen are removed during suction, it is recommended that you suction for no more than 15 seconds.
   - Decrease time in infants and children
   - Infants 5 seconds
   - Children 10 seconds
5. Watch for decreased heart rate in infants.
6. If you note a decrease in heart rate, stop suctioning and provide ventilation.

7. Determining Presence of Breathing

Immediately after opening the airway, check to see whether the patient is breathing. As you determine the presence of breathing, look at the effort or work of breathing. Normal breathing should be effortless. Observe the chest for adequate rise and fall. Look for *accessory muscle* use (contractions). The accessory muscles of respiration are in the chest wall and neck.

Techniques

1. In patients who are responsive, ask: "Can you speak, are you choking?" The ability to talk or make vocal sounds indicates that air is moving past the vocal cords.
2. In patients who are unresponsive, maintain an open airway and place your ear close to the patient's mouth and nose.

3. Assess for 3 to 5 seconds.
4. Look for the rise and fall of the chest.
5. Listen for air escaping during exhalation.
6. Feel for air coming from the mouth and nose.

The First Responder may observe the rise and fall of the chest even if an airway obstruction is present, but will not hear or feel air movement. Some reflex gasping (agonal respirations) may be present just after cardiac arrest. This should not be confused with normal breathing.

Inadequate breathing is characterized by the following:
1. Rate (breaths per minute: count number of breaths for 15 seconds and multiply times 4)
   - Less than 8 in adults
   - Less than 10 in children
   - Less than 20 in infants
2. Inadequate chest wall motion
3. Cyanosis
4. Mental status changes
5. Increased effort
6. Gasping
7. Grunting
8. Slow heart rate associated with slow respirations

8. Ventilation

Once you have ensured the patient's airway and assessed his/her breathing, it may be necessary to provide breathing for the patient. If the patient is not breathing, he/she only has the oxygen remaining in the lungs and bloodstream. To prevent death under these circumstances, the First Responder must ventilate the patient. There are many techniques for ventilation, but the First Responder must be competent in the following three techniques of ventilation, which are listed in order of preference:

Mouth to mask
Mouth to barrier device
Mouth to mouth

a. Mouth-to-Mask Ventilation

Mouth to mask is the most effective First Responder technique for ventilation. Most masks have a one-way valve to divert the patient's exhalations. Masks should be transparent so that vomiting can be recognized. Mouth-to-mask ventilation is highly effective since you use two hands to seal around the mask.

Technique
1. Place the mask around the patient's mouth and nose using the bridge of the nose as a guide for correct position. Mask position is critical since the wrong size mask will leak.
2. Seal the mask by placing the heel and thumb of each hand along the border of the mask and compressing firmly around the margin.
3. Place your index fingers on the portion of the mask that covers the chin.

4. Place your other fingers along the bony margin of the jaw and lift the jaw while performing a head tilt.
5. Give one slow (1 ½ - 2 second) breath of sufficient volume to make the chest rise (usually 800 to 1,200 ml in the average adult).
6. Too great a volume of air and too fast an inspiratory time are likely to allow air to enter the stomach.
7. Adequate ventilation is determined by:
   - Observing the chest rise and fall
   - Hearing and feeling the air escape during exhalation
8. Continue at the proper rate.
   - 10 to 12 breaths per minute for adults with 1 ½ - 2 second ventilation time
   - 20 breaths per minute for children and infants with 1-12 second inspiratory time
   - 40 breaths per minute for newborns with 1-12 second inspiratory time
9. If the ventilation cannot be delivered, consider the possibility of an airway obstruction.

b. *Mouth-to-Barrier Device*

A barrier device should be used if available when no ventilation mask is available. Some rescuers may prefer to use a barrier device during ventilation; however, barrier devices have no exhalation valve and air often leaks around the shield. Barrier devices should have low resistance to delivered ventilation.

Technique

1. If ventilation is necessary, position the device over the patient's mouth and nose, ensuring an adequate seal.
2. Keep the airway open by the head tilt-chin lift or jaw-thrust maneuver.
3. Give one slow (1 ½ - 2 second) breath of sufficient volume to make the chest rise (usually 800 to –1,200 ml in the average adult).
4. Too great a volume of air and too fast an inspiratory time are likely to allow air to enter the stomach.
5. Adequate ventilation is determined by:
   - Observing the chest rise and fall
   - Hearing and feeling the air escape during exhalation
6. Continue at the proper rate.
   - 10 to 12 breaths per minute for adults, with 1 ½ - 2 second inspiratory time
   - 20 breaths per minute for children and infants, with 1-12 second inspiratory time
   - 40 breaths per minute for newborns, with 1-12 second inspiratory time
7. If the ventilation cannot be delivered, consider the possibility of an airway obstruction.

c. *Mouth to Mouth*

The First Responder must be aware of the risks of performing mouth-to-mouth ventilation. The risks include exposure to potentially infectious bodily fluids such as blood, which may carry infectious diseases including hepatitis or human immunodeficiency virus. However, mouth-to-mouth is a quick, effective method of delivering oxygen to the non-breathing patient. This method involves ventilating a patient with your exhaled breath while making mouth-to-mouth contact. The rescuer's exhaled air contains enough oxygen to support life. Barrier devices and face masks with one-way valves are available for use during ventilation. It is recommended that First Responders always use these devices rather than the mouth-to-mouth technique. The use of a mouth-to-mask/barrier device does not replace training in mouth-to-mouth ventilation. The decision to perform mouth-to-mouth ventilation is a personal choice. Whenever possible, First Responders should use a barrier device or mouth-to-mask technique.

Technique

1. Keep the airway open by the head tilt-chin lift or jaw-thrust maneuver.
2. Gently squeeze the patient's nostrils closed with the thumb and index finger of your hand on the patient's forehead.
3. When ventilating an infant, cover the infant's mouth and nose.
4. Take a deep breath and seal your lips to the patient's mouth, creating an airtight seal.
5. Give one slow (1 ½ - 2 second) breath of sufficient volume to make the chest rise. Too great a volume of air and too fast an inspiratory time are likely to allow air to enter the stomach.
6. Adequate ventilation is determined by:
   - Observing the chest rise and fall
   - Hearing and feeling the air escape during exhalation
7. Continue at the proper rate.
   - 12 breaths per minute for adults
   - 20 breaths per minute for children and infants
   - 40 breaths per minute for newborns
8. If the ventilation cannot be delivered, consider the possibility of an airway obstruction.

9. Foreign Body Airway Obstructions in the Adult

An obstruction of the airway by a foreign body may be the *cause* of cardiac arrest. If the airway becomes blocked as a result of choking on food, bleeding into the airway, or regurgitated stomach contents, the resulting lack of oxygen can lead to cardiac arrest. Conversely, an obstruction of the airway can also be the *result* of a cardiac arrest. Patients with cardiac arrest frequently vomit, with resulting obstruction of the airway from stomach contents. Dentures may become dislodged or the tongue may fall back in the throat in the unconscious patient, obstructing the airway.

a. Types of Airway Obstructions

When a patient is suffering from a *partial* airway obstruction there may be good air exchange or poor air exchange. Patients with *good air exchange* remain responsive and may be able to speak. They can often cough forcefully, but may be wheezing between coughs. Patients with *poor air exchange* often have a weak or ineffective cough. They may have a high-pitched noise on inhalation (stridor) and show increased respiratory difficulty. They may also appear cyanotic (blue). In patients with *complete* airway obstruction, no air can be exchanged. The patient will be unable to speak, breathe, or cough. The patient may clutch the neck with thumb and fingers — the universal distress signal. Death will follow rapidly if prompt action is not taken.

b. Management of the Obstructed Airway

(Refer to the American Heart Association guidelines for the management of foreign body airway obstruction. See Appendices B and C.)

1. Partial with good air exchange
2. Partial with poor air exchange or complete airway obstructions

10. Foreign Body Airway Obstructions in Infants and Children

More than 90% of childhood deaths from foreign body airway obstruction are in children under the age of 5. Of these, 65% are infants. Foreign body airway obstruction in children can be caused by toys, balloons, small objects, and food (hot dogs, round candies, nuts, and grapes). Foreign body airway obstruction should be suspected in infants and children who demonstrate a sudden onset of respiratory distress associated with coughing, gagging, stridor, or wheezing. Airway obstructions also may be caused by infection. The First Responder should only attempt to clear a complete or partial airway obstruction with poor air exchange. Do not attempt blind finger sweeps in infants or children.

a. Management of Foreign Body Airway Obstructions in Infants

(Refer to current American Heart Association guidelines for foreign body airway obstruction.)

b. Management of Foreign Body Airway Obstructions in Children

(Refer to current American Heart Association guidelines for foreign body airway obstruction.)

11. Special Considerations

a. Patients with Stomas

Persons who have undergone a laryngectomy (surgical removal of the voice box) have a permanent opening (stoma) that connects the trachea to the front of the neck. When such persons require rescue breathing, mouth-to-stoma ventilations are required.

Technique

1. Make an airtight seal around the stoma. Use a barrier device, if possible.
2. Deliver a breath slowly, allowing the chest to rise.
3. After delivering the ventilation, allow time for adequate exhalation.
4. Some patients have partial laryngectomies. If, upon ventilating the stoma, air escapes from the mouth or nose, close the mouth and pinch the nostrils.

b. Infant and Child Patients

Place an infant's head in neutral position, but extend a little past neutral if the patient is a child. Avoid excessive hyperextension of the head. Consider an oral airway when other procedures fail to provide a clear airway. Gastric distension is more common in children. Gastric distension may significantly impair ventilation attempts in children.

c. Dental Appliances

Ordinarily, dentures should be left in place. Partial dentures (plates) may become dislodged during an emergency. Leave in place, but be prepared to remove it if it becomes dislodged.

Airway

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with funding from
the US Agency for International Development

The Respiratory System

- Delivers oxygen to the body
- Removes carbon dioxide from the body

Anatomy

- Nose and mouth
- Pharynx, oropharynx, nasopharynx
- Epiglottis
- Trachea
- Bronchi
- Lungs
- Diaphragm

Infant and Child Anatomy

- Structures are smaller and more easily obstructed
- Tongue takes up more space
- Trachea is more flexible

Opening the Airway

- Opening the airway is one of the most important actions the First Responder can perform
- The tongue is the most common cause of airway obstruction
- Head tilt-chin lift technique
- Jaw thrust without head tilt technique

Inspection of the Airway

- An unresponsive patient may have fluids or solids in the airway that may compromise the airway
- Responsive patients who cannot protect their airway should also have their airways inspected

Airway Adjuncts

- Oropharyngeal airway
- Nasopharyngeal airway

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Clearing and Maintaining an Airway

- Three ways that First Responders can clear or maintain an airway:
  - Recovery position
  - Finger sweeps
  - Suctioning

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Determining Presence of Breathing

- In patients who are responsive, the ability to talk or make vocal sounds indicates that air is moving past the vocal cords
- In unresponsive patients
  - Look for rise and fall of chest
  - Listen for air escaping during exhalation
  - Feel for air coming from the mouth and nose

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Airway Slide 8

Ventilation

- Mouth to mask
- Mouth-to-barrier device
- Mouth to mouth
- Adequate ventilation is determined by:
  - Observing chest rise and fall
  - Hearing and feeling air escape during exhalation

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Foreign Body Airway Obstruction

- Partial airway obstruction
  - Good air exchange
  - Poor air exchange
- Complete airway obstruction
  - Patient unable to breathe, speak, or cough

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Airway
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Foreign Body Airway Obstruction in Infants and Children

- Most in children younger than 5 years old
- Only attempt to clear a complete or partial airway obstruction with poor air exchange
- Do not attempt blind finger sweeps in infants or children

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Patient Assessment

Contents

1. Objectives

a. Cognitive Objectives

1. At the completion of this lesson, the First Responder student will be able to:
2. Discuss the components of scene size-up.
3. Describe common hazards found at the scene of a trauma and a medical patient.
4. Determine if the scene is safe to approach.
5. Discuss common mechanisms of injury/nature of illness.
6. Discuss the reason for identifying the total number of patients at the scene.
7. Explain the reason for identifying the need for additional help or assistance.
8. Summarize the reasons for forming a general impression of the patient.
9. Discuss methods of assessing mental status.
10. Differentiate between assessing mental status in the adult, child, and infant patient.
11. Describe methods to assess if a patient is breathing.
12. Differentiate between a patient with adequate and inadequate breathing.
13. Describe the methods to assess circulation.
14. Differentiate between obtaining a pulse in an adult, child, and infant patient.
15. Discuss the need for assessing the patient for external bleeding.
16. Explain the reason for prioritizing a patient for care and transport.
17. Discuss the components of the physical exam.
18. State what areas of the body are evaluated during the physical exam.

19. Explain what additional questioning may be asked during the physical exam.
20. Explain the components of the “SAMPLE” history.
21. Discuss the components of the ongoing assessment.
22. Describe the information included in the First Responder "hand-off" report.

b. Affective Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Explain the rationale for crew members to evaluate scene safety before approaching.
2. Serve as a model for others by explaining how patient situations affect your evaluation of the mechanism of injury or illness.
3. Explain the importance of forming a general impression of the patient.
4. Explain the value of an initial assessment.
5. Explain the value of questioning the patient and family.
6. Explain the value of the physical exam.
7. Explain the value of an ongoing assessment.
8. Explain the rationale for the feelings that these patients might be experiencing.
9. Demonstrate a caring attitude when performing patient assessments.
10. Place the interests of the patient as the foremost consideration when making any and all patient care decisions during patient assessment.
11. Communicate with empathy during patient assessment to patients as well as with family members and friends of the patient.

c. Psychomotor Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Demonstrate the ability to differentiate various scenarios and identify potential hazards.
2. Demonstrate the techniques for assessing mental status.
3. Demonstrate the techniques for assessing the airway.
4. Demonstrate the techniques for assessing if the patient is breathing.
5. Demonstrate the techniques for assessing if the patient has a pulse.
6. Demonstrate the techniques for assessing the patient for external bleeding.
7. Demonstrate the techniques for assessing the patient's skin color, temperature, condition, and capillary refill (infants and children only).
8. Demonstrate questioning a patient to obtain a “SAMPLE” history.
9. Demonstrate the skills involved in performing the physical exam.
10. Demonstrate the ongoing assessment.

2. Introduction

Size-up is the first aspect of patient assessment. It begins as the First Responder approaches the scene. During this phase, the First Responder surveys the scene to determine if any threats may cause an injury to the First Responder, bystanders, or additional injury to the patient. The initial assessment, physical exam, and patient/family questioning are used to identify patients who require critical interventions.

3. Scene Size-Up

On arrival at the scene of any pre-hospital call, emergency personnel may be tempted to immediately rush to the aid of a severely injured patient or one who otherwise appears to be in significant distress. To ensure the safety of both personnel and patients, however, it is important to always begin by assessing the overall picture at any scene. The information gained through this overview also will give valuable clues about the types of injuries that may be encountered and what additional EMS resources may be required.

a. Body Substance Isolation Review

If there is any possibility of exposure to blood or other bodily fluids that may transmit infectious diseases, then emergency personnel must take the necessary precautions to minimize their risk of exposure. Wear latex gloves whenever coming in contact with a patient who is bleeding or who has blood visible on or near them. Wear eye protection and face mask if there is active bleeding and/or a risk of being splashed in the face. A protective gown to cover the arms and body may also be used in these circumstances.

b. Scene Safety

Is the scene safe? The First Responder should think about safety throughout the time they are on scene. Upon arrival at the scene, the First Responder should ask the question: Is it safe to approach the patient? Numerous scenarios can create an unsafe situation for emergency personnel. Motor vehicle accident scenes can have sharp objects and unstable wreckage, as well as risks for electrical shock, fire, and explosions. Chemicals and other toxic substances can be released from vehicles in which they are transported. Fires, as well as clouds of smoke or chemicals, can consume or displace oxygen, creating a life-threatening environment for personnel. There is the potential for violence at crime scenes that have not yet been secured by the police. Potentially unstable landscapes such as steep slopes, icy surfaces, and bodies of water present additional risks to emergency personnel and the patients they are trying to care for.

Once the scene is secure and you have assessed any risks to personnel, protect the patient from any on-scene hazards or environmental exposures to prevent any further deterioration of their condition. Exposure to cold, wind, and rain is a serious problem in trauma patients exposed to the elements, and can result in hypothermia, which can worsen their chances for survival.

In addition to protecting the patient, it is necessary to consider the safety of bystanders who may try to approach the accident scene out of curiosity or a desire to help. Do not allow bystanders to become ill or injured. Bystanders should be kept away from the scene if there are any real or potential risks to their safety, if their presence creates a risk to the patient or emergency personnel, or if they interfere with patient care efforts.

If the scene is unsafe, make it safe. Otherwise, do not approach. Request assistance from qualified public safety personnel, such as fire, rescue, and/or police units whenever you are uncertain about the safety of an accident scene.

c. Mechanism of Injury/Nature of Illness

Determining the mechanism of an injury means evaluating the forces that caused the injury. Understanding the mechanism of injury may be helpful in determining the presence and/or type of internal injuries. For example, different types of car collisions are associated with different types of injuries. Frontal collisions, where the driver is thrown forward and hits the dashboard with the knees, are associated with fracture or dislocations of the hip. Side-on collisions with intrusion into the passenger compartment can result in fractures of the upper extremities and ribs. Mechanisms of injury in trauma can be determined by questioning the patient, family members, and bystanders, as well as by inspecting the scene. For patients requesting emergency medical services for a medical complaint, determine from the patient, family, or bystanders the nature of the illness or symptoms that led to the call.

d. Number of Patients Involved

Situations with multiple patients will require additional help from law enforcement, fire, rescue, advanced emergency medical units, and/or utility workers (gas, water, electricity). First Responders will be less able to call for additional help once they are involved with patient care. Request additional help early if you will need assistance. Then begin triaging patients to determine who requires immediate intervention and who can wait.

e. Additional EMS Resources

After addressing immediate, life-threatening problems, the First Responder can confirm that additional EMS resources are en route.

4. Initial Assessment

The initial assessment is completed to assist the First Responder in identifying immediate threats to life.

a. General Impression of the Patient

The general impression of the patient is based on the First Responder's immediate assessment of the scene environment and the patient's chief complaint. Determine whether the patient is ill (medical case) or injured (trauma case). In situations where this is unclear because of inadequate patient information, treat the patient as though he/she could be a trauma victim. Determine the approximate age and sex of the patient.

b. Responsiveness

If there is any suspicion of trauma, the patient's spine must be stabilized from the very beginning. The head and neck must not be moved in any way in case there is an unstable fracture of the spine that could result in a spinal cord injury with movement.

Begin by speaking to the patient. State your name and tell the patient that you are a First Responder and are here to help. The "AVPU" scale is used to describe the level of responsiveness of a patent:

- **A** – alert
- **V** – responds to verbal stimuli
- **P** – responds to painful stimuli
- **U** – unresponsive

Infants and small children will often not respond to methods used to assess responsiveness in adults. Instead of providing verbal and painful stimuli, assess the child's interactions with the environment and parents.

c. Airway Status

For patients who are responsive, determine if the airway is patent by asking the patient to speak. If the patient can speak, it demonstrates that the patient both has a patent airway and is breathing. If the responsive patient cannot speak, appears to be choking, or has noisy respirations, the patient may have an airway obstruction that needs to be cleared right away. Unresponsive patients are at high risk for airway obstruction and require assistance with opening and maintaining their airway. The tongue can fall backwards and obstruct the airway in the unresponsive patient. The jaw-thrust maneuver without head tilt is used to open the airway for patients with suspicion for trauma to the head or neck. For non-trauma patients, the jaw-thrust or head –tilt-chin lift maneuver may be used to open the airway. Once you have opened the airway, inspect the airway visually and reassess for persistent obstruction. Foreign bodies, secretions, blood, and vomit can all cause airway obstruction and should be cleared as best as possible when they are detected in the setting of airway obstruction.

d. Breathing

Once you have assessed, opened, and cleared the airway, assess the patient's breathing. Look, listen, and feel for the presence of ventilations. If the patient is not breathing spontaneously after the airway has been opened and cleared, then you need to ventilate the patient. Techniques for ventilation include bag-valve mask, mouth to mask, and mouth to mouth. If the patient is breathing spontaneously, observe the work of breathing. Does the patient appear to be breathing comfortably? Or does the patient appear to be having difficulty breathing? A patient who continues to have difficulty breathing after the airway is opened and cleared most likely has an underlying problem requiring urgent medical attention. These patients should receive oxygen as quickly as possible. They may require artificial ventilation.

e. Circulation

After you have assessed the airway and breathing and dealt with any problems in these areas, assess the patient's circulatory status. Check for the radial pulse in adults who are responsive. Check for the carotid pulse in adults who are unresponsive. For infants, assess the brachial pulse. In unresponsive children, check the carotid or femoral pulse. In responsive children, check the brachial or radial pulse.

Determine if major external bleeding is present. If bleeding is present, control bleeding as described in Skill Algorithms: Illness and Injury.

Assess the patient's skin color and temperature for signs of shock, or decreased blood flow to important anatomic structures and organs. Patients with shock may have skin that is moist or clammy and cool to the touch. Their skin or mucous membranes may have a pale or cyanotic (bluish) appearance. Normally, the skin should be warm and dry, with a normal color.

f. Brief EMS Report

After completing the initial assessment and addressing any life-threatening problems noted in the ABCs, the First Responder can update the responding EMS unit with a brief radio report describing the findings. This step will give the responding EMS unit a sense of the urgency of the needs of the patient and what they are likely to expect upon arrival at the scene. This brief report should include the following elements in the following order:

1. Age and sex
2. Chief complaint
3. Responsiveness
4. Airway and breathing status
5. Circulation status

Determine estimated time of arrival of additional EMS resources.

5. First Responder Physical Exam

The First Responder physical exam is designed to locate and begin the initial management of the signs and symptoms of illness or injury. The First Responder should complete a physical exam on all patients after completing the initial assessment. The physical exam should focus specifically on the patient's chief complaint and injuries, e.g., a cut finger would not require the complete physical exam. As the First Responder locates signs and symptoms of illness or injury, the First Responder should ask specific questions. This material is described in specific lessons on Illness and Injury. Perform a physical exam on the patient to gather additional information.

a. Physical Exam Techniques

Deformities. Visual abnormalities in the normal contour or shape of parts of the body suggest underlying injuries, such as fractures or dislocations. Improper movement of extremities with obvious deformities can result in pain and injury to underlying soft tissues such as blood vessels and nerves. For extremities with obvious deformities, support the extremity in the current position until EMS personnel can assist with splinting. Determine the color and temperature of the extremity beyond (distal to) the deformity. Carefully check for pulses beyond the deformity as well as sensation and ability to move fingers and toes.

Open injuries. Sharp external objects such as broken metal or glass may cause cuts or lacerations. Lacerations, however, may also be caused by the sharp edges of underlying broken bones. Lacerations can be associated with injuries to underlying soft tissues such as nerves, blood vessels, ligaments, and tendons.

Tenderness. Areas of tenderness indicate underlying injury and should be treated with caution.

Swelling. Bleeding underneath the skin results in swelling that may also be associated with bruising or ecchymoses. Inflammation in response to injuries can also result in swelling.

The mnemonic "DOTS" described above may help you remember the signs of injury.

b. Parts of the Body to Examine

1. Head
2. Neck
3. Chest
4. Abdomen
5. Pelvis
6. All four extremities

When examining each part of the body, evaluate for (1) deformities, (2) open injuries, (3) tenderness, and (4) swelling. If the patient is complaining of neck or head pain, and has been involved in an accident, do not manipulate the neck in any way. In this situation, do not allow the patient to move his/her head or neck. EMS personnel should apply a cervical collar and any other appropriate immobilization device to prevent any neurologic injury in the case of an unstable cervical fracture.

6. Patient History

Some patients wear medical identification tags that may be beneficial in identifying allergies, medications, or past medical history. Look for medical identification tags during the physical exam.

a. "SAMPLE" History

You can use the "SAMPLE" mnemonic to remember the essential elements of the patient history. For medical patients the "SAMPLE" history may be completed before the physical exam.

S – Signs/Symptoms

Why did you call EMS today? Determine why EMS was called for this patient if it is not immediately obvious, e.g., motor vehicle accident. For most medical patients, the reason for the emergency call is usually because of worrisome physical signs and/or symptoms. These signs and/or symptoms constitute the patient's chief complaint. A *sign* is any medical or trauma condition displayed by the patient that is *identifiable* by the First Responder. For example, a patient with respiratory distress may have *noisy respirations* that the First Responder can *hear*. A patient with *bleeding* that is external will have blood visible that the First Responder can *see*. A patient with a *fever* may have warm skin that the First Responder can *feel*. *Symptoms* are any condition that the patient describes, but that the First Responder would *not be able to identify* with their own senses, such as difficulty breathing, headache, or pain.

A – Allergies

Are you allergic to anything? It is important to identify any allergies the patient might have so they are not given anything that might cause an allergic reaction. A patient can have allergies to medications, the environment (dust, mold, animal hair, etc.), or food.

M – Medications

Do you take any prescription or non-prescription medicine? Determine if the patient is currently taking any medications, either by prescription from a physician or non-prescription medication purchased over –the counter at a pharmacy or other store. Also determine whether the patient may have been taking any medications that he/she recently discontinued.

P – Pertinent Past History

Are you seeing a doctor for anything? Have you ever been in the hospital? Determine whether the patient has seen a doctor for any medical or surgical problems or if he/she was admitted to a hospital, either recently or in the past. Also determine if he/she has experienced any trauma, either recently or in the past.

L – Last Oral Intake: Solid or Liquid

When was the last time you had anything to eat or drink? Determine the time and quantity of the last oral intake of solids or liquids. If the patient ends up requiring surgery and must be put under general anesthesia, the anesthesiologist will need to know whether the stomach is full in order to take any necessary precautions to prevent vomiting and aspiration (inhaling) of stomach contents into the lungs.

E – Events Leading to the Injury or Illness
What were you doing when this happened? Are there any other associated symptoms? Determine the story behind the illness or injury. This information can provide important diagnostic clues to other medical personnel treating the patient.

7. Ongoing Assessment

While awaiting additional EMS resources, the First Responder should continue to assess the patient. Repeat the initial assessment every 15 minutes for a stable patient and every 5 minutes for an unstable patient. The reassessment of the patient should include the following elements:

1. Reassess mental status.
2. Maintain an open airway.
3. Monitor breathing for rate and quality.
4. Reassess pulse for rate and quality.
5. Monitor skin color, temperature, and condition.

The First Responder should repeat the physical exam as needed depending on whether the patient's condition changes or if new signs or symptoms are revealed. Check interventions to ensure that they are effective. In addition to performing the continued assessments, the First Responder should calm and reassure the patient.

8. "Hand-Off" Report

Upon arrival of more advanced EMS personnel, the First Responder should provide a hand-off report to the individual(s) taking over the care of the patient. Careful communication of patient information is essential to ensure *continuity of care*. This verbal report should briefly describe the relevant information the First Responder obtained from the patient assessment. The report should be clear, concise, and complete. Avoid spending time on details that do not provide any useful information relevant to patient care. The following points constitute the essential elements of a good hand-off report:

1. Age and sex
2. Chief complaint
3. Responsiveness
4. Airway and breathing status
5. Circulation status
6. Physical findings
7. "SAMPLE" history
8. Interventions provided and patient's response

Patient Assessment

Prepared for AIHA by EMVI
with funding from
the US Agency for International Development

Overview

- Scene size-up
- Initial assessment
- Physical exam
- Patient history
- Report

Scene Size-Up

- Universal precautions
- Scene safety
- Mechanism of injury/nature of illness
- Number of patients involved
- Are additional EMS resources en route?

Universal Precautions

- Eye protection
- Gloves
- Gown
- Mask

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Scene Safety

- Protection of emergency personnel
- Crash scenes
- Toxic substances
- Crime scenes
- Protection of patient
- Protection of bystanders
- If scene is unsafe, make it safe

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Mechanism of Injury

- Evaluation of forces that caused injury
- Predict types of internal injuries
- Determine from family, bystanders

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Nature of Illness

- Why was EMS called?
- Signs and symptoms
- Determine from patient, family, bystanders

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No. of Patients Involved

- Determine what additional resources are needed
- Police
- Fire, rescue
- Advanced medical personnel
- Utilities
- Request additional resources early
- Begin scene triage

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Initial Assessment

- Identify immediate life threats
- General impression
- Assessment of scene environment
- Patient's chief complaint
- Medical vs. trauma
- Approximate age
- Sex

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Patient Assessment
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Assess Responsiveness

- Stabilize cervical spine if trauma
- Speak to the patient
- AVPU scale
  - Alert
  - Responds to verbal stimuli
  - Responds to painful stimuli
  - Unresponsive

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Assess Airway Status

- Unresponsive patient
  - Open the airway
  - Inspect the airway
  - Clear the airway
- Responsive patient
  - Can the patient speak?
  - Is the airway patent?
  - Difficulty maintaining airway?

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Assess Breathing

- Is the patient breathing?
  - Look
  - Listen
  - Feel
- If not breathing: ventilate
- If breathing: assess work of breathing

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Assess Circulation

- Check for pulse
  - Radial
  - Carotid
  - Femoral
- Check for external bleeding
  - Control with direct pressure
- Skin color and temperature
  - Evidence of shock?

Update EMS

- Age and sex
- Chief complaint
- Responsiveness
- Airway and breathing status
- Circulation status
- Estimated time of arrival of EMS

Physical Exam

- Locate signs and symptoms
- Begin initial management
- Perform physical exam on all patients
- Specific to patient and chief complaint

Inspect and Palpate

- Remember DOTS
  - Deformities
  - Open injuries
  - Tenderness
  - Swelling

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Assess Entire Body

- Head
- Neck
- Chest
- Abdomen
- Pelvis
- All four extremities

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Obtain History

- Look for medical identification tags
- SAMPLE history
  - Signs/symptoms
  - Allergies
  - Medications
  - Past medical history
  - Last meal
  - Events leading to injury/illness

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Signs/Symptoms

- Why did you call EMS today?
- Signs
  - Displayed by patient
  - Identified by first responder
- Symptoms
  - Described by patient

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Allergies

- Are you allergic to anything?
  - Medications
  - Environmental allergies
  - Foods

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Medications

- Do you take any prescription or non-prescription medicine?
  - Currently
  - Recently

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Pertinent Past History

- Are you seeing a doctor for anything?
- Have you ever been in the hospital?
  - Medical
  - Surgical
  - Trauma

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Last Oral Intake

- When was the last time you had anything to eat or drink?
  - Time
  - Amount
- Possibility of surgery/general anesthesia

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Events Preceding

- What were you doing when this happened?
- Were there any other associated symptoms?

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Ongoing Assessment

- Repeat initial assessment
- Reassess mental status
- Maintain open airway
- Monitor breathing and pulse
- Skin color, temperature, condition
- Are interventions effective?
- Calm and reassure patient

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Hand-Off Report

- Clear, concise, complete
- Avoid irrelevant information
- Age and sex
- Chief complaint
- Responsiveness
- Airway status
- Circulation status
- Physical, SAMPLE history, interventions

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Patient Assessment
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Circulation

Contents

1. Objectives

a. Cognitive Objectives

At the completion of this lesson, the First Responder student will be able to:

1. List the reasons for the heart to stop beating.
2. Define the components of cardiopulmonary resuscitation (CPR).
3. Describe each link in the chain of survival and how it relates to the emergency medical services (EMS) system.
4. List the steps of one-rescuer adult CPR.
5. Describe the technique of external chest compressions on an adult patient.
6. Describe the technique of external compressions on an infant.
7. Describe the technique of external chest compressions on a child.
8. Explain when the First Responder is able to stop CPR.
9. List the steps of two-rescuer adult CPR.
10. List the steps of infant CPR.
11. List the steps of child CPR.

b. Affective Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Respond to the feelings that the family of a patient may be having during a cardiac event.
2. Demonstrate a caring attitude toward patients with cardiac events who request emergency medical services.
3. Place the interests of the patient with a cardiac event as the foremost consideration when making any and all patient care decisions.
4. Communicate with empathy with family members and friends of the patient experiencing a cardiac event.

c. Psychomotor Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Demonstrate the proper technique of chest compressions on an adult.
2. Demonstrate the proper technique of chest compressions on a child.
3. Demonstrate the proper technique of chest compressions on an infant.
4. Demonstrate the steps of one-rescuer adult CPR.
5. Demonstrate the steps of two-rescuer adult CPR.
6. Demonstrate child CPR.
7. Demonstrate infant CPR.

2. Introduction

In the United States, more than 600,000 people die each year from cardiovascular diseases. Half of these deaths occur outside the hospital, with sudden death (collapse) being the first sign of cardiac disease in 50% of the cases. Early CPR, which will be covered in this lesson, is the major determinant of survival in cardiac arrest. In this lesson, we will review the anatomy and physiology of the circulatory system and learn the techniques of CPR in a step-by-step manner.

3. Review of the Circulatory System

The circulatory system functions to deliver oxygen and essential nutrients to the tissues of the body. It also functions to remove carbon dioxide and other waste products from the tissues of the body. It is a highly efficient system composed of the heart and blood vessels (arteries, veins, capillaries).

a. Anatomy

The heart is a muscle with specialized intrinsic conduction fibers. This highly efficient muscle pumps blood throughout the entire body, supplying all of our organs with the vital oxygen and nutrients they need. It is composed of four chambers, two atria and two ventricles. The right atrium receives deoxygenated blood returning through the veins of the body. Blood then travels through the tricuspid valve into the right ventricle. The right ventricle then pumps blood to the lungs through the pulmonic valve. Oxygenated blood from the lungs returns to the left atrium. Blood flows through the mitral valve into the left ventricle. The left ventricle then pumps the oxygenated blood through the aortic valve to the rest of the body. The valves act to prevent backflow of blood into the respective heart chambers.

Arteries are muscular tubes that carry oxygenated blood away from the heart to the rest of the body. It is important to remember four major arteries because their pulsations can be palpated at the level of the skin. Palpating these arteries at their appropriate landmarks provides vital information when evaluating the circulatory system of any patient. The carotid arteries supply the head and brain and can be palpated on either side of the neck, just lateral to the trachea. The femoral arteries supply the lower extremities and can be palpated on either side in the groin, just below the inguinal ligament. The radial arteries supply the forearms and wrists and can be palpated on the palm aspect, thumb side of either wrist. The brachial arteries supply the upper arms and can be palpated on the inner aspect of the arm between the elbow and shoulder.

Capillaries connect the arteries to the veins at the tissues. These thin-walled, tiny blood vessels allow exchange of oxygen and carbon dioxide, and nutrients and waste products, at the tissues throughout the body.

Veins are the vessels that carry blood from the tissues of the body back to the heart. These vessels are less muscular than the arteries and under much less pressure. Venous pulsations, in general, are not palpated.

Blood is the fluid of the circulatory system. As mentioned above, it carries oxygen and nutrients to the tissues and carbon dioxide and waste products away from the tissues. Highly oxygenated blood appears bright red. Blood with a low oxygen content appears blue.

b. Physiology

When assessing a patient's circulation, it is important to know the anatomy and function of the circulatory system. Without the effective pumping of the heart and the distribution of blood and its nutrients through the blood vessels to the rest of the body, the vital organs (such as the brain) are subject to injury and death. Recognizing circulatory impairment is the first step. Understanding the techniques of restoring circulation through CPR is the first step in becoming an effective First Responder.

The heart is a four-chambered muscular pump that contracts to send blood to the rest of the body. The left ventricle is the largest portion of the muscle. When the left ventricle contracts, it sends a wave of blood through the arteries. This wave of pressurized blood produces a palpable pulse when the artery passes near the skin surface and over bone. Medical personnel typically use four major arteries to evaluate the effectiveness of circulation: the carotid, femoral, radial, and brachial arteries. A strong, regular pulse indicates that the heart is effectively pumping blood throughout the body. A weak pulse indicates ineffective circulation. A patient with no palpable pulse is in cardiac arrest and requires emergency intervention to restore circulation.

Remember that organ damage begins quickly after the blood flow has stopped. In fact, brain damage begins 4 to 6 minutes after a patient suffers a cardiac arrest. Irreversible brain damage results in 8 to 10 minutes. Therefore, it is vital to begin CPR as soon as you identify that a patient is in cardiac arrest. The heart may stop beating for several reasons. Sudden death because of heart disease and respiratory arrest, especially in children, are common causes. Medical emergencies, such as stroke, epilepsy, diabetes, allergic reactions, electrical shock, and poisonings are also considerations. Drowning, suffocation, congenital abnormalities, trauma, and bleeding are also causes of cardiac arrest. Regardless of the reason, the First Responder will treat cardiac arrest using the techniques of CPR.

External chest compressions are used to circulate blood any time the heart is not beating. External chest compressions are combined with artificial ventilation to oxygenate the blood. The combination of artificial ventilation and external chest compressions is called cardiopulmonary resuscitation.. Remember that the First Responder is not required to identify the reason why a patient is in cardiac arrest. The ability to assess a patient's airway, breathing, and circulation and perform effective CPR, however, makes the First Responder a vital first link in the chain of survival for the patient.

4. Cardiopulmonary Resuscitation

CPR is a combination of artificial ventilation and external chest compressions to oxygenate and circulate blood when the patient is in cardiac arrest. By depressing the sternum to change the pressure in the chest, external chest compressions cause enough blood to flow to sustain life for a short time. CPR has limitations, but it is the best first response to a patient in cardiac arrest. Even the most effective chest compression may only produce approximately 25% of the heart's normal functional blood flow. However, it is essential to sustain life in this manner until more advanced cardiac care can be given. CPR is only effective for a short time and must be started as soon as possible. The earlier you are able to treat a person suffering from cardiac arrest, the likelier the survival. In many cases, patients may require defibrillation to survive. CPR increases the amount of time that defibrillation will be effective. Early CPR and defibrillation, if available, are the keys to patient survival from cardiac arrest.

For a patient who has suffered a cardiac arrest, there exists a chain of survival within the community. The links in this chain of survival include early access, early CPR, early defibrillation, and early advanced cardiac life support (ACLS). Early access includes public awareness and education, rapid recognition of a cardiac emergency, and rapid notification of the EMS system and more advanced emergency care providers. Early CPR can only begin if First Responders, as well as the lay public including family and bystanders, are trained to perform CPR. Early defibrillation is now recognized as a vital link in the chain of survival. First Responders can effectively learn the use of automated external defibrillation and save lives in the community. It is the ultimate goal to sustain life long enough so that more advanced cardiac care can be given. Early ACLS is the final link in the chain of survival. Through the use of more advanced airway management, defibrillation techniques, and cardiac stimulating and supporting medications, ACLS providers in the field and in the hospital are better able to increase the likelihood of survival. It is important to remember that all links in the chain of survival are vital. Any weak links in the chain lower survival rates.

a. Steps of One-Rescuer Adult CPR

If you are the first person to encounter a patient, be sure that the scene is safe and that you follow body substance isolation precautions while performing CPR. Remember, as a First Responder, you are the initial link in the chain of survival for the patient.

Step 1: Determine unresponsiveness – As you approach a patient, gently shake the patient and ask, "Are you OK?" If the patient does not respond, activate the EMS system and call for more advanced help. If there are two rescuers, one person should call for help while the other rescuer continues the assessment. If the patient is responsive, monitor the airway and conduct a history and physical exam.

Step 2: Activate EMS

Step 3: Airway – Position the patient on his/her back on a firm surface. Take precautions to stabilize the cervical spine if trauma is suspected. Open and maintain the airway using the head –tilt-chin lift maneuver in non-trauma patients, or the jaw thrust without head tilt maneuver if trauma is suspected.

Step 4: Breathing – Look, listen, and feel. After opening the patient's airway, look to see if the chest is rising and falling, listen for breath sounds from the patient's mouth, and feel if any air is coming from the patient's mouth. Assess breathing for 3 to 5 seconds.

Step 5: If the patient is breathing, and no trauma is suspected, place the patient in the recovery position. If the patient is not breathing, give two rescue breaths (mouth-to-mouth, mouth-to-barrier device, mouth-to-mask, or bag-valve mask ventilations). Ventilate the patient at approximately every 5 seconds to achieve a rate of 12 breaths/minute. Each breath should take about 2 seconds, causing the chest to rise with effective ventilations. A second rescuer applying cricoid pressure may effectively compress the esophagus and limit the amount of gastric distension and possible vomiting. The cricoid ring lies just below the Adam's apple (larynx) and is compressed using the thumb and index finger.

Step 6: Circulation – After you open the airway and assess the breathing, assess the patient's circulation by checking the carotid pulse for 5 to 10 seconds. If the patient has a pulse, but is not breathing, perform rescue breaths every 5 seconds (12 breaths/minute). Reassess the patient's breathing and circulation every few minutes.

Step 7: If the patient does not have a pulse, find the appropriate hand position and begin chest compressions. A patient without a pulse is in cardiac arrest. Perform 15 chest compressions at a rate of 80 to –100/minute. Open the airway and deliver two rescue breaths. Then perform 15 more chest compressions. Then give two more rescue breaths, and so on.

Step 8: Perform four cycles of 15 compressions to 2 ventilations.

Step 9: After four cycles, reassess the pulse for 3 to 5 seconds. If the patient has a pulse, reassess breathing. If breathing is present, keep reassessing the patient and place him/her in the recovery position (lying the non-traumatic patient on his/her side to maintain an open airway). If breathing is absent, continue rescue breathing every 5 seconds (12 breaths/minute). If the patient does not have a pulse, continue chest compressions.

Step 10: Continue to reassess the patient's airway, breathing, and circulation every few minutes.

Step 11: Chest Compressions – Always remember that the patient should be supine on a firm, flat surface for effective compressions. Hand position for chest compressions varies with age. On the adult patient, the rescuer should locate the edge of the ribs on the side of the patient nearest to them. Trace the rib to the midline positioned sternum and xiphoid process. Place two fingers over the xiphoid process, and then the heel of the other hand just above these fingers on the lower half of the sternum. The heel of the second hand is then placed over the first hand. Lean over the patient so that your shoulders are directly over the sternum. This allows the rescuer to apply direct downward pressure most effectively. Remember, chest compressions over the xiphoid process could break this bone and damage internal organs. Compressions should depress the sternum of the adult patient approximately 2 inches. Release pressure in between compressions to allow refilling of the heart with blood. Compression and relaxation times should be equal. Hands should remain on the chest at all times to maintain appropriate hand position. If hand position is lost, or after reassessing the ABCs, hand position should be resumed as above. The rate of compressions in the adult should be between 80 and –100/minute.

b. Steps of Two-Rescuer CPR

Adult CPR can be performed with one or two rescuers. Two-rescuer CPR is more efficient and less tiring. In two-rescuer CPR, one rescuer performs chest compressions, while the other rescuer provides rescue breathing and pulse assessment. If a pulse can be felt during compressions, then they are effective compressions. If the rescuer doing the compressions becomes fatigued, the rescuers may switch positions.

Step 1: Rescuer 1 assesses responsiveness. If the patient is unresponsive, Rescuer 2 activates additional EMS personnel.

Step 2: Rescuer 1 opens the airway and assesses breathing: If breathing is present, rescuers place the patient in the recovery position. If breathing is absent, Rescuer 1 performs two rescue breaths, each for approximately 2 seconds

Step 3: Rescuer 1 assesses circulation: If a pulse is present, but breathing is absent, Rescuer 1 continues breathing for the patient at a rate of 10 to 12 breaths/minute. If a pulse is absent, Rescuer 2 finds hand position and performs five chest compressions at a rate of 80 to –100/minute.

Step 4: After every five chest compressions, Rescuer 1 performs one rescue breath (lasting approximately 2 seconds). Rescuer 2 pauses chest compressions during the rescue breaths so the lungs can fill with air.

Step 5: Perform 20 cycles of 5 chest compressions to 1 ventilation, then reassess the pulse: If there is a pulse, reassess breathing and treat accordingly. If there is no pulse, continue with five chest compressions to one ventilation. Reassess the ABCs every few minutes.

c. *Infant and Child CPR*

Many of the steps and techniques used in adult CPR are similar to those used in infant and child CPR. There are, however, some differences. Infants and children suffer cardiac arrest primarily as a result of a respiratory problem, whereas adults usually suffer cardiac arrest as a result of primary cardiac dysfunction. Therefore, providing the infant or child with an open airway and effective ventilation is the most effective way to restore cardiac function.

The airway in the infant and child is opened in the same manner as in the adult. In medical situations, use the head –tilt-chin lift. In the traumatic situation, use the jaw thrust without head-tilt maneuver.

Breathing can be performed by mouth-to-mouth, mouth-to-barrier device, or mouth-to-mask (if available) techniques. If the patient is less than 1 year old, the rescuer places his/her mouth over both the mouth and nose of the infant. If the patient is more than 1 year old, the rescuer places his/her mouth over the child's mouth only. Use two fingers to close the nose during rescue breathing. The rate of breathing in infants and children is 1 breath every 3 seconds (20 breaths/minute). Each ventilation should allow the chest to rise and fall. Each breath should take approximately 1 to 1½ seconds. Providing breaths that are too rapid or too large a volume can induce gastric distention and vomiting.

Positioning hands for chest compressions in infants and children is also somewhat different. In the infant, keep one hand on the patient's head to maintain a head tilt. Place the other hand's index finger at the nipple line, with the middle and ring fingers next to it. Use the middle and ring fingers to perform compressions to a depth of approximately 1 inch. Avoid the xiphoid process. Compressions in the infant are performed at a rate of 100/minute. In the child, also place one hand on the patient's forehead to maintain head tilt. Find the xiphoid process, as in the adult, and place the heel of the other hand above the xiphoid process. Compressions should be at a depth of 1 to 1½ inches at a rate of 100/minute.

Finally, two-rescuer CPR can be performed on a child as it is performed in an adult. One-rescuer CPR is more effective in infants because of their size.

Steps of Infant CPR

Step 1: Assess responsiveness.
Step 2: Open the airway using the head –tilt-chin lift maneuver for medical patients or the jaw thrust for trauma patients.
Step 3: Assess Breathing – If the patient is breathing, place him/her in the recovery position. If the patient is not breathing, administer two rescue breaths (1 to 1½ seconds each).
Step 4: Assess Circulation – Use the brachial pulse in infants. If the patient has a pulse, continue rescue breathing at a rate of 20/minute (every 3 seconds). If the patient does not have a pulse, perform chest compressions at a rate of at least 100/minute
Step 5: Perform 20 cycles of 5 compressions to 1 ventilation and then reassess the patient (after about 1 minute). If the patient has regained a pulse and breathing, place him/her in the recovery position. If the patient has regained a pulse only, continue with rescue breathing at a rate of 20/minute. If the patient has not regained a pulse, continue with cycles of five chest compressions to one ventilation and reassess the patient every few minutes.
Step 6: If only one rescuer is present, activate EMS after the initial 20 cycles of CPR (approximately 1 minute).

Steps of Child CPR

Step 1: Assess responsiveness.
Step 2: Open the airway using the head –tilt-chin lift maneuver for medical patients or the jaw thrust for trauma patients.
Step 3: Assess Breathing – If the patient is breathing, place him/her in the recovery position. If the patient is not breathing, perform two rescue breaths (1 to 1½ seconds each).
Step 4: Assess Circulation – Use the carotid artery in children over the age of 1 year old. If the patient has a pulse, continue with rescue breathing at a rate of 20/minute. If the patient does not have a pulse, perform chest compressions at a rate of 100/minute
Step 5: Perform 20 cycles of 5 chest compressions to 1 ventilation and then reassess the patient (after approximately 1 minute). If the patient has regained a pulse and is breathing, place him/her in the recovery position. If the patient has regained a pulse, but is not breathing, continue with rescue breathing. If the patient has not regained a pulse, continue with cycles of five chest compressions to one ventilation, and reassess every few minutes.
Step 6: If only one rescuer is present, activate EMS after the initial 20 cycles of CPR (approximately 1 minute).

Always remember the ABCs: airway, breathing, and circulation. The First Responder must focus on these vital functions of the patient as his/her first priority. Also remember, however, to interact with family and friends of the victim in a caring manner. It is not the responsibility of the First Responder to offer a diagnosis or suggest advanced levels of treatment. The First Responder's responsibilities are to offer reassurance that appropriate care is being given and to display a caring attitude.

5. Defibrillation: Automated External Defibrillation

The automated external defibrillator (AED) is a machine used by First Responders to provide an electrical shock to an adult patient who is not breathing and is pulseless. The machine may be automatic or semiautomatic. The AED is used to recognize abnormal, chaotic heart rhythms (*ventricular tachycardia* and *ventricular fibrillation*) that do not create a pulse. If the patient has no pulse, and the AED detects either of these chaotic rhythms, the AED delivers an electrical shock that stops the abnormal rhythm. Defibrillation, using the AED, is considered the highest priority in adult patients in cardiac arrest, even before CPR is started. Early defibrillation makes the greatest difference in the chance for survival in adult cardiac arrest patients. The AED is not used in patients under the age of 12 or those weighing less than 41 kg (90 lb).

The AED works by placing two conductive electrode patches on the patient's chest and turning on the battery-operated machine. The AED analyzes the patient's cardiac rhythm. If the computer (AED) detects a life-threatening electrical rhythm, it automatically delivers an electrical shock that stops the chaotic rhythm, hopefully resulting in a non-chaotic rhythm that produces a pulse. If a life-threatening rhythm is not detected by the AED, it will not shock the patient.

The AED delivers electrical shocks when a patient has either ventricular fibrillation or ventricular tachycardia. Ventricular fibrillation is a chaotic dysrhythmia causing the heart to quiver, without any effective pumping action. Ventricular tachycardia is another dysrhythmia that may or may not produce a pulse. It is vitally important that the First Responder attach the AED to a patient who is pulseless and not breathing. However, providing an electrical shock with an AED to a patient who has ventricular tachycardia and a pulse may cause the rhythm to deteriorate to ventricular fibrillation or an unshockable rhythm known as asystole. *Asystole* is a condition of no detectable electrical rhythm. Do not attach an AED to a patient unless he/she is unresponsive with no pulse and no breathing.

There are two types of AEDs: fully automatic and semiautomatic. The fully automatic AED simply requires the First Responder to attach the two electrode patches to the patient's chest, connect the two lead wires, and turn on the AED. The semiautomatic AED requires the First Responder to attach the two electrode patches to the patient's chest, connect the two lead wires, turn on the AED, and press a button on the AED to analyze the rhythm. The AED's computer-synthesized voice then advises you whether or not to press the shock button. Both machines deliver up to three shocks in a row. The fully automatic AED requires fewer steps, but both are equally effective. Both AEDs will automatically deliver electrical shocks of increasing energy until the abnormal rhythm stops (first 200 joules, then 200 to 300 joules, and then 360 joules).

You must follow important general rules when using an AED. First, **never attach an AED to a patient who is responsive, breathing, or has a pulse**. Your primary concern is determining the presence or absence of a pulse, then using the AED if the patient is pulseless and not breathing. The AED's batteries should always be properly charged. **CPR should be stopped when the AED is analyzing the patient's heart rhythm**. People and objects in contact with the patient may also receive an electrical shock. Therefore, do not touch the patient while the AED is analyzing a patient's rhythm. **The AED also should not be used in a moving vehicle**. The unstable movement may cause improper analysis of the cardiac rhythm.

Remember, early defibrillation is the life-saving intervention of first priority. The earlier the heart is defibrillated, the more likely abnormal rhythms can be successfully converted to life-sustaining rhythms. Therefore, it is beneficial to stop CPR to use the AED. CPR may be stopped for up to 90 seconds when three consecutive shocks are delivered. Resume CPR only after the first three shocks are delivered, or when the AED indicates a "no shock" situation.

a. Use of the Semiautomatic External Defibrillator

Step 1: If no other EMS personnel are on the scene, the First Responder should continue CPR and use of the AED until they arrive. If two First Responders are available, one performs CPR while the other operates the AED and continually reassesses the patient's ABCs.

Step 2: After opening the airway, and confirming that the patient is in cardiac arrest (unresponsive, not breathing, no pulse), defibrillation comes first. Optimally, the first shock should be delivered within 1 minute of arrival at the patient's side.

Step 3: Turn on the AED

Step 4: Attach one electrode patch to the right of the upper sternum below the clavicle. Attach the other electrode to the left of the nipple in the midaxillary line (lateral aspect of the chest).

Step 5: Stop CPR. Clear everyone away from the patient and initiate analysis of the cardiac rhythm. If the machine advises a shock, deliver the first shock (generally 200 joules).

If the machine advises "no shock," check the patient's pulse. If there is a pulse, support the patient's breathing and transport as soon as possible. If there is no pulse, perform CPR for 1 minute and recheck the pulse. Reanalyze the rhythm if there is still no pulse. If "no shock" is advised again, and there is still no pulse, resume CPR for another 1 minute. Analyze the rhythm a third time. If shock is advised, deliver up to two sets of three stacked shocks (200 joules, 200 to 300 joules, 360 joules) separated by 1 minute of CPR, and transport the patient as soon as possible. If "no shock" is advised a third time, and there is no pulse, resume CPR and transport the patient as soon as possible

Step 6: After the first shock, reanalyze the rhythm.

Step 7: If the machine advises another shock, deliver a second shock at 200 to 300 joules. Reanalyze the rhythm.

Step 8: If the machine advises another shock, deliver a third shock at 360 joules

Step 9: Check the patient's pulse. If the patient has a pulse after a shock, check breathing. If the patient is breathing adequately, place the patient in the recovery position and monitor the airway and pulse and transport the patient as soon as possible. If the patient has a pulse and is not breathing adequately, provide artificial ventilation and transport the patient as soon as possible. If the patient does not have a pulse, resume CPR for 1 minute. Then reanalyze the rhythm using the AED, deliver another cycle of three consecutive shocks (at 360 joules), and reassess the pulse. If there is still no pulse, continue with cycles of three stacked shocks followed by 1 minute of CPR, etc., until the patient can be transported.

Step 10: **Important Reminders**

- Do not attach the AED to a patient who is responsive or has a pulse.
- Do not leave the patient to contact medical direction or to call for assistance until the "no shock indicated" command is given by the AED, the pulse returns, three shocks are delivered, or additional help arrives.
- Do not use the AED near water or in the rain. Remove wet clothes and move the patient to a dry place.
- Do not allow the patient to contact any metal objects or surfaces.
- Do not remove the AED if the patient regains a pulse and respirations. Simply turn the power off. The patient's condition may deteriorate after successful resuscitation, requiring further use of the AED.
- Always remember to continuously monitor the patient's airway, breathing, and circulation (ABCs).

AEDs are considered the first-line treatment of adult patients in cardiac arrest. Early defibrillation has been found to be the most effective life-saving intervention in adult patients in cardiac arrest. The AED eliminates the need for First Responders to be trained in analysis and treatment of various cardiac dysrhythmias. It is easy to use and training time is short. The use of these devices is expanding because of its direct impact on survival of cardiac arrest patients. In many parts of the United States, AEDs are available in shopping malls, hotels, airports, and passenger airlines. Many police and fire departments also offer training with AEDs. Periodic training reviews on the operation of AEDs is recommended, as is recertification in the techniques of CPR.

Circulation

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Circulatory System

- **Function**: to deliver oxygen and nutrients to the tissues and remove waste products from the tissues
- **Heart**: atria and ventricles
- **Arteries**: carotid, femoral, radial, brachial
- **Capillaries**
- **Veins**
- **Blood**: carries oxygen and carbon dioxide

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Physiology

- Left ventricle contracts, pushing blood through the arteries
- **Pulses**: carotid, femoral, radial, brachial
- The body cannot survive if the heart stops contracting
- When the patient loses a pulse, he/she is in cardiac arrest
- Brain damage begins 4 to 6 minutes after cessation of blood flow
- Brain damage becomes irreversible after 8 to 10 minutes
- **External chest compressions and artificial ventilation are performed to circulate oxygenated blood to the vital organs**
- This is called **Cardiopulmonary Resuscitation (CPR)**

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Reasons for Cardiac Arrest

- Sudden death from heart arrhythmia, heart disease
- Respiratory arrest (especially in infants and children)
- Medical emergencies (stroke, epilepsy, diabetes, allergic reactions, electrical shock, poisoning, etc.)
- Drowning, suffocation
- Trauma and bleeding
- Congenital heart and lung abnormalities

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Cardiopulmonary Resuscitation (CPR)

- CPR is the use of external chest compressions and artificial ventilation to oxygenate and circulate blood in a cardiac arrest patient
- **CPR**:
  - **Cannot** sustain life indefinitely
  - Must be started early after cardiac arrest
  - Effectiveness decreases with time
  - Increases the amount of time that defibrillation will be effective
- **Early defibrillation and CPR are the first priorities**

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One-Rescuer Adult CPR

- **8 years of age or older**
- **Establish unresponsiveness** and activate EMS system
- **Open Airway**: head tilt-chin lift or jaw thrust (trauma)
- **Check for Breathing**: look, listen, and feel
- Give 2 initial breaths at 1½ to 2 sec/breath
- 12 breaths/minute
- Heimlich maneuver for foreign body airway obstruction
- If victim is breathing, or resumes effective breathing, place in the recovery position

Continued

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One-Rescuer Adult CPR

- **Check pulse, circulation**: carotid
- **If pulse is present, but breathing is absent**, provide rescue breathing (1 breath every 5 to 6 seconds)
- **If pulse is absent**, begin chest compressions and ventilate
- **Landmarks**: lower half of sternum
- **Method**: heel of one hand, other hand on top
- **Depth**: 1½ to 2 inches (1/3 to ½ chest depth)
- **Rate**: 80 to 100/minute
- **Compression:Ventilation Ratio**: 15:2

Two-Rescuer Adult CPR

- **Establish unresponsiveness** and activate EMS system
- **Open airway**
- **Check breathing** : look, listen, feel
- If victim is breathing, or resumes effective breathing, place in the recovery position
- If victim is not breathing, give 2 slow breaths at 1½ to 2 sec/breath
- 12 breaths/minute
- Heimlich maneuver for foreign body airway obstruction

Continued

Two-Rescuer Adult CPR

- **Check pulse, circulation**: carotid
- **If pulse is present, but breathing absent,** provide rescue breathing (1 breath every 5 to 6 seconds)
- **If pulse is absent,** begin chest compressions and ventilate
- **Landmarks**: lower half of sternum
- **Method**: heel of one hand, other hand on top
- **Depth**: 1½ to 2 inches (1/3 to ½ chest depth)
- **Rate**: 80 to 100/minute
- **Compression:Ventilation Ratio**: 5:1

Child CPR (Ages 1 to 8)

- **Establish unresponsiveness** and activate EMS system
- **<u>Open airway</u>**: head tilt-chin lift or jaw thrust (trauma)
- **<u>Check for breathing</u>**: look, listen, feel
- If victim is breathing, or resumes effective breathing, place in the recovery position
- If victim is not breathing, give 2 breaths at 1 to 1½ sec/breath
- 20 breaths/minute
- Back blows and chest thrusts for foreign body airway obstruction

Continued

Child CPR (Ages 1 to 8)

- **Check pulse, circulation**: carotid
- **If pulse is present, but breathing is absent**, provide rescue breathing (1 breath every 3 seconds)
- **If pulse is present, but less than 60 beats/min in a child** with poor perfusion, begin chest compressions
- **<u>Landmarks</u>**: lower half of sternum
- **<u>Method</u>**: heel of one hand
- **<u>Depth</u>**: 1 to 1½ inches (1/3 to ½ chest depth)
- **<u>Rate</u>**: 100/minute
- **<u>Compression:Ventilation Ratio</u>**: 5:1

Infant CPR (Less Than 1 Year)

- **Establish unresponsiveness** and activate EMS system
- **<u>Open airway</u>**: head tilt-chin lift or jaw thrust (trauma)
- **<u>Check for breathing</u>**: look, listen, feel
- If victim is breathing, or resumes effective breathing, place in the recovery position
- If victim is not breathing, give 2 breaths at 1 to 1½ sec/breath
- 20 breaths/minute
- Back blows and chest thrusts for foreign body airway obstruction

Continued

Infant CPR (Less Than 1 Year)

- **Check pulse, circulation:** brachial or femoral
- **If pulse is present, but breathing is absent**, provide rescue breathing (1 breath every 3 seconds)
- If pulse is present, but less than 60 beats/min, begin chest compressions
- **Landmarks:** one finger width below nipple line
- **Method:** 2 or 3 fingers
- **Depth:** ½ to 1 inch (1/3 to ½ chest depth)
- **Rate:** 100 to 120/minute
- **Compression:Ventilation Ratio**: 5:1

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Medical Emergencies

Contents

1. Objectives

a. Cognitive Objectives

At the completion of this lesson, the First Responder will be able to:

1. Identify the patient who presents with a general medical complaint.
2. Explain the steps in providing emergency medical care to a patient with a general medical complaint.
3. Identify the patient who presents with a specific medical complaint of altered mental status.
4. Explain the steps in providing emergency medical care to a patient with altered mental status.
5. Identify the patient who presents with a specific medical complaint of seizures.
6. Explain the steps in providing emergency medical care to a patient with seizures.
7. Identify the patient who presents with a specific medical complaint of chest pain.
8. Explain the steps in providing emergency medical care to a patient with chest pain.
9. Identify the patient who presents with a specific medical complaint of shortness of breath.
10. Explain the steps in providing emergency medical care to a patient with shortness of breath.
11. Identify the patient who presents with a specific medical complaint of abdominal pain.
12. Explain the steps in providing emergency medical care to a patient with abdominal pain.
13. Identify the patient who presents with a specific medical complaint of exposure to cold.
14. Explain the steps in providing emergency medical care to a patient with an exposure to cold.
15. Identify the patient who presents with a specific medical complaint of exposure to heat.

16. Explain the steps in providing emergency medical care to a patient with an exposure to heat.
17. Identify the patient who presents with a specific medical complaint of behavioral change.
18. Explain the steps in providing emergency medical care to a patient with a behavioral change.
19. Identify the patient who presents with a specific medical complaint of a psychological crisis.
20. Explain the steps in providing emergency medical care to a patient with a psychological crisis.

b. *Affective Objectives*

1. Attend to the feelings of the patient and/or family when dealing with the patient with a general medical complaint
2. Attend to the feelings of the patient and/or family when dealing with the patient with a specific medical complaint.
3. Explain the rationale for modifying your behavior toward the patient with a behavioral emergency.
4. Demonstrate a caring attitude toward patients with a general medical complaint who request emergency medical services.
5. Place the interests of the patient with a general medical complaint as the foremost consideration when making any and all patient care decisions.
6. Communicate with empathy to patients with a general medical complaint, as well as with family members and friends of the patient.
7. Demonstrate a caring attitude toward patients with a specific medical complaint who request emergency medical services.
8. Place the interests of the patient with a specific medical complaint as the foremost consideration when making any and all patient care decisions.
9. Communicate with empathy to patients with a specific medical complaint, as well as with family members and friends of the patient.
10. Demonstrate a caring attitude toward patients with a behavioral problem who request emergency medical services.
11. Place the interests of the patient with a behavioral problem as the foremost consideration when making any and all patient care decisions.
12. Communicate with empathy to patients with a behavioral problem, as well as with family members and friends of the patient.

c. *Psychomotor Objectives*

At the completion of this lesson, the First Responder student will be able to:

1. Demonstrate the steps in providing emergency medical care to a patient with a general medical complaint.
2. Demonstrate the steps in providing emergency medical care to a patient with altered mental status.
3. Demonstrate the steps in providing emergency medical care to a patient with seizures.
4. Demonstrate the steps in providing emergency medical care to a patient with chest pain.

5. Demonstrate the steps in providing emergency medical care to a patient with shortness of breath.
6. Demonstrate the steps in providing emergency medical care to a patient with abdominal pain.
7. Demonstrate the steps in providing emergency medical care to a patient with an exposure to cold.
8. Demonstrate the steps in providing emergency medical care to a patient with an exposure to heat.
9. Demonstrate the steps in providing emergency medical care to a patient with a behavioral change.
10. Demonstrate the steps in providing emergency medical care to a patient with a psychological crisis.

2. Introduction

The First Responder will encounter many different patients with various medical conditions and complaints. Specific skills may be required for certain medical situations; however, it is important for the First Responder to remember the basic principles to use when evaluating any patient with a medical complaint. As always, the first priority will be the assessment of the patient's airway, breathing, and circulation (ABCs). Intervening to protect or provide an airway, support breathing, and improve circulation is paramount. The First Responder must be prepared to provide appropriate emergency medical care to various medical patients. In this section, we will discuss the First Responder assessment and emergency medical treatment of a variety of common medical complaints.

3. General Medical Complaints

Patients may request emergency medical assistance for a variety of medical complaints. We will address many of these types of medical complaints in the following sections. The First Responder will need to assess each patient to determine the patient's initial chief complaint. Assessment of the patient's symptoms and physical signs follows the determination of the chief complaint. The role of the First Responder, whenever called upon to provide emergency medical care, is to complete the First Responder assessment. This involves: (1) completing a scene size-up before initiating emergency medical care, (2) completing an initial assessment of all patients, (3) completing a physical exam as needed, (4) providing ongoing assessments until additional EMS resources/personnel arrive, and (5) providing comfort, calm, and reassurance to the patient.

4. Specific Medical Complaints

a. Altered Mental Status

Altered mental status may be defined as a sudden or gradual decrease in the patient's level of consciousness, responsiveness, and understanding. This patient presentation may vary from mild disorientation to complete unresponsiveness. Although the medical conditions that may cause an altered mental status may vary, the approach to each patient is similar. Etiologies (causes) of an altered mental status include: (1) fever; (2) infections; (3) poisoning, including chemicals, alcohol, or drugs; (4) low or high blood sugars; (5) insulin reactions; (6) head injury; (7) decreased levels of oxygen in the brain; and (8) psychiatric conditions.

Determining the exact cause of a patient's altered mental status is not the primary duty of the First Responder. Knowledge regarding various illnesses and injuries, however, will provide the First Responder with greater awareness and confidence that he/ she is providing the appropriate emergency medical care. Always support the patient and maintain scene safety for the patient, observers, and yourself.

Role of the First Responder

The role of the First Responder is to complete the First Responder assessment by completing a scene size-up before initiating emergency medical care, completing an initial assessment of all patients, completing a physical exam as needed, completing ongoing patient assessments, and providing comfort, calm, and reassurance to the patient.

Management

Many patients with altered mental status are unable to protect their airway. Ensuring a patent airway and adequate ventilation for the patient is of paramount importance. Remember, the first priority in managing any patient with any medical complaint is to assess and support the patient's airway, breathing, and circulation (ABCs). Ensure the patency of the patient's airway. Place the unresponsive patient in the recovery position if the possibility of spine trauma is excluded. Do not put anything into the patient's mouth, except an oral airway, if available. Use of various airway adjuncts, including oral and nasal airways, suction, and oxygen may be helpful, if available.

b. Seizures

Seizures may be defined as a sudden alteration of cerebral (brain) function resulting in altered mental status, unresponsiveness, and various forms of excessive motor activity. Seizures are caused by excessive neuronal discharge in certain areas of the brain, which may result in excessive motor activity throughout the body (convulsions) or isolated muscle contractions in a certain part of the body. Seizures are rarely life threatening, mostly because the majority of seizures are short (less than 15 minutes) and self-limited (will spontaneously resolve without medical intervention). Seizures do, however, represent a serious emergency that may result in physical harm to the patient because of violent muscle contractions, airway compromise, and brain damage if seizures persist for longer than 30 minutes.

There are many types of seizures, as well as many causes. Causes of seizures include: (1) chronic medical conditions such as epilepsy; (2) fever; (3) infections; (4) poisoning with chemicals, alcohol, or drugs; (5) low or high blood sugars; (6) head injury; (7) decreased levels of oxygen to the brain; (8) brain tumors; (9) complications of pregnancy (toxemia); and (10) unknown causes. It is important to be aware of these possible causes, but the First Responder is not responsible for determining the cause of the seizure. Support the patient's airway, breathing, and circulation. Most seizure patients are unresponsive and may vomit during the seizure, potentially compromising their airway. Patients are typically tired and sleep following an attack. This is known as the post-ictal phase.

Role of the First Responder

The role of the First Responder is to complete the First Responder assessment. Complete a scene size-up before initiating emergency medical care. Complete an initial assessment on all patients. Complete a physical exam as needed. Complete ongoing assessments of the patient's ABCs. Comfort, calm, and reassure the patient until additional emergency medical personnel arrive. As you can see, the same step-wise First Responder assessment will be used when approaching all patients.

Management

Here are some important considerations when assessing and managing seizure patients. Protect the patient from the environment. Remove dangerous objects located near the seizure patient to prevent physical trauma. Protect modesty by asking bystanders to leave the immediate area, unless they are helping. Ensure the patency of the patient's airway. Place the patient in the recovery position if no spinal cord injury is suspected. Never restrain the patient. Restraint of the patient is not helpful and may lead to injury to you or the patient. Do not put anything in the patient's mouth, especially your fingers. Foreign objects (including fingers) may be broken by the patient's teeth and result in a foreign body obstructing the airway. If the patient is bluish, ensure airway patency and artificially ventilate. If suction is available, use to remove excess oral secretions. Finally, report the initial assessment findings to arriving additional EMS personnel. It will be important to describe the seizure activity, since the First Responder may be the only witness. The type of seizure activity, generalized convulsions or focal motor seizures, may help in determining the cause of the seizure. It also is important to report the length of time of the seizure. Try to obtain information regarding past medical history, medications, allergies, or exposure to toxins from family or friends, if available.

Remember that airway management is of primary importance. Seizure patients will often have excess oral secretions, including saliva, blood, and vomit. These oral secretions may compromise the patient's airway and result in respiratory arrest. It is essential to place these patients in the recovery position when the convulsions have ended. Patients who are actively seizing, bluish, and breathing inadequately should be suctioned and ventilated, if possible.

c. *Chest Pain*

Chest pain is a common complaint the First Responder will encounter. The etiologies, or causes, of chest pain are numerous. It is not the responsibility of the First Responder to identify the specific clinical condition causing the chest pain. It is, however, important to assess the patient's complaints and transport the patient to the hospital for further evaluation and treatment.

The ultimate goal is to determine if the patient has a potentially life-threatening clinical condition or a minor cause. Potentially life-threatening causes include acute myocardial infarction, unstable angina, dissecting thoracic aortic aneurysm, pulmonary embolism, pneumothorax, or pneumonia. Other causes of chest pain include gastrointestinal problems (esophagitis, gastritis, pancreatitis, cholecystitis), costochondritis, and muscle or rib strain.

Assessment should include a history of when the pain started, what the patient was doing when it started, and what makes the pain better or worse. Ask the patient if there is any radiation of the pain, or any associated shortness of breath, sweating, or nausea. Obtain a past medical history, including information on medications, allergies, and cardiac risk factors. These cardiac risk factors include previous heart disease, hypertension, diabetes, high cholesterol, smoking, and a family history of heart disease.

Management
Complete the First Responder assessment. Maintain body substance isolation. Assess and maintain the patient's airway and breathing. Assess the patient's circulation and allow the patient to assume a position of comfort until additional EMS personnel arrive.

d. *Shortness of Breath*

The respiratory system functions to maintain adequate exchange of oxygen and carbon dioxide. Any acute process interfering with this vital function is an emergency. Common causes of shortness of breath include asthma, pneumonia, bronchitis, chronic obstructive pulmonary disease , congestive heart failure , myocardial infarction, and pulmonary embolism. Other causes include pneumothorax, laryngeal or tracheal obstruction, pleural effusions, and lung cancer.

Assessment involves taking a history and evaluating for signs and symptoms of respiratory difficulty. Dyspnea is the sensation of difficulty getting air into or out of the lungs, or air hunger. This is the most common complaint. Other symptoms include fever, cough, chest pain, and difficulty breathing while lying down (orthopnea). Signs of respiratory illness include wheezing, stridor from upper airway obstruction, cyanosis, fever, and lower extremity swelling.

Management
Complete the First Responder assessment. Maintain body substance isolation. Maintain and support the patient's airway and breathing, using airway adjuncts as needed. Assess the circulation and control bleeding. Allow the patient to maintain a position of comfort. Comfort, calm, and reassure the patient until additional EMS personnel arrive.

e. *Abdominal Pain*

Abdominal pain also is a common complaint First Responders will encounter. Specific causes of abdominal pain are often difficult to determine at the scene. Causes of abdominal pain include gastroenteritis, bowel obstruction, abdominal aortic aneurysm, perforated viscous ulcer disease, gallbladder or liver disease, diverticulitis, and appendicitis. Myocardial infarctions and pneumonia also can present with abdominal pain. Gynecological problems, such as ectopic pregnancy, ovarian cysts, and pelvic inflammatory disease, also must be considered.

Assessment of patients with abdominal pain can be difficult. There are multiple causes of abdominal pain, and the signs and symptoms are often generalized and nonspecific. It is not the responsibility of the First Responder to identify the specific illness causing the abdominal pain.

Management
Complete the First Responder assessment. Maintain body substance isolation. Maintain the patient's airway and breathing, assess circulation, and control bleeding. Assess the patient's abdomen. Allow the patient to maintain a position of comfort. Comfort, calm, and reassure the patient until additional EMS personnel arrive.

f. *Exposure to Cold*

Hypothermia is a medical condition in which the body is no longer able to maintain its normal body temperature (98.6°F/37°C). All of the body's organ systems function optimally at or near this normal body temperature. When the body is unable to maintain this internal temperature, adverse effects result throughout the entire body. Generalized cold emergencies may result from many contributing factors, including (1) a cold environment, (2) age (very young or very old), (3) medical conditions such as hypothyroidism, and (4) alcohol, drugs, or poisons. Remember that hypothermia is not just seen in typically colder regions of the world.

Signs and Symptoms
Patients may have an obvious exposure to cold environmental conditions such as prolonged exposure to cold temperatures, water immersion or submersion, snow, rain, and wind. Or hypothermic patients may have a more subtle exposure resulting from an underlying illness, alcohol or drug poisoning, chemical exposure, or generalized decreased ambient temperatures such as in the cool home of an elderly patient.
The first sign may simply be cool/cold skin temperature. To assess the patient's general temperature, simply place the back of your hand between the clothing and the patient's abdomen. The patient may be shivering. Shivering is the one of the body's intrinsic mechanisms to generate heat by muscle spasm or fasciculation. Unfortunately, shivering often leads to further heat loss through the skin. Decreasing mental status or motor function often correlates with the degree of hypothermia. These signs and symptoms include poor coordination, memory disturbances or confusion, reduced or lost touch sensation, mood changes, decreased verbal communication, speech difficulty, and dizziness. Other signs and symptoms may include a stiff or rigid posture, muscle rigidity, joint pain or stiffness, and poor judgment. Ironically, patients suffering from hypothermia may remove their clothing. Untreated mild hypothermia may result in temporary physical and mental impairment. Untreated severe hypothermia may lead to permanent organ damage or even death.

Role of the First Responder
Complete the First Responder assessment. Complete a scene size-up before initiating emergency medical care. Complete an initial assessment on all patients. Complete a physical exam as needed. Complete ongoing assessments. Comfort, calm, and reassure patients until additional EMS help arrives.

Management
1. Check the airway, breathing, and circulation of the patient.
2. Assess pulses for 30 to 45 seconds before starting cardiopulmonary resuscitation.
3. Remove the patient from the cold environment.
4. Protect the patient from further heat loss.
5. Remove any wet clothing and cover the patient with a dry blanket.
6. Handle the patient extremely gently. Undue force or stress may cause external tissue injury or internal cardiac dysrhythmias or arrest.
7. Do not allow the patient to walk or exert himself/herself.
8. Do not give the patient anything by mouth. Do not allow the patient to eat or drink stimulants. Coffee, tea, or smoking may worsen the condition.
9. Do not massage extremities.
10. Cover the patient with a blanket. Try to keep the patient warm.

g. Local Cold Emergencies
General hypothermia was discussed above. Now, we will discuss the assessment and treatment of local cold emergencies. Isolated injuries usually result from the freezing or

near freezing of a body part, which usually occurs in the exposed areas of the body such as the fingers, toes, face, ears, and nose. Injuries resulting from such exposure to cold may range from temporary or permanent sensory or motor dysfunction of a body part, or even loss of that body part.

Signs and Symptoms of Local Cold Injuries

Signs and symptoms vary according to the temperature of exposure and length of exposure of a particular body part. We can divide these signs and symptoms into superficial and deep injuries.

Superficial, or early, injuries result in blanching of the skin. Blanching of the skin is apparent when normal color does not return after palpation of the skin. Loss of feeling and sensation in the injured area also occurs. The skin remains soft in superficial injuries. If rewarmed, a tingling sensation results. This type of cold injury may result in temporary or partial dysfunction of the injured area.

Deep, or late, injuries result in white, waxy skin. Upon palpation, the skin feels firm to frozen. There may be swelling and blister formation. If thawed or partially thawed, the skin may appear flushed with areas of purple and blanching or may be mottled and cyanotic. These cold injuries may result in severe pain for the patient, which you should consider when caring for the patient. These deep cold injuries often lead to permanent tissue dysfunction and death.

Role of the First Responder

Complete the First Responder assessment. Complete a scene size-up before initiating emergency medical care. Complete an initial assessment on all patients. Complete a physical exam as needed. Complete ongoing assessments. Comfort, calm, and reassure the patient while waiting for additional EMS personnel to arrive.

Management

1. Always try to remove the patient from the environment.
2. Protect the cold-injured extremity from further injury.
3. Remove wet or restrictive clothing.
4. If the injury appears to be early or superficial, manually stabilize the extremity and cover it with a dry cloth or dressings. Do not rub or massage. Do not re-expose the injured area to the cold.
5. If the injury appears to be late or deep, remove jewelry and cover with dry cloth or dressings. Do not break blisters. Do not rub or massage the area. Do not apply heat or rewarm the injured area. Do not allow the patient to walk on the affected extremity.

h. Exposure to Heat

Exposure to excessive heat may result in local tissue injury as well as generalized hyperthermia. Patients who suffer heat exposure injuries will often have predisposing factors that lead to such injuries. Climate plays an important role. High ambient temperature reduces the body's ability to lose heat by radiation. High relative humidity reduces the body's ability to lose heat through evaporation. Exercise and excessive activity can lead to significant volume (water) loss, in some cases, more than a liter per hour. Other predisposing factors include extremes of age (very old/young), pre-existing medical illnesses or conditions, as well as drugs and certain medications.

Signs and Symptoms
Signs and symptoms vary relative to the length and degree of exposure to heat. Common signs and symptoms include:
1. Muscle cramps
2. Generalized weakness or exhaustion
3. Dizziness or faintness
4. Rapid heart rate
5. Altered mental status to unresponsiveness

Role of the First Responder
Complete the First Responder assessment. Complete a scene size-up before initiating emergency medical care. Complete an initial assessment on all patients. Complete a physical exam as needed. Complete ongoing assessments. Comfort, calm, and reassure the patient until additional EMS personnel arrives.

Management
Initial treatment of excessive heat exposure involves three basic steps. First, remove the patient from the hot environment and place in a cool environment as soon as possible. Next, cool the patient by fanning. Fanning, however, may be ineffective if the humidity is high. Finally, place the patient in the recovery position.

i. *Behavioral Emergencies*
Behavior may be defined as the manner in which a person acts or performs. This may include any or all activities of a person, including physical and mental activity. Behavioral emergencies occur in situations where the patient exhibits abnormal behavior that is unacceptable or intolerable to the patient, family, or community. This behavior can result from extremes of emotion leading to violence or other inappropriate behavior. It may also result from a psychological or physical condition such as lack of oxygen or low blood sugar in diabetes.

When assessing a patient with an abnormal behavior, remember that there are many potential causes for a patient's change in behavior. Common causes for altered behavior include:
1. Situational stresses
2. Medical illnesses or traumatic injuries including low blood sugar, lack of oxygen, inadequate blood flow to the brain, head trauma, excessive heat, and excessive cold
3. Mind-altering substances such as alcohol or drugs
4. Psychiatric conditions
5. Psychological crises such as panic, agitation, bizarre thinking, and behavior
6. Suicidal thoughts resulting in self-destructive behavior or suicide itself
7. Homicidal thoughts resulting in threatening behavior or violence toward others

Role of the First Responder
Complete the First Responder assessment. Complete a scene size-up before initiating emergency medical care. Complete an initial assessment on all patients. Complete a physical exam as needed. Complete ongoing assessments. Comfort, calm, and reassure the patient while waiting for additional EMS personnel.

Management
The general approach to the patient with a change in behavior begins with trying to calm the patient. It is important that you do not leave the patient alone once you have made contact. Always consider the need for additional help from law enforcement. If the patient has had a suspected overdose, give the medications or drugs found at the scene to the transporting EMS personnel.

Principles for Assessing Behavioral Emergency Patients
When approaching a patient with a behavioral emergency, identify yourself and let the person know you are there to help. Inform the patient of what you are doing and when you are going to do it. Always try to ask questions in a calm, reassuring voice. Allow the patient to tell you what happened. Listen to the patient, and show that you are listening by rephrasing or repeating part of what the patient tells you. Try to acknowledge the patient's feelings. The goal is to assess individuals with behavioral emergencies, prevent further harm or escalation of the abnormal behavior, and transport the patient safely to an emergency care facility.

Assessing patients with an abnormal change in behavior begins with an assessment of the patient's mental status. Evaluate the patient's appearance, activity, speech, and orientation to person, place, and time. Observe the patient's appearance. Observe the patient's clothing, general state of hygiene, and identify any obvious external injuries that the patient may have suffered or self-inflicted. Observe the patient's activity. Note whether the patient is hyperactive or somnolent, and identify any abnormal activity that you see. Listen to the patient's speech. Is it pressured or relaxed, garbled or clear? Finally, determine if the patient is oriented to person, place, and time. When additional EMS personnel arrive, inform them of your observations prior to transfer.

Assessment of Potential Violence
Violent, or potentially violent, patients present a difficult problem for the First Responder, as well as for other EMS personnel, law enforcement, and innocent bystanders. The first priority when approaching a potentially violent patient is the scene size-up. Assess the safety of the scene for both the patient and yourself. Try to obtain a history from the family or bystanders. Try to determine if there is a known history of aggressive or combative behavior. Note the patient's posture. The patient may be standing or sitting in a position that threatens the patient or others. Look to see if the patient's fists are clenched or if lethal objects are in the patient's hand or nearby. Note the patient's vocal activity, whether he/she is yelling or verbally threatening harm to himself/herself or others. Finally, note the patient's physical activity. A violent patient may move toward you, carry heavy or threatening objects, exhibit quick or irregular movements, or simply exhibit tense muscles. Always be aware of your surroundings and your relative position to the patient. Never compromise your own safety.

Methods to Calm Behavioral Emergency Patients
When assessing patients with behavioral changes, several methods may be helpful to calm the potentially violent or unstable patient. Following these guidelines will improve your effectiveness as a First Responder and help to protect the patient and yourself from potential harm or injury.

1. Acknowledge that the person seems upset and restate that you are there to help.
2. Inform the person of what you are doing.

3. Ask questions in a calm, reassuring voice.
4. Maintain a comfortable distance.
5. Encourage the patient to state what is troubling him/her.
6. Do not make quick moves.
7. Respond honestly to the patient's questions.
8. Do not threaten, challenge, or argue with disturbed patients.
9. Tell the truth. Do not lie to the patient.
10. Do not "play along" with visual or auditory disturbances of the patient.
11. Involve trusted family members or friends, if possible.
12. Be prepared to stay at the scene a long time. Always remain with the patient.
13. Avoid unnecessary physical contact. Call additional help if needed.
14. Maintain good eye contact.

Restraining Patients
In some cases, it may be necessary to restrain a patient whose activity may result in injury to the patient or others. Follow these guidelines to ensure your safety as well as the patient's own safety:

1. Avoid physical restraint unless the patient is a danger to self and others.
2. When using restraints, have police present, if possible, and get approval from medical oversight.
3. If restraints must be used, work in conjunction with other EMS providers.
4. Avoid unreasonable force. Reasonable force depends on what force is necessary to keep the patient from injuring himself/herself or others. Reasonable force is determined by the set of circumstances involved: the patient's size and strength, the type of abnormal behavior, the sex/gender of the patient, the mental state of the patient, and the method of restraint to be used.
5. Be aware that after a period of combativeness and aggression, some apparently calm patients may cause sudden and unexpected injury to self and others.
6. Avoid acts or physical force that may cause injury to the patient.
7. EMS personnel may use reasonable force to defend against an attack by emotionally disturbed patients.
8. Seek medical oversight when considering restraining a patient.
9. Ask for police assistance as soon as possible if the patient appears or acts aggressive or combative.

When dealing with patients with behavioral changes, it is important to protect yourself from false accusations by the patient. It is important to document abnormal behavior exhibited by the patient. Have witnesses in attendance, if possible. Unfortunately, emotionally disturbed patients historically have commonly accused First Responders of sexual misconduct. Therefore, try to get help, same sex attendants, and third-party witnesses, whenever possible.

Medical/Legal Considerations
Whenever possible, try to obtain verbal consent from the patient to initiate assessment and emergency care. This step will significantly reduce potential legal problems. Obtaining verbal consent, however, is often difficult given the patient's abnormal state of mind or behavior. Here are some general considerations when handling the patient who does not consent, or resists, treatment:

1. Emotionally disturbed patients will often resist treatment.
2. Emotionally disturbed patients may threaten First Responders and others.
3. To provide emergency care against the patient's will, you must have a reasonable belief that the patient may cause harm to self or others.
4. If the patient is believed to be a danger to self or others, the patient may be transported without consent. Try to contact medical oversight whenever possible for direction and approval.
5. Try to involve law enforcement as soon as possible whenever dealing with a potentially violent or aggressive patient.

Medical Emergencies

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Cognitive Objectives

- Identify the patient with:
  1. A general medical complaint
  2. Altered mental status
  3. Seizures
  4. Chest pain
  5. Shortness of breath
  6. Abdominal pain
- Describe the steps of emergency care in a patient with:
  1. A general medical complaint
  2. Altered mental status
  3. Seizures
  4. Chest pain
  5. Shortness of breath
  6. Abdominal pain

Affective Objectives

- Demonstrate care and support for the patient with a general or specific medical complaint
- Always try to provide comfort and reassurance to the patient with a medical complaint
- Communicate with the patient, family members, and friends

Psychomotor Objectives

- Demonstrate the steps in providing emergency medical care to the patient with:
  1. A general medical complaint
  2. Altered mental status
  3. Seizures
  4. Chest pain
  5. Shortness of breath
  6. Abdominal pain
  7. Exposure to cold/heat
  8. Behavioral emergencies

General Medical Complaints

- First responders are not expected to diagnose the patient
- **First responders**:
  - Obtain information
  - Provide care in a stepwise fashion on the basis of the patient's signs and symptoms
  - Provide comfort and reassurance

General Medical Complaints: Signs and Symptoms

- **Symptoms**:
  - Confusion,disorientation
  - Headache, dizziness
  - Chest pain
  - Shortness of breath
  - Abdominal pain
  - Nausea and vomiting
  - Back pain
  - Numbness or tingling
  - Weakness
- **Signs**:
  - Temperature
  - Skin color
  - Heart rate
  - Respiratory rate
  - Mental status
  - Motor function
  - Sensory function
  - Blood pressure and oxygen saturation monitor if available

Medical Complaints: Providing Emergency Care

- **Complete assessment**:
  - Scene assessment
  - Initial patient assessment: ABCs
  - SAMPLE history
  - Physical exam
  - Ongoing assessment
  - Comfort, calm, and reassure patient and family
  - Report to more advanced personnel

Altered Mental Status: Etiologies

- **Altered mental status**: a sudden or gradual decrease in level of responsiveness
- **Common causes** include:
  - Fever, infection
  - Stroke, tumor, head injury
  - Abnormal blood sugar, poisonings (drugs and alcohol)
  - Shock
  - Psychiatric

Altered Mental Status: Signs and Symptoms

- **Symptoms**:
  - Sleepy
  - Confused
  - Lethargy
  - Coma
  - Dementia
  - Delirium
- **Signs**:
  - Evidence of head injury
  - Respiratory rate and pattern
  - Heart rate
  - Breath odor
  - Skin temperature and color
  - Abnormal eye exam

Altered Mental Status: Providing Emergency Care

- **Complete assessment**:
  - Scene assessment
  - Initial patient assessment: ABCs
  - SAMPLE history
  - Physical exam
  - Ongoing assessment
  - **First priority is airway patency**: recovery position for the uninjured patient, airway maneuvers and adjuncts for the injured patient
  - Comfort and reassure patient and family

Seizures

- **Seizures**: rapid, repeated excitation of certain brain tissue that results in a patient becoming unresponsive
- Descriptions ranging from staring spells to generalized tonic-clonic seizures
- **Complications**:
  - Injury during a seizure
  - Airway obstruction
  - Vomiting
  - Rarely life threatening. Complications increase with seizure duration

Seizures: Etiologies

- Epilepsy
- Fever, infections
- Stroke, tumor
- Abnormal blood sugar
- Poisonings (drugs and alcohol)
- Shock
- Trauma, head injury

Seizures: Providing Emergency Care

- **Complete assessment**:
  - Scene assessment
  - Initial patient assessment: ABCs
  - SAMPLE history
  - Physical exam
  - Ongoing assessment
  - First priority is airway protection
  - Protect patient from injury, never restrain a patient
  - Comfort, calm, and reassure patient and family
  - Postictal period

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Exposure to Cold

- **Factors that contribute to cold emergencies**:
  - Cold environment
  - Age (very old/very young)
  - Underlying medical conditions
  - Alcohol/drugs/ poisons

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Signs and Symptoms of Hypothermia

- Obvious versus subtle exposure
- Cool/cold skin temperature
- Shivering
- Deteriorating mental status and motor function
- Poor coordination, confusion, dizziness, mood changes, difficulty speaking
- Stiff or rigid posture
- Muscular rigidity
- Poor judgment
- Joint and muscle stiffness

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Role of the First Responder in Cold Exposure

- Complete the First Responder assessment
- Assess pulses 30 to 45 seconds before starting CPR
- Remove the patient from the cold environment
- Protect from further heat loss
- Remove wet clothing
- Cover with a blanket
- Handle gently
- Patient should not walk or exert him- or herself
- Nothing by mouth
- Do not massage skin
- Keep the patient warm

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Local Cold Emergencies

- **<u>Superficial injury</u>**:
  - Blanching of the skin
  - Loss of sensation
  - Skin remains soft
  - If re-warmed, tingling sensation
- **<u>Deep injury</u>**:
  - White, waxy skin
  - Feels firm or frozen
  - Swelling
  - Blisters
  - Thawing causes skin to have areas that are flushed, mottled, purple, or blanched

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Role of the First Responder in Local Cold Emergencies

- Complete a First Responder assessment
- Remove the patient from the environment
- Protect the cold-injured area from further injury
- Remove wet or constrictive clothing
- **<u>Superficial injury</u>**: stabilize and cover the extremity; do not massage or re-expose to the cold
- **<u>Deep injury</u>**: remove jewelry and cover with dry cloth; do not break blisters, massage, apply heat, re-warm, or allow the patient to walk on the affected extremity

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Exposure to Heat

- **Predisposing factors**:
  - Climate
  - Exercise and activity
  - Age
  - Pre-existing illness
  - Drugs/medications

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Signs and Symptoms of Heat Exposure

- Muscle cramps
- Weakness or exhaustion
- Dizziness or faintness
- Rapid heart rate
- Altered mental status
- Unresponsive

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Role of the First Responder in Heat Exposure

- Complete a First Responder assessment
- Comfort, calm, and reassure the patient
- Remove the patient from the hot environment and place in a cool environment
- Cool the patient by fanning
- Place in the recovery position

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Chest Pain: Etiologies

- Angina: decreased supply of blood and oxygen to the heart
- Acute myocardial infarction (heart attack)
- Pericarditis
- Dissecting thoracic aortic aneurysm
- Pulmonary embolus
- Pneumothorax
- Pneumonia
- Reflux (heartburn)

Chest Pain: Signs and Symptoms

- **Symptoms**:
  - Chest pain
  - Extremity or jaw pain
  - Back pain
  - Shortness of breath
  - Sweating
  - Nausea
  - Vomiting
  - Dizziness
- **Signs**:
  - Abnormal heart rate
  - Abnormal heart rhythm
  - Abnormal respirations
  - Altered mental status
  - Sweating
  - Skin color and temperature changes

Chest Pain: Providing Emergency Care

- **Complete assessment**:
  - Scene assessment
  - Initial patient assessment: ABCs
  - SAMPLE history
  - Physical exam
  - Ongoing assessment
  - First priority is the airway
  - Provide oxygen and position of comfort
  - Comfort, calm, and reassure the patient and family

Shortness of Breath: Etiologies

- Asthma
- Chronic obstructive pulmonary disease
- Pneumonia
- Bronchitis
- Pulmonary embolism
- Congestive heart failure
- Angina or heart attack
- Pneumothorax
- **Always remember airway obstruction**

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Shortness of Breath: Signs and Symptoms

- **Symptoms**:
  - Shortness of breath
  - Stridor
  - Wheezing
  - Cough
  - Chest pain
  - Hemoptysis: coughing up blood
- **Signs**:
  - Fever
  - Abnormal breath sounds from wheezing to crackles
  - Abnormal respiratory rate
  - Abnormal heart rate or rhythm
  - Cyanosis
  - Sweating
  - Accessory muscle use
  - Leg swelling

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Shortness of Breath: Providing Emergency Care

- **Complete assessment**:
  - Scene assessment
  - Initial patient assessment: ABCs
  - SAMPLE history
  - Physical exam
  - Ongoing assessment
  - First priority is airway
  - Provide oxygen and a position of comfort
  - Comfort, calm, and reassure patient and family

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Abdominal Pain: Etiologies

- Gastroenteritis
- Peptic ulcer disease (gastritis)
- Pancreatitis
- Gallbladder disease
- Hepatitis (liver disease)
- Bowel obstruction
- Appendicitis
- Diverticulitis
- Myocardial infarction
- Aortic aneurysm
- Ectopic pregnancy
- Ovarian cysts
- Pelvic inflammatory disease

Abdominal Pain: Signs and Symptoms

- **Symptoms**:
  - Generalized abdominal pain
  - Epigastric abdominal pain
  - Right upper quadrant pain
  - Left upper quadrant pain
  - Right lower quadrant pain
  - Left lower quadrant pain
  - Back pain
  - Chest pain
  - Nausea, vomiting, diarrhea
- **Signs**:
- Abdominal tenderness
- Guarding
- Rigidity
- Distension

Abdominal Pain: Providing Emergency Care

- **Complete assessment**:
  - Scene assessment
  - Initial patient assessment: ABCs
  - SAMPLE history
  - Physical exam
  - Ongoing assessment
  - First priority is airway protection
  - **Do not give food or drink**. Provide a position of comfort
  - Comfort, calm, and reassure patient and family

Behavioral Emergencies

- Defined as a situation where the patient exhibits abnormal behavior that is unacceptable or intolerable to the patient, family, or community
- This behavior can result from extremes of emotion leading to violent behavior or from a psychological or physical condition such as lack of oxygen or low blood sugar in diabetes

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Causes of Behavioral Change

- Situational stresses
- Illness/injury
- Low blood sugar
- Lack of oxygen
- Head trauma
- Excessive heat
- Excessive cold
- Alcohol and drugs
- Psychiatric illness
- Panic
- Agitation
- Bizarre thinking and behavior can lead to danger to self and others

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Role of the First Responder in Behavioral Emergencies

- Complete a First Responder assessment
- Identify yourself
- Inform the person what you are doing
- Ask questions in a calm, reassuring voice
- Allow the patient to talk
- Show you are listening
- Acknowledge feelings
- **Assess patient's mental status**: appearance, activity, speech, orientation
- **Assess potential violence**: history, posture, vocal activity, physical activity

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Methods to Calm Behavioral Emergency Patients

- Acknowledge that the person is upset
- Say you are there to help
- Inform the person of what you are doing
- Be calm, reassuring
- Maintain comfortable distance
- No quick moves
- Respond honestly
- Do not argue , challenge, or threaten
- Tell the truth
- Do not "play along"
- Involve trusted family or friends
- Remain with the patient
- Use good eye contact
- Avoid unnecessary contact

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Restraining Patients

- When patient is a danger to self or others
- If possible, have police present and get medical oversight
- Avoid unreasonable force that may injure the patient
- Get additional EMS help to restrain patients
- May use reasonable force if attacked
- Documentation of the patient's behavior and witnesses is important

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Bleeding and Soft Tissue Injuries

Contents

1. Objectives

a. Cognitive Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Differentiate between arterial, venous, and capillary bleeding.
2. State the emergency medical care for external bleeding.
3. Establish the relationship between body substance isolation and bleeding.
4. List the signs of internal bleeding.
5. List the steps in the emergency medical care of the patient with signs and symptoms of internal bleeding.
6. Establish the relationship between body substance isolation and soft tissue injuries.
7. State the types of open soft tissue injuries.
8. Describe the emergency medical care of the patient with a soft tissue injury.
9. Discuss the emergency medical care considerations for a patient with a penetrating chest injury.
10. State the emergency medical care considerations for a patient with an open wound to the abdomen.
11. Describe the emergency medical care for an impaled object.
12. State the emergency medical care for an amputation.
13. Describe the emergency medical care for burns.
14. List the functions of dressings and bandages.

b. Affective Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Explain the rationale for body substance isolation when dealing with bleeding and soft tissue injuries.

2. Attend to the feelings of the patient with a soft tissue injury or bleeding.
3. Demonstrate a caring attitude toward patients with a soft tissue injury or bleeding who request emergency medical services.
4. Place the interests of the patient with a soft tissue injury as the foremost consideration when making any and all patient care decisions.
5. Communicate with empathy to patients with a soft tissue injury or bleeding, as well as with family members and friends of the patient.

c. Psychomotor Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Demonstrate direct pressure as a method of emergency medical care for external bleeding.
2. Demonstrate the use of diffuse pressure as a method of emergency medical care for external bleeding.
3. Demonstrate the use of pressure points as a method of emergency medical care for external bleeding.
4. Demonstrate the care of the patient exhibiting signs and symptoms of internal bleeding.
5. Demonstrate the steps in the emergency medical care of open soft tissue injuries.
6. Demonstrate the steps in the emergency medical care of a patient with an open chest wound.
7. Demonstrate the steps in the emergency medical care of a patient with an open abdominal wound.
8. Demonstrate the steps in the emergency medical care of a patient with an impaled object.
9. Demonstrate the steps in the emergency medical care of a patient with an amputation.
10. Demonstrate the steps in the emergency medical care of an amputated part.

2. Introduction

Trauma is the leading cause of death in the United States in persons between the ages of 1 and 44 years. Trauma is prevalent throughout all regions of the world. Traumatic injuries occur as a result of many different scenarios, such as automobile accidents, workplace/industrial injuries, direct physical altercations, the use of weapons (knifes, guns), athletic activities, and physical abuse. Traumatic injuries and bleeding are some of the most dramatic situations that the First Responder will encounter. The early control of major bleeding has great life-saving potential.

Soft tissue injuries are common and often dramatic, but rarely life threatening. These soft tissue injuries range from minor abrasions to serious, full-thickness burns. The First Responder must become familiar with the emergency medical care of soft tissue injuries. Emphasis will be placed on methods to control bleeding, prevent further injury, and reduce contamination and subsequent infection or tissue death.

3. Bleeding

A patient who is bleeding often presents in a dramatic fashion. Unlike other medical or traumatic injuries or complaints, which may not have as obvious external signs, bleeding is readily visible and often startling. It is important to approach bleeding patients in a stepwise manner, following the same principles involved in approaching patients with less obvious injuries. Always remember that the patient's airway and breathing are the first priority, followed immediately by attention to the circulation (ABCs).

Remember some general considerations when responding to a patient with a bleeding injury. The First Responder must always be aware of the risk of infectious disease from contact with blood or body fluids. The severity of blood loss must be assessed on the basis of the patient's signs and symptoms and the general impression of the amount of blood loss. Remember that the body's normal response to bleeding is blood vessel constriction and clotting. More severe injuries may overwhelm the body's ability to clot blood and prevent further blood loss. In severe cases, uncontrolled bleeding and significant blood loss lead to shock and possibly death. The bleeding may be internal or external. Both internal and external bleeding can result in shock or death, if uncontrolled. We will now discuss the types of external and internal bleeding, their signs and symptoms, and the appropriate management of these traumatic injuries.

a. Types of External Bleeding

External bleeding can be divided into three types: arterial, venous, and capillary bleeding. Understanding the differences between these three sources of bleeding will help you to better evaluate and treat the patient.

Arterial bleeding occurs with injury to arteries, the muscular blood vessels carrying oxygenated blood from the heart to the body's tissues. The blood is bright red, signifying that it is oxygen-rich. Arterial bleeding tends to spurt (or pulsate) from the wound. It is the most difficult to control because arterial blood is under much higher pressure than the blood in veins or capillaries. As the patient's blood pressure drops from excessive blood loss, pulsating flow may decrease.

Venous bleeding occurs with injury to the veins, the less muscular blood vessels carrying oxygen-poor blood away from the tissues back to the lungs and heart. Blood tends to flow as a steady stream, rather than a pulsating or spurting stream seen in arterial bleeding. The blood tends to be dark blue, signifying that it is oxygen-poor. Venous bleeding can be profuse. In most cases, however, bleeding is more easily controlled because of the lower venous pressure.

Capillary bleeding occurs with injury to the capillaries, the small blood vessels where oxygen exchange occurs at the tissue level. In simple terms, capillaries connect arteries and veins. Blood tends to ooze from a capillary and is dark red in color. Capillary bleeding often clots spontaneously, because the blood is under extremely low pressure with minimal volume loss.

Role of the First Responder

Complete the First Responder assessment. Complete a scene size-up before initiating emergency medical care. Complete an initial assessment on all patients. Complete a physical exam as needed. Complete ongoing assessments. Comfort, calm, and reassure the patient until additional emergency medical services (EMS) personnel arrive.

The First Responder must be aware of the implications of not using body substance isolation precautions. These precautions include protective gloves and protective face masks and clothing when available. Body substance isolation is necessary to prevent transmission of disease to yourself or others. Always remember that the ABCs (airway, breathing, and circulation) are your first priority. You must support and maintain the patient's airway and provide artificial ventilation, if necessary.

Use the following guidelines whenever attempting to control external bleeding:
1. Apply fingertip pressure directly on the point of bleeding, using the flat part of the fingers.
2. If no injury to the muscle or bone exists, elevate the bleeding extremity, while maintaining direct pressure.
3. Large gaping wounds may require sterile gauze and direct hand pressure if fingertip pressure is ineffective.
4. If bleeding does not stop, remove the dressing and assess for the bleeding point to apply direct pressure. If more than one bleeding site is identified, apply additional pressure.
5. Pressure points, superficial arteries proximal to the injured area, may be used in the upper and lower extremities if direct pressure fails to control the bleeding.

b. *Internal Bleeding*

Internal bleeding is often not as visually startling to the First Responder. Injured or damaged internal organs, however, commonly lead to extensive bleeding that is concealed. Deformed, swollen extremities resulting from long bone fractures may also lead to serious internal blood loss. Pelvic bone fractures can also result in serious internal bleeding.

Signs and Symptoms

The signs and symptoms of internal blood loss are much more subtle than those of external blood loss. Pay special attention to the patient's vital signs and associated signs and symptoms as well as the condition of the injured body part. These signs and symptoms include:
1. Discolored, tender, swollen, or hard tissue
2. Increased respiratory and pulse rates
3. Pale, cool skin
4. Nausea and vomiting
5. Thirst
6. Altered mental status

Role of the First Responder

Complete the First Responder assessment. Complete a scene size-up before initiating emergency medical care. Complete an initial assessment on all patients. Complete a physical exam as needed. Complete ongoing assessments. Comfort, calm, and reassure the patient until additional EMS personnel arrive.

Management
1. Complete the First Responder assessment.
2. Maintain body substance isolation.
3. Check ABCs: airway, breathing, circulation
4. Maintain airway/artificial ventilation.
5. Manage any external bleeding.
6. Reassure the patient.

7. Keep the patient calm and in a position of comfort.
8. Keep the patient warm.
9. Treat for shock.

c. Shock

Shock is a condition resulting from the inadequate delivery of oxygenated blood to body tissues. The tissues are hypoperfused, resulting in tissue injury and death if untreated. Shock can result from failure of the heart to effectively pump oxygen-rich blood to the tissues of the body. It may also result from abnormal dilation of blood vessels and blood volume loss. It is important for the First Responder to recognize the signs and symptoms of shock and begin appropriate initial treatment.

Signs and Symptoms

1. Extreme thirst
2. Restlessness, anxiety
3. Rapid, weak pulse
4. Rapid, shallow respirations
5. Pale, cool, moist skin
6. Mental status changes

Role of the First Responder

Complete the First Responder assessment. Complete a scene size-up before initiating emergency medical care. Complete an initial assessment on all patients. Complete a physical exam as needed. Complete ongoing assessments. Comfort, calm, and reassure the patient until additional EMS personnel arrive.

Management

1. Maintain airway/ventilation.
2. Prevent further blood loss.
3. Keep the patient calm, in a position of comfort.
4. Keep the patient warm, try to maintain normal body temperature.
5. Provide care for specific injuries.
6. Do not give food or drink.

4. Specific Injuries

a. Types of Soft Tissue Injuries

Abrasions are superficial skin injuries in which the outermost layer of the skin is damaged by shearing forces. These injuries are superficial, but can cause significant pain, depending on the size of the abrasion and the location on the patient’s body. There is either no active bleeding or minimal oozing from these superficial wounds. Consequences of inadequately treated abrasions are infection and, rarely, mild scarring.

Lacerations are actual breaks of varying depths in the skin. Lacerations may occur in isolation or together with other types of soft tissue injury. Sharp objects with forceful impacts generally cause these injuries. Bleeding can be severe, depending on the depth of the laceration and damage to underlying structures (arteries, veins). Infection and scarring are consequences of inadequate treatment of lacerations.

Sharp, pointed objects cause penetration injuries, or puncture wounds. These injuries may deceptively conceal internal bleeding of structures beneath the skin. Extent of injury depends on the object causing the wound, the velocity of the object, and the underlying structures damaged by the penetrating object. Puncture wounds may have an exit wound as well as an entrance wound. Examples of such penetrating injuries include gunshot and stab wounds.

b. *Role of the First Responder*

Complete the First Responder assessment. Complete a scene size-up before initiating emergency medical care. Complete an initial assessment on all patients. Complete a physical exam as needed. Complete ongoing assessments. Comfort, calm, and reassure the patient while waiting for additional EMS personnel.

c. *Management*

It is necessary to maintain body substance isolation whenever managing any soft tissue injury. Gloves and eye protection are crucial for preventing transmission of disease. Wearing a gown is also highly recommended, if available. Washing hands to prevent disease transmission cannot be overstated. Remember that body substance isolation guidelines are for your protection, as well as for the patient.

The first step in managing soft tissue injuries is to maintain a proper airway and assist in ventilation, as necessary. Remember the ABCs. Once you have evaluated and maintained the airway, breathing, and circulation, management of open soft tissue injuries includes:

1. Exposing the wound.
2. Controlling the bleeding and preventing further blood loss.
3. Preventing further contamination of the wound by covering with sterile dressings, if available, or cloth towels/blankets, etc.
4. Applying sterile dressing to the wound and bandaging securely in place.

5. Special Considerations

a. *Chest Injuries*

Chest injuries can involve chest wall injuries as well as internal injuries to the lungs and heart. When open wounds are present in the chest, place an occlusive dressing over the wound and seal on three sides. This technique allows air to escape the chest cavity during exhalation while preventing air from entering the chest cavity with inhalation. This method will help prevent the creation of a tension pneumothorax (lung collapse, which causes increased pressure within the chest cavity, resulting in a potentially fatal reduction in heart function and cardiac arrest). If no spinal injury is suspected, the patient should be placed in a position of comfort.

b. *Impaled Objects*

Impaled objects also require special consideration. To manage these injuries, the First Responder must never remove the impaled object from the injured patient, unless it is through the cheek or in a position that interferes with airway management or chest compressions. It is important to secure the object in place to prevent further injury. Expose the wounded area, control the bleeding, and cover the area with a bulky dressing to help stabilize the impaled object.

c. *Eviscerations*

Eviscerations are extensive injuries that involve an open wound that has internal organs protruding from the wound. These injuries must be cared for surgically. To manage these injuries, cover the protruding organs with a thick, moist dressing. Do not attempt to replace the organs inside the body.

d. *Amputations*

Amputation of extremities or other body parts requires special management as well. These injuries may produce massive or limited bleeding. The primary goal, as in all the above special considerations, remains the stabilization of the patient's airway, breathing, and circulation first. The amputated body part should be located and preserved for potential reattachment. Place the body part in a plastic bag. Then place this bag inside another plastic bag or container with ice and water. This step will lengthen the time the body part remains viable. Do not use ice alone or dry ice. These can cause direct injury to the amputated part and reduce viability.

6. Burns

Burns can result from direct exposure to heat, steam, fire, chemicals, or electricity. The classification of burns is according to the depth of skin and underlying tissue involvement. Burns are classified as superficial, partial thickness, and full thickness. Superficial burns involve the outer layer of skin. The underlying tissue is not involved. These burns, also known as first-degree burns, result in reddening and swelling of the skin. Partial-thickness, or second-degree, burns produce redness, swelling, and blister formation. These burns can be very painful and involve the outer and middle layers of the skin. Full-thickness, or third-degree, burns extend through all layers of skin. These burns result in destruction of nervous tissue and underlying structures that provide blood and nutrients to the skin. The skin, therefore, may appear charred or white and feel leathery. The patient may experience little to no pain after the injury, because the area no longer has sensation. Full-thickness burns can result in significant scarring and disfigurement.

a. *Role of the First Responder*

Complete the First Responder assessment. Complete a scene size-up before initiating emergency medical care. Complete an initial assessment on all patients. Complete a physical exam as needed. Complete ongoing assessments. Comfort, calm, and reassure the patient until additional EMS personnel arrive.

b. *Management*

When caring for a patient who has sustained a burn injury, take the following steps:

1. Stop the burning process initially with water or saline.
2. Remove smoldering clothing and jewelry. Be aware that some clothing may have melted onto the skin. If you meet resistance when removing the clothing, leave it in place.
3. Observe appropriate body substance isolation to prevent transmission of disease.
4. Continually monitor the patient's airway for compromise or closure.
5. Prevent further contamination by covering the burned area with a dry, sterile dressing.
6. Do not use any type of lotion, ointment, or antiseptic.
7. Do not break blisters, if possible.

c. Chemical Burns

Chemical burns from industrial or household products may result in ongoing injury if the offending agent is not removed from contact with the skin or eyes. Chemical burns also can cause inhalation injury to the airway and lungs. Scene safety is important. Remove the patient from further exposure to the chemical. Flush the skin or eyes with copious amounts of water. Brush off any dried powder. Use glove and eye protection to prevent injury or exposure to yourself.

d. Electrical Burns

Electrical burns also involve ensuring scene safety and preventing further injury. Electrical injuries may not produce significant external evidence of injury. Internal damage to organs, however, can be significant. The patient should be examined for potential entrance and exit wounds. The patient also should be monitored closely for cardiac or respiratory arrest.

e. Burns Sustained by Infants and Children

These burns also involve special consideration. Infants and children have a greater surface area in relation to total body size. This results in greater fluid and heat loss with burn injuries. Therefore, it may be important to keep the environment warm when caring for these patients to prevent fluid and heat loss. Finally, a First Responder must also consider child abuse whenever an infant or child sustains a burn.

7. Dressing and Bandaging

There are three primary functions of dressing and bandaging:

1. Stop the bleeding.
2. Protect the wound from further damage.
3. Prevent further contamination.

Types of dressings include universal dressings, 4 x 4 inch gauze pads, adhesive type, and occlusive barrier dressings. Bandages are used to hold the dressing in place. Bandage types include self-adherent bandages, gauze rolls, triangular bandages, and adhesive tape.

Bleeding and Soft Tissue Injuries

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Bleeding: General Considerations

- Be aware of the risk of infectious disease from contact with blood or body fluids
- Severity of blood loss is based on signs and symptoms
- Serious injury may prevent effective clotting
- Significant blood loss may lead to shock and death
- Bleeding may be external or internal

Types of External Bleeding

- <u>**Arterial**</u>:
  - Blood pulsates from wound, is bright red, oxygen-rich, under increased pressure, difficult to control
- <u>**Venous**</u>:
  - Blood flows as a steady stream, dark, oxygen-poor, under lower pressure than arterial blood
- <u>**Capillary**</u>:
  - Blood oozes from wound, often clots spontaneously

Role of the First Responder in External Bleeding

- Complete the First Responder assessment
- Body substance isolation
- Maintain airway/artificial ventilation
- **Control bleeding**:
  - Apply fingertip pressure
  - Elevate and stabilize the extremity
- Use gauze and direct hand pressure for larger wounds
- Pressure points may be used in the upper and lower extremities

Internal Bleeding

- **Signs and Symptoms**:
  - Internal organ damage and bleeding concealed
  - Extensive blood loss from internal organs as well as long bone fractures
  - Discolored, tender, swollen, or hard tissue
  - Increased respiratory and pulse rates
  - Pale, cool skin
  - Nausea and vomiting
  - Thirst
  - Mental status changes

Role of the First Responder in Internal Bleeding

- Complete the First Responder assessment
- Body substance isolation
- Maintain airway/artificial ventilation
- Control external bleeding
- Reassure the patient
- Keep the patient calm and in a position of comfort
- Keep the patient warm
- Treat for shock

Shock

- **Defined** as the inadequate delivery of oxygenated blood to body tissues
- **Causes**:
  - Blood volume loss
  - Abnormally dilated blood vessels
  - Failure of the heart to provide oxygenated blood
- **Signs and Symptoms**:
  - Thirst
  - Restlessness, anxiety
  - Rapid weak pulse
  - Rapid, shallow respirations
  - Pale, cool, moist skin
  - Mental status changes

Role of the First Responder in Shock

- Complete the First Responder assessment
- Body substance isolation
- Maintain airway/artificial ventilation
- Control external bleeding
- Prevent further blood loss
- Keep patient calm, in a position of comfort
- Keep warm
- Do not give food or drink
- Provide care for specific injuries

Specific Injuries

- **Abrasion**:
  - Superficial, painful, little blood
- **Laceration**:
  - Break in the skin, bleeding may be severe
- **Penetration/Puncture Wound**:
  - Sharp object, internal bleeding may be severe without external bleeding, e.g., gunshot or stab wound

Role of the First Responder

- Complete the First Responder assessment
- Body substance isolation
- Maintain airway/artificial ventilation
- **Manage soft tissue injuries**:
  - Expose the wound
  - Control the bleeding
  - Prevent further contamination
  - Apply sterile dressing and bandage securely

Special Considerations

- **Chest Injuries**:
  - Occlusive dressing sealed on three sides for open wounds
- **Impaled Objects**:
  - Do not remove the object, secure it, control bleeding
- **Evisceration**:
  - Do not replace protruding organs, cover w/ moist dressing
- **Amputation**:
  - Locate and preserve body part in plastic bag in a bag/ container filled with ice and water

Burns

- **Classification** according to depth of injury
- **Superficial**:
  - Outer layer of skin, redness and swelling
- **Partial Thickness**:
  - Outer and middle skin layers, reddening and blisters
- **Full Thickness**:
  - All layers of skin, nerve and blood supply damage, leathery or charred skin

Role of the First Responder in Burns

- Complete the First Responder assessment
- Body substance isolation
- Maintain airway/artificial ventilation
- Use water or saline
- Remove smoldering clothing and jewelry
- Prevent further contamination
- Cover the burned area with a dry, sterile dressing
- Do not use ointment, lotion, or antiseptic
- Do not break blisters

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Special Burn Considerations

- **Chemical Burns**:
  - Brush off powders, flush with copious amounts of water
- **Electrical Burns**:
  - Often more severe than external indications, possible respiratory and cardiac arrest
- **Infant and Child Considerations**:
  - Greater surface area in relation to total body size, greater fluid and heat loss, consider child abuse

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Dressing and Bandaging

- **Function**:
  - Stop bleeding
  - Protect wound from further damage
  - Prevent contamination and infection
- **Dressings**:
  - Universal, 4X4 gauze pads, adhesive, occlusive
- **Bandages:**
  - Hold dressings in place
  - Self-adherent, gauze rolls, triangular, adhesive tape

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Injuries to Muscles and Bones

Contents

1. Objectives

a. Cognitive Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Describe the function of the musculoskeletal system.
2. Differentiate between an open and a closed painful, swollen, deformed extremity.
3. List the emergency medical care for a patient with a painful, swollen, deformed extremity.
4. Relate mechanism of injury to potential injuries of the head and spine.
5. State the signs and symptoms of a potential spine injury.
6. Describe the method of determining if a responsive patient may have a spine injury.
7. List the signs and symptoms of injury to the head.
8. Describe the emergency medical care for injuries to the head.

b. Affective Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Explain the rationale for the feeling patients have who need immobilization of a painful, swollen, deformed extremity.
2. Demonstrate a caring attitude toward the patient with a musculoskeletal injury who requests emergency medical services.
3. Place the interests of the patient with a musculoskeletal injury as the foremost consideration when making any and all patient care decisions.
4. Communicate with empathy to patients with a musculoskeletal injury, as well as with family members and friends of the patient.

c. Psychomotor Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Demonstrate the emergency medical care of a patient with a painful, swollen, deformed extremity.

2. Demonstrate opening the airway in a patient with suspected spinal cord injury.
3. Demonstrate evaluating a responsive patient with a suspected spinal cord injury.
4. Demonstrate stabilizing the cervical spine.

2. Introduction

Injuries to the muscles and bones are common types of injuries the First Responder will encounter. These injuries are mostly non–life threatening, but may be dramatic. Prompt identification and appropriate emergency medical care of musculoskeletal injuries is crucial to reduce pain, prevent further injury, and minimize permanent damage. We will learn this by first reviewing the anatomy and function of the musculoskeletal system. Then we will discuss the proper evaluation and treatment of injuries to the bones, joints, spine, brain and skull, as well as other traumatic situations. Remember, securing and maintaining the airway and breathing and supporting the circulation take precedence over the treatment of musculoskeletal injuries.

3. Review of the Musculoskeletal System

The skeletal system functions to give the body shape and protect vital internal organs. This system is composed of bones of varying size and shape. These bones connect to other bones in areas called joints. Muscles, tendons, and ligaments hold joints together.

The skull, or cranium, houses and protects the brain. Multiple bones form the face, including the maxilla, mandible, and zygoma (cheek) bones. The skull is connected to the spinal column, which is made up of 33 bones (vertebrae), divided into the cervical, thoracic, lumbar, sacral, and coccygeal regions. The spinal column serves to protect the spinal cord, which is connected to the brain, and provides us with an upright posture.

The thorax, or chest, is composed of the ribs and sternum. There are 12 sets of paired ribs. The first 10 sets of paired ribs attach to the posterior spinal column and to the anterior sternum. The 11th and 12th pairs of ribs only attach to the spinal column and “float” anteriorly. The sternum, or breastbone, is a midline anterior bone in the center of the chest. The lowest portion of the sternum is the xyphoid process, which serves as the crucial landmark for hand positioning during chest compressions. Together, the ribs and sternum provide protection for the vital organs of the chest, including the heart and lungs. They also help to protect the liver and spleen in the abdomen.

The pelvis is a composition of bones that serve to cradle the upper portions of the body. The spinal column fuses in the sacrum and attaches to the pelvis. The lower extremities also connect to the pelvis, which protects the bladder, lower intestine, uterus, and ovaries.

The lower extremities are connected to the pelvis at the hips. The lower extremities are composed of the femur (thigh), the patella (kneecap), the tibia and fibula (lower leg/shin), ankle, feet, and toes. The upper extremities are connected to the thorax at the shoulders. The upper extremities are composed of the shoulder, the clavicle and scapula (collarbone and shoulder blade, respectively), the humerus (upper arm), the radius and ulna (forearm), the wrist, hand, and fingers.

The muscular system functions to give the body shape, provide movement, and protect internal organs. Three types of muscle are found in our bodies: voluntary (skeletal), involuntary (smooth), and cardiac muscle.

Voluntary, or skeletal, muscle attaches to bone to provide the body with movement. These muscles are under the direct control of the brain and nervous system. The will of the individual can cause these muscles to contract and relax. The muscles are under voluntary control.

Involuntary, or smooth, muscles contract and relax automatically under the control of the autonomic nervous system. These muscles are found in the walls of tubular structures of the gastrointestinal tract and urinary systems. They are also found in the walls of blood vessels and bronchi (airways).

Cardiac muscle is a special muscle that has its own intrinsic electrical activity. It even has specialized pacemaker cells. These cardiac muscle fibers are found in no other part of the body. This muscle can tolerate interruption of blood supply for only very short periods.

4. Injuries to Bones and Joints

To care for patients with bone and joint injuries, the First Responder must ascertain the mechanism of injury, identify the primary injury along with any other associated injuries, and appropriately treat the injury(ies). As always, the first priority is attention to the airway, breathing, and circulation.

The mechanism of injury will often correlate with the nature and extent of the bone or joint injury. Three primary forces are involved with injuries to the bones and joints. Direct forces directly impact the bone or joint injured. Indirect forces occur when a force directly impacts another body part that stresses, and injures, a bone or joint in another part of the body. Twisting forces can also produce significant injury.

There are two types of bone and joint injuries: open and closed. In open injuries, the continuity of the skin is disrupted, exposing the underlying bone and soft tissues. These injuries are prone to infection. In closed injuries, the skin continuity remains. Both injuries can result in significant blood loss.

a. Signs and Symptoms

When evaluating a patient for bone or joint injuries, several signs and symptoms will help to identify the injury. Pain and tenderness are almost always present. The extremity or body part may be angulated, shortened, or deformed. There is often swelling of the surrounding soft tissues and bruising (discoloration). When palpating the injured area, the First Responder may feel crepitus or grating of the bones. The joint may be deformed or locked into position. More dramatically, fractured bone ends may be visualized in the wound.

b. Management

Complete a scene assessment. Obey body substance isolation guidelines. Assess the airway, breathing, and circulation (ABCs). Protect and maintain the airway and breathing. After controlling life-threatening injuries, allow the patient to remain in a position of comfort. After identifying the injured area of the extremity, apply a cold pack to the painful, swollen, or deformed area to reduce swelling and pain. Finally, manually stabilize the injured extremity. Follow these general guidelines whenever stabilizing an injured extremity:

1. Always support the extremity above and below the injured area.
2. Cover open wounds with a sterile dressing.

3. Try to pad the extremity to prevent pressure and discomfort to the patient.
4. Do not intentionally replace protruding bones.
5. Whenever in doubt, manually stabilize the injured extremity.

5. Injuries to the Spine

Injuries to the spine can result in some of the most physically disabling injuries a First Responder may encounter. These injuries may result in a patient losing effective respiratory effort and in paralysis. One must always suspect a spinal cord injury whenever trauma occurs. Several mechanisms of injury, however, should create a higher index of suspicion when evaluating a trauma patient.

Suspicious mechanisms of injury include motor vehicle accidents; pedestrian versus vehicle accidents; falls; blunt trauma; motorcycle accidents; penetrating injuries to the head, neck, or back; hangings; and diving accidents. Consider any unresponsive trauma patient to have a spinal cord injury, until proven otherwise.

a. Signs and Symptoms

Spinal cord injury can result in many different signs and symptoms. These signs and symptoms depend primarily on the level of spinal cord injury. Perform full spine immobilization of any trauma patient suspected of a spinal column injury or exhibiting any of the following signs or symptoms to prevent worsening of the spinal cord injury. Signs and symptoms of spinal cord injury include:

1. Tenderness of the cervical, thoracic, lumbar, or sacral spine.
2. Pain associated with moving. Do not ask these patients to move to try to find a pain response. Do not move the patient to test for a pain response.
3. Pain independent on movement or palpation along the spine or lower legs. This pain may be intermittent.
4. Soft tissue injuries associated with the trauma. Suspicious injuries include the head and neck (cervical spine), the shoulders, back, or abdomen (thoracic, lumbar), and the lower extremities (lumbar, sacral).
5. Numbness, weakness, or tingling in the extremities.
6. Loss of sensation or paralysis below the suspected level of injury.
7. Loss of sensation or paralysis in the upper or lower extremities.
8. Respiratory impairment (high cervical spine).
9. Loss of bladder and/or bowel control.
10. Ability of the patient to walk, move extremities or feel sensation, or lack of pain in the spinal column does not rule out the possibility of spinal column or cord damage.

b. Assessing the Potential Spine-Injured Patient

In a responsive patient, assess the mechanism of injury by asking questions. Questions to ask include:

1. What happened?
2. Where does it hurt?
3. Does your neck or back hurt?
4. Can you move your hands and feet?
5. Can you feel me touching your fingers and toes?

In the unresponsive patient, maintain the patient’s airway and breathing. Stabilize the patient’s head and neck manually in the position found, and obtain information from observers at the scene. Try to determine the mechanism of injury and the patient's mental status.

c. Management

Complete a scene assessment. Maintain body substance isolation. Establish and maintain manual stabilization of the head and neck. Manual stabilization should only stop after additional EMS personnel have appropriately positioned the patient on a backboard with the head stabilized. After manual stabilization, perform an initial assessment. Control the patient's airway without moving the patient's head, using the jaw-thrust maneuver, if necessary. Whenever possible, artificial ventilation should be performed without moving the patient's head. Once you have assessed and maintained the patient's airway and breathing, assess the patient's pulse (circulation) and motor and sensory function in all extremities (disability).

6. Injuries to the Brain and Skull

Injuries to the head may result in injuries to the scalp, skull, or underlying brain. Head injuries are classified as either open or closed. Open injuries require penetration of the scalp and present with bleeding. Closed injuries of the head have no penetration of the scalp. These injuries may appear deceptively minor, despite significant underlying brain injury. Patients with closed head injury may present with swelling of the scalp or depression of skull bones.

Scalp injuries are rarely life threatening, but may result in large amounts of blood loss because of the significant numbers of blood vessels in the scalp. Treatment of these injuries starts with direct pressure to control bleeding.

Injuries to the brain may result in bleeding or swelling of brain tissue within the skull. Because the bony skull does not expand, this results in increased pressure on the brain, which, in turn, can lead to confusion, unconsciousness, as well as respiratory and cardiac arrest.

a. Management

Complete a scene assessment. Observe body substance isolation guidelines. Maintain the patient's airway/artificial ventilation/oxygenation. The initial patient assessment with manual spinal stabilization should be done on scene where the patient was injured (unless the scene is not safe for you or the patient). During ongoing assessments of the patient's airway, breathing, and circulation, also frequently monitor the patient's mental status for deterioration. If there is any bleeding from the scalp, apply enough direct pressure to control the bleeding, without disturbing the underlying tissue. Finally, dress and bandage any open wound as indicated in the emergency medical care of soft tissue injuries.

7. Special Considerations

a. Multiple Trauma

Patients sustaining traumatic injury may suffer from an isolated injury or multiple injuries. There are three basic mechanisms of injury: blunt trauma, penetrating trauma, and trauma from blasts or explosions. When a patient has multiple injuries, the First Responder must prioritize evaluation and management of the patient's injuries. First, address life-threatening injuries such as respiratory or cardiac failure. Second, once you have managed life-threatening injuries, assess and treat other injuries, such as bone and soft tissue injuries. Remember, the top priorities are maintenance of the airway, breathing, circulation, and full spine immobilization.

Assessment should include obtaining a history of the traumatic event, including circumstance, mechanism of injury, and extent of damage at the scene. Try to obtain the patient's initial mental status at the scene, and monitor the patient for mental status deterioration frequently. Other important information would include the time of the injury, vehicular damage, use of seatbelts, extrication time, and the presence or absence of a loss of consciousness.

Management
Complete a scene assessment. Maintain body substance isolation. Perform the Primary Survey ("ABCD"). Assess the patient's airway, and maintain and support breathing as necessary with cervical-spine immobilization. Assess the patient's circulation, and provide hemorrhage/bleeding control. Assess the patient's initial disability, neurologic status, and perform frequent, ongoing assessments. Comfort, calm, and reassure the patient until additional EMS personnel arrive to help.

b. Abdominal/Genitourinary Trauma
Injury to the abdominal and genitourinary organs may be difficult to assess at the scene because of the presence of other injuries, or the presence of an altered mental status, which makes the abdominal exam unreliable. It is not important for the First Responder to isolate and identify the specific abdominal injury. It is, however, important to be aware of the possibility of internal injury to abdominal organs, which can lead to significant blood loss.

There are two primary mechanisms of injury. Blunt trauma may result from a motor vehicle accident, contact sports, or a violent altercation. The liver and spleen are most commonly injured from blunt trauma. Penetrating trauma occurs most frequently with gunshot wounds or stab wounds. Assessment of the patient's abdomen includes visualization for bruises on the abdomen, pelvis, or back, as well as abdominal distension. It also includes palpation of the abdomen and pelvis to assess for pain.

Management
Complete a scene assessment. Maintain body substance isolation. Control the patient's airway and breathing. Maintain cervical-spine immobilization. Assess the circulation and provide bleeding control. Assess the patient for abdominal and pelvic injury. Comfort, calm, and reassure the patient until additional EMS personnel arrive to help.

Injuries to Muscles and Bones

Prepared for AIHA by EMVI
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The Skeletal System

- Functions to give the body shape and protect internal organs
- **Components**:
  - Skull
  - Face
  - Spinal column
  - Thorax (ribs and sternum)
  - Pelvis
- **Lower extremities**:
  - Femur (thigh), patella (kneecap), tibia and fibula (shin), ankle, feet, toes
- **Upper extremities**:
  - Scapula and clavicle (shoulder), humerus (upper arm), radius and ulna (forearm), wrist, hands, and fingers

The Muscular System

- Functions to give the body shape, provide movement, and protect internal organs
- **Three Types of Muscle**:
  - **Voluntary** or skeletal muscle
  - **Involuntary** or smooth muscle
  - **Cardiac** muscle

Injuries to Bones and Joints

- **Types of Injuries**:
  - Open
  - Closed
- **Mechanism of Injury**:
  - Direct force
  - Indirect force
  - Twisting force

Signs and Symptoms of Bone and Joint Injuries

- Deformity or angulation
- Pain and tenderness
- Grating of bone fragments
- Swelling
- Bruising
- Exposed bone ends
- Joint locked into position

Management of Bone and Joint Injuries

- Complete the First Responder assessment
- Body substance isolation
- Maintain airway/artificial ventilation
- Apply a cold pack or ice to reduce swelling and pain
- Manually stabilize the extremity
- Support above and below the injury
- Cover open wounds with a sterile dressing
- Pad the area of injury to prevent further pressure and pain

Injuries to the Spine

- **Mechanisms of Injury**:
  - Motor vehicle crashes
  - Motorcycle or bicycle crashes
  - Falls
  - Blunt trauma
  - Penetrating head, neck, or torso trauma
  - Hangings
  - Diving accidents
  - Unresponsive trauma patients

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Injuries to the Spine: Signs and Symptoms

- Tenderness
- Pain associated with movement
- Pain independent of movement
- Associated soft tissue injuries
- Numbness, tingling, weakness of the extremities
- Loss of sensation or paralysis below the suspected level of injury
- Loss of sensation or paralysis in the extremities
- Respiratory impairment
- Loss of bowel/bladder control

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Assessing the Potential Spine-Injured Patient

- **Responsive Patient**:
  - Ask what happened, where it hurts, if the patient can move hands and feet, if the patient can feel you touching the fingers and toes?
- **Unresponsive Patient**:
  - Maintain airway and breathing
  - Stabilize head and neck manually in the position found
  - Obtain information from observers at the scene

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Management of the Spine-Injured Patient

- Complete the First Responder assessment
- Body substance isolation
- Maintain constant manual stabilization of the spine
- Whenever possible, perform airway control and artificial ventilation without moving the head
- Assess pulse, motor, and sensory function in all the extremities

Injuries to the Brain and Skull

- **Head Injuries**:
  - Open versus closed
- **Scalp Injury**:
  - Control bleeding with direct pressure
- **Brain Injury**:
  - May increase the pressure inside the skull, resulting in unresponsiveness as well as respiratory and cardiac arrest

Management of Brain and Skull Injuries

- Complete the First Responder assessment
- Body substance isolation
- Maintain airway and artificial ventilation
- Monitor the patient's mental status for deterioration
- Control bleeding with direct pressure without further injuring the underlying tissue
- Dress and bandage open wounds

Multiple Trauma

- Multiple injuries in a single patient
- **Three types of trauma**:
  - Blunt
  - Penetrating
  - Blasts or explosions
- **First goal is to save life**
- **Second goal is to save function**

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Multiple Trauma Assessment

- **Primary Survey**:
  - **A** - airway maintenance with cervical-spine control
  - **B** - breathing and ventilation
  - **C** - circulation and bleeding control
  - **D** - neurologic disability
  - **E** - exposure to determine nature and extent of injuries
- **Secondary Survey**:
  - Head-to-toe evaluation

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Management of Multiple Trauma

- Complete the First Responder assessment
- Body substance isolation
- Maintain airway/artificial ventilation with manual cervical-spine immobilization and stabilization
- Assess circulation and control bleeding
- Assess neurologic status and frequently reassess
- Maintain full-spine immobilization and support breathing until additional EMS personnel arrive

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Abdominal and Genitourinary Trauma

- Blunt and penetrating trauma
- Potential for significant blood loss
- Multiple organs to consider
- Head injury, intoxication, neurologic injury, and severe pain from another distracting injury may make evaluation difficult
- Most commonly injured organs in blunt trauma are the spleen and liver
- Injuries to the abdomen or pelvis may also lead to other organ injuries: bowel, kidneys, bladder, ovaries, etc.

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Management of Abdominal and Genitourinary Trauma

- Complete the First Responder assessment
- Body substance isolation
- Maintain airway/artificial ventilation
- Assess circulation and control bleeding
- Assess neurological disability
- Assess the abdomen and pelvis along with any other associated injuries
- Comfort, calm, and reassure the patient until additional EMS personnel arrive

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Childbirth

Contents

1. Objectives

a. Cognitive Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Identify the following structures: birth canal, placenta, umbilical cord, and amniotic sac.
2. Define the following terms: crowning, bloody show, labor, and abortion.
3. State indications of an imminent delivery.
4. State the steps in the pre-delivery preparation of the mother.
5. Establish the relationship between body substance isolation and childbirth.
6. State the steps to assist in the delivery.
7. Describe care of the baby as the head appears.
8. Discuss the steps in the delivery of the placenta.
9. List the steps in the emergency medical care of the mother post-delivery.
10. Discuss the steps in caring for a newborn.

b. Affective Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Explain the rationale for attending to the feelings of a patient in need of emergency medical care during childbirth.
2. Demonstrate a caring attitude toward patients during childbirth.
3. Place the interests of the patient during childbirth as the foremost consideration when making any patient care decisions.
4. Communicate with empathy to patients, family, and friends.

c. Psychomotor Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Demonstrate the steps to assist in the normal cephalic delivery.
2. Demonstrate necessary care procedures of the fetus as the head appears.
3. Attend to the steps in the delivery of the placenta.
4. Demonstrate the post-delivery care of the mother and newborn.

2. Introduction

Childbirth can occur both in the pre-hospital setting as well as in-hospital. Although caring for a mother giving birth to a child is not a frequent scenario that First Responders encounter, situations may occur in which there is not enough time to transport the mother to the hospital for delivery. In situations where pre-hospital delivery is likely, the First Responder on scene must be ready to assist the mother in the childbirth process.

In this lesson, we will discuss the reproductive anatomy and physiology of the woman and her developing, unborn child. We will discuss emergency care for pre-delivery emergencies that may occur. We will review the stages of labor in a normal delivery, as well as the resuscitation of the newborn and post-delivery care of the mother. With this basic knowledge and skill, the First Responder will be able to effectively assist a mother giving birth to a child.

a. Reproductive Anatomy and Physiology

The woman has a unique anatomy that allows pregnancy and delivery to occur, usually without any medical intervention. The uterus is the muscular organ in which the baby develops, and finally contracts to force the baby out through the birth canal. The cervix is the lowest portion of the uterus. During labor, the cervix dilates, and a mucus plug eventually dislodges, indicating imminent delivery. The birth canal is the lower part of the uterus and vagina, which leads to the external opening in the female. The perineum is the area of skin between the vagina and the anus. This area of skin often tears during childbirth.

An unborn, developing baby is called a fetus. The fetus grows and develops inside the uterus. The fetus is nourished with oxygen and nutrients from the mother through an organ called the placenta. The placenta is composed of fetal and maternal tissue and is attached to the wall of the uterus. The placenta attaches to the fetus via an umbilical cord. This cord contains two arteries and one vein. Blood flows from the fetus to the placenta and back to the fetus. Maternal and fetal circulations are independent, but the placenta and umbilical cord allow for effective nourishment and waste exchange between the mother and fetus. The fetus is surrounded by an amniotic sac, which contains 1 to 2 liters of fluid. This fluid helps to cushion and protect the developing fetus during pregnancy. Before childbirth, this sac ruptures, and the amniotic fluid helps lubricate the birth canal.

Many changes occur in a woman’s physiology during pregnancy, and the First Responder should be generally aware of these changes. The pregnant woman has an increased blood volume, increased heart rate, increased respiratory weight, and slightly decreased blood pressure. Digestive processes slow and urinary frequency increases. During pregnancy, the uterus expands to accommodate the growing fetus. The fetus grows for approximately 9 months, or 40 weeks. To estimate a woman’s date of delivery, add 9 months plus 7 days from the first day of the woman’s last menstrual period.

b. Stages of Labor

Labor can be defined as uterine contractions that increase in frequency and intensity, resulting in the delivery of both the fetus and the placenta. Labor can be divided into three stages.

The first stage of labor begins with regular contractions of the uterus and continues until the fetus enters the birth canal. During the first stage, the cervix gradually thins and dilates to 10 cm, allowing the fetal head to move into the birth canal. As the cervix dilates, blood and mucus are passed (bloody show), indicating imminent delivery.

The second stage of labor begins when the fetus enters the birth canal and ends when the baby is delivered. The presenting part of the fetus is the first body part that can be seen at the vaginal opening. In normal presentations this is usually the head. Other body parts may present first, however, indicating a more complicated delivery process. Crowning occurs when the head, or other presenting part, bulges against the vaginal opening.

The third stage of labor begins after the baby is delivered and ends after the placenta has been delivered. It may take up to 30 minutes after the baby is delivered for the placenta to detach from the uterus and pass through the birth canal. The length of labor varies greatly among women. In general, the length of time a woman spends in labor decreases with each pregnancy and delivery.

It should be noted here that some pregnancies end prematurely. A miscarriage is the delivery of the fetus before it can live independently of the mother. A miscarriage usually occurs in the first 3 months of pregnancy, but may occur at any time during the pregnancy. Women will usually experience cramping and vaginal bleeding from the expulsion of the products of conception. These products of conception (blood clots and tissue) should be transported to the hospital with the patient in a pad or towel. Be prepared to treat for shock, if the bleeding is heavy.

3. Delivery

In general, most deliveries occur without complication or need for medical intervention. The First Responder's role is to provide support and assistance to the mother as she delivers the baby and to provide post-delivery care to the mother and newborn, as necessary.

In general, it is best to transport a mother in labor to the hospital unless delivery is anticipated within a very short time. When trying to decide whether to transport the patient or to assist with delivery at the scene, the First Responder should ask the following questions to determine if delivery is imminent:

1. What is your due date?
2. Is there any chance of multiple births?
3. Is there any bleeding or discharge from the vagina?
4. Do you feel as if you are having a bowel movement, with increasing pressure in the vaginal area?

Examine the patient for crowning. If the patient answers yes to questions 3 and 4, and crowning is present, prepare to assist with delivery. Observe body substance isolation precautions. Do not touch the vaginal area except during delivery (a secondary partner or witness is preferred). Do not let the mother go to the bathroom, and do not hold the mother's legs together to slow the delivery process. If the head is not the presenting part, this may be a complicated delivery requiring medical intervention. Tell the mother not to push, and transport to the hospital as quickly as possible.

a. Delivery Procedures

When assisting a patient with the delivery of a baby, the First Responder should follow the delivery procedures listed below:

1. Observe body substance isolation precautions.
2. Have the mother lie on her back with knees drawn up and legs spread apart.
3. Place absorbent, clean materials (sheets, towels, etc.) under the patient's buttocks.
4. Elevate the patient's buttocks with a pillow or blankets.
5. When the infant's head appears, place the palm of your hand on top of the delivering baby's head and exert very gentle pressure to prevent an explosive delivery.
6. If the amniotic sac does not break, or has not broken, tear it open with your fingers and push it away from the infant's head and mouth.
7. As the infant's head is being delivered, determine if the umbilical cord is wrapped around the infant's neck. If it is around the neck, try to slip the cord over the baby's shoulder. If unsuccessful, attempt to alleviate pressure on the cord.
8. After the infant's head is delivered, support the head as it rotates. Suction the mouth and nostrils of the infant with a bulb syringe, if available. Suction the mouth and each nostril two or three times. Each time, withdraw the syringe and expulse the secretions onto a towel. Try to avoid gagging the infant while suctioning. If a bulb syringe is not available, wipe the secretions from the mouth and nostrils with a clean cloth or gauze.
9. As the torso and full body are delivered, support the infant with both hands. Do not pull on the infant. The uterine contractions will force the infant out.
10. As the feet are delivered, grasp them.
11. Keep the infant level with the vagina.
12. You may place the infant on the mother's abdomen for warmth.
13. When the umbilical cord stops pulsating, it should be tied with gauze between the mother and the newborn.
14. Wipe the blood and mucus from the baby's mouth and nose with gauze. Suction the mouth and nose again.
15. Dry the infant. Rub the infant's back or flick the soles of the feet to stimulate breathing. Wrap the infant in a warm blanket and place on its side, the head slightly lower than the trunk.
16. There is no need to cut the cord in a normal delivery. Keep the infant warm until additional emergency medical services personnel arrive with the appropriate equipment to clamp and cut the cord.
17. Record the time of delivery.
18. If there is a chance of multiple births, prepare for the second delivery.
19. Observe for the delivery of the placenta, which may take up to 30 minutes. If the placenta is delivered, wrap it in a towel with at least three fourths of the umbilical cord and place it in a plastic bag. Keep the bag at the level of the infant.
20. Place a sterile pad over the vaginal opening, lower the mother's legs, and help her to hold them together.

b. Vaginal Bleeding Following Delivery

The First Responder can expect up to 300 to 500 ml of blood loss following a normal delivery. This blood loss is generally well tolerated by the mother. It is important to know this, because it allows the First Responder to alleviate his/her personal psychological stress as well as that of the mother or family. In some cases, however, vaginal bleeding may be continuous and heavier than normal. If there is continued blood loss beyond 500 ml, massage the uterus. Place the palm of one hand with the fingers fully extended on the lower abdomen just above the pubic bone. Continue to massage this area until the bleeding stops.

c. *Initial Care of the Newborn*

Once the infant is delivered, dry the baby and wrap him/her in a warm blanket to conserve body heat. Place the infant on its side with the head slightly lower than the feet. Suction the secretions from the mouth and nose as needed.

The initial First Responder assessment of the newborn infant generally consists of assessing the newborn's breathing and circulation. The normal pulse rate is greater than 100 beats/minute. The pulse can be assessed at the infant's brachial artery or at the umbilical cord. The newborn's respiratory status is assessed by counting the infant's respiratory rate. A normal respiratory rate for a newborn is greater than 40 breaths/minute.

If the newborn is not breathing, rub the back and flick the soles of the feet to try to stimulate the infant's breathing. If the infant is still not effectively breathing after 1 minute, the First Responder will have to assist the infant's respiratory efforts. Ensure an open and patent airway. Ventilate at a rate of at least 40 breaths/minute. Reassess the newborn's breathing after each minute. If the newborn's heart rate is less than 80 beats/minute, start chest compressions at a rate of at least 100/minute.

d. *Post-Delivery Care of the Mother*

Always remember that after delivery, you now have two patients to care for. After you complete the initial care of the newborn, the First Responder should reassess the mother. Monitor her respirations and pulse. Control vaginal bleeding as necessary with uterine massage. Replace any blood-soaked towels or sheets while awaiting transport. Comfort and reassure the mother. Always remember to keep the mother informed throughout the entire delivery and post-delivery process. Keep in mind that labor and delivery is an extremely exhausting process.

Childbirth

Prepared for AIHA by EMVI
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Reproductive Anatomy and Physiology

- **<u>Birth canal</u>**: vagina and lower part of the uterus
- **<u>Placenta</u>**: organ for exchange of fetal nourishment and waste products
- **<u>Umbilical cord</u>**: connects fetus to the placenta
- **<u>Amniotic sac</u>**: surrounds fetus inside the uterus
- **<u>Crowning</u>**: fetal head or presenting part bulging out of the vagina
- **"<u>Bloody show</u>"**: mucus and blood expulsed at the beginning of labor

Is Delivery Imminent?

- **<u>Questions to ask the mother</u>**:
  1. What is your due date?
  2. Any chance of multiple births?
  3. Any bleeding or discharge?
  4. Do you feel as if you are having a bowel movement with increasing pressure in the vaginal area?
- **If the mother answers "yes" to questions 3 and 4, prepare for delivery**

Stages of Labor

- **First Stage**:
  - Begins with regular uterine muscle contractions and continues until the fetus enters the birth canal
- **Second Stage**:
  - Begins when the fetus enters the birth canal and ends when the baby is born
- **Third Stage**:
  - Starts after the baby is born and ends after the placenta, umbilical cord, and other tissues are delivered

Delivery Procedures

- Ensure body substance isolation
- Have the mother lie on her back with knees drawn up and legs spread apart
- Place absorbent, clean materials (sheets, towels) under the patient's buttocks
- Elevate the buttocks with a blanket or pillow
- When the infant's head appears, place the palm of your hand on top of the baby's head and exert gentle pressure to prevent explosive delivery

Continued

Delivery Procedures

- If the amniotic sac has not broken, tear it with your fingers and wipe away from the baby's nose and mouth
- Determine if the umbilical cord is wrapped around the baby's neck
- Attempt to slip the cord over the baby's shoulder or attempt to alleviate pressure on the cord
- Support the head and suction the mouth and nostrils 2 to 3 times, or wipe the secretions from the nose and mouth
- As the torso and full body are born, support the infant with both hands. Do not pull the infant.

Continued

Delivery Procedures

- As the feet are delivered, grasp them
- Keep the infant level with the vagina or place the infant on the mother's abdomen for warmth
- When the umbilical cord stops pulsating, tie it with gauze in between the mother and newborn
- Suction or wipe blood and mucus from the baby's mouth and nostrils every 1 to 2 minutes as necessary
- Dry the infant
- Rub the baby's back or flick the soles of the feet to stimulate breathing

Continued

Delivery Procedures

- Wrap the infant in a warm blanket
- Place the infant on its side with the head slightly lower than the trunk
- Record the time of delivery
- No need to cut the cord immediately in a normal delivery
- If there is a chance for multiple births, prepare for a second delivery

Continued

Delivery Procedures

- Observe for delivery of the placenta; may take up to 30 minutes
- If the placenta is delivered, wrap it and ¾ of the umbilical cord in a towel and place in a bag. Keep the bag at the same level as the infant.
- Place sterile pads or gauze over the vaginal opening, lower the mother's legs, and help her hold them together

Vaginal Bleeding Following Delivery

- 300 to 500 ml blood loss is acceptable and usually tolerated well by the mother
- If bleeding continues, massage the uterus with the palm of your hand with fingers extended
- Massage the uterus until bleeding stops

Initial Care of the Newborn

- Assessment of an infant with normal findings:
- Pulse greater than 100/minute at the brachial artery or umbilical cord
- Respiratory rate of greater than 40/minute and crying
- The most important care is to position, dry, keep warm, and stimulate the newborn to breathe
- Wrap the newborn in a blanket and cover its head
- Repeat suctioning as necessary

Continued

Initial Care of the Newborn

- Continue to stimulate the newborn if not effectively breathing by rubbing the infant's back or flicking the soles of the feet
- If the newborn does not begin to breathe, or is having respiratory difficulty after 1 minute, consider CPR
- Ensure an adequate airway and ventilate at a rate of 40 breaths/minute
- Reassess after 1 minute
- If the heart rate is less than 80/minute, begin chest compressions at 100/minute

Post-Delivery Care of the Mother

- Keep contact with the mother throughout the process
- Monitor the mother's respirations and pulse
- Replace any blood-soaked sheets/towels/blankets while awaiting transport
- Keep in mind that delivery is an extremely exhausting procedure for the mother

Infants and Children

Contents

1. Objectives

a. Cognitive Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Describe the differences in anatomy and physiology of the infant, child, and adult patient.
2. Describe the assessment of an infant or child.
3. Indicate causes of respiratory emergencies in infants and children.
4. Summarize emergency medical care strategies for respiratory distress and respiratory failure/arrest in infants and children.
5. List common causes of seizures in infants and children.
6. Describe management of seizures in infants and children.
7. Discuss emergency medical care of the infant and child trauma patient.
8. Summarize the signs and symptoms of possible child abuse and neglect.
9. Describe the medical-legal responsibilities in suspected child abuse.
10. Recognize the need for the First Responder debriefing following a difficult infant or child scenario/transport.

b. Affective Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Attend to the feelings of the family of the ill or injured infant or child.
2. Understand the provider’s own emotional response to caring for infants and children.
3. Demonstrate a caring attitude.
4. Place the interests of the infant or child as the foremost consideration when making any patient care decisions.
5. Communicate with empathy.

c. Psychomotor Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Demonstrate the assessment of an infant and child.

2. Introduction

The First Responder will be called upon to provide emergency medical care to infants and children, as well as to adults. These younger patients often cause increased anxiety for the First Responder. Fear of failure and, more importantly, lack of experience in dealing with this special population of patients, contribute greatly to this anxiety. There are many special considerations when taking care of infant and child patients. We will learn what makes an infant or child unique, both in the assessment and treatment phases of emergency care. This knowledge will significantly reduce the anxiety of the First Responder and will improve the quality of care you deliver to infant and child patients.

3. Anatomic and Physiologic Concerns

To say that an infant or child is just a small adult may be generally accepted as true. Some important anatomic and physiologic differences, however, require identification. In infants and children, the airway is notably different from that of an adult. Remembering these differences will enable the First Responder to adequately manage the pediatric airway.

The diameter of the airway is reduced in infants and children. Secretions and airway swelling easily block small airways. The tongue also is large relative to the small mandible, and can cause airway obstruction in an unresponsive infant or child. Positioning the airway is different in infants and children. The neck is not hyperextended to open the airway, as it is in adults. Hyperextension of the neck can actually further obstruct the airway in infants and children. Also remember that infants are nose breathers. Suctioning secretions from the nasopharynx will often improve breathing problems in an infant.

Children can compensate well for short periods of time when experiencing respiratory problems and shock. They compensate with an increased breathing rate and respiratory effort. Compensation, however, is followed rapidly by decompensation when the respiratory muscles become fatigued. Cardiac arrest resulting from heart problems is rare in infants and children. Cardiac arrest is most often the result of respiratory compromise and failure. Finally, infants and children tend to lose heat more rapidly than do adults because of a relative increase in body surface area to volume ratio. Keeping infants and children warm reduces the risk of hypothermia.

4. Pediatric Airway

Airway management is reviewed in the lecture entitled Airway. This section will emphasize the essentials of pediatric airway management.

Open the airway in an unconscious patient by positioning the infant or child's airway using the head –tilt-chin lift maneuver. As a general guideline, extend the head and neck only until the bottom of the nose points straight up. This produces the "sniffing position" in infants and children. This maneuver will limit potential airway obstruction caused by the tongue or other oropharyngeal muscles. Do not hyperextend the neck. Instead, placing a folded towel under the shoulders may assist in adequate positioning. In pediatric trauma patients, use the jaw-thrust maneuver with spine immobilization.

Suctioning the airway also is an important pediatric airway intervention. Oropharyngeal secretions, blood, and vomit may lead to airway obstruction. Suctioning should be performed whenever necessary to improve respiratory function. In infants, the use of a bulb syringe to clear nasal secretions is often effective. When suctioning infants and children, only suction as deeply as you can see. In general, a soft, flexible catheter should be used. Measure the distance between the corner of the patient's mouth and the angle of the jaw. Measure this distance on the suction catheter, and do not go beyond this point. Try to avoid stimulating the back of the throat excessively in infants and children. This can cause a gag reflex, vomiting, and slowing of the heart rate. Also, limit the time of suctioning to 15 seconds or less to prevent hypoxia.

Food or toys in infants and children often cause foreign body airway obstructions . The First Responder must be able to differentiate between a partial and complete airway obstruction. Interfering with a child's attempt to clear a partial obstruction may cause a complete airway obstruction.

Partial airway obstruction is often indicated by noisy respirations (inspiratory stridor) and coughing. Retractions of chest wall may be seen during inhalation. In partial airway obstruction, the tissues may still be adequately perfused, maintaining pink-appearing mucous membranes and nail beds. Cyanosis and altered mental status signal significant lack of oxygen delivery and may indicate a complete airway obstruction. Whenever caring for an infant or child with a partial airway obstruction, always allow the patient to assume a position of comfort. Do not agitate the child. Do not allow the child to lie supine, as this may cause further airway obstruction.

Complete airway obstruction is a life-threatening emergency. Complete airway obstruction is indicated when patients cannot effectively cry or speak. Increased respiratory effort followed by altered mental status and unconsciousness soon result. Clearing the airway of foreign body obstructions is the first priority whenever a complete airway obstruction is suspected.

In a responsive infant with a foreign body airway obstruction, hold the infant face down with his/her head lower than his/her chest. Perform a series of five back blows followed by five chest thrusts. Repeat this series until the foreign body obstruction is relieved, or until the patient loses responsiveness.

In an unresponsive infant with a foreign body airway obstruction, the First Responder should position the airway and try to ventilate the patient. If you are unable to ventilate the patient, perform five back blows followed by a series of five chest thrusts. Repeat back blows and chest thrusts and repeat airway assessment until the obstruction is relieved. Perform a finger sweep only if you are able to directly visualize the foreign body.

In children, foreign body airway obstructions are managed the same way as in adults. In a responsive child with a foreign body airway obstruction, perform the Heimlich maneuver (abdominal thrusts while positioning yourself behind the patient) until the obstruction is resolved or the patient loses consciousness. In an unresponsive child with a foreign body airway obstruction, position the patient's airway and attempt to ventilate. If unsuccessful, lie the patient supine and straddle the patient's thighs, performing abdominal thrusts just below the xyphoid process of the chest. Continue to inspect the airway, ventilate, and perform abdominal thrusts until the foreign body obstruction is removed. Only use a finger sweep if you can visualize the foreign body.

If a patient (infant, child, or adult) is initially responsive with a foreign body airway obstruction, but becomes unresponsive while you are treating them, gently lower the patient to the floor. Open and position the airway using the head –tilt-chin lift maneuver and attempt to ventilate the patient. If the patient is not breathing and ventilation is unsuccessful, go directly to the appropriate technique: back blows, chest thrusts, or abdominal thrusts.

a. Airway Adjuncts

Airway adjuncts are not used for initial ventilation efforts in infants and children. Oral airways, however, are used to help maintain an open airway when the head –tilt-chin lift or jaw-thrust maneuvers are ineffective. First Responders do not generally use nasal airways in the pediatric population.

Use an oral airway only if the patient is unresponsive and has no gag reflex. If the patient has a gag reflex, he/she may vomit or gag, causing further respiratory compromise. Size the oral airway by measuring from the corner of the mouth to the lower tip of the ear. Using a tongue depressor, push down on the base of the tongue and insert the oropharyngeal airway following the anatomic curve of the oropharynx. Do not rotate the oral airway, as this may damage the soft palate.

5. Pediatric Assessment

Whenever caring for a pediatric patient, always attempt to involve the parents in your assessment and management of the patient. They can often provide necessary health information and emotional support and comfort for the patient. Inform the parents of any interventions you believe are necessary.

When assessing an infant or child for illness or injury, first note the overall appearance of the patient. This visual assessment will often give you a general impression of the patient as a well versus sick child. Assess the patient’s mental status (talking, crying, agitated, lethargic, unresponsive). Note the patient’s effort of breathing. Look for signs of airway obstruction (nasal flaring, chest wall retractions, accessory muscle use). Note if the skin color is pink, pale, or blue (cyanotic). Listen for the quality of the patient’s cry or speech. Also observe the child’s interaction with the environment and parents. Is the child’s behavior normal for the child’s age? Is the child playing, moving around, attentive, making good eye contact, crying, upset, or scared? Is the child responding to the parents or you? General observations such as these will enhance your ability to assess an ill or injured infant or child.

Begin the First Responder assessment from across the room, observing the general appearance of the surroundings and the patient. Attempt to identify any mechanism of injury. Note the patient’s body tone and position. The first priority is the respiratory assessment. Observe the presence or absence of symmetrical chest wall expansion. Note the effort of breathing and respiratory rate. Look for nasal flaring, accessory muscle use, or chest wall retractions. Listen for inspiratory stridor or grunting. After the respiratory assessment, assess the circulation by palpating the brachial or femoral pulse. Compare central and distal pulses. Assess skin temperature and color. Comfort, calm, and reassure the patient and parents.

6. Common Problems in Infants and Children

a. Airway Obstructions

As discussed earlier, airway obstructions are common in infants and children. Management of these patients requires a systematic approach. The First Responder should differentiate between partial and complete airway obstruction. An infant or child with a partial airway obstruction is alert (not unresponsive), pink, with possible chest wall retractions and stridor. The First Responder should allow the patient to be in a position of comfort. Do not place the patient in a supine position. An infant or child with a complete airway obstruction generally has an altered mental status, ineffective cough, inability to speak or cry, stridor, and ultimately unresponsiveness. The child will become cyanotic (blue). In complete airway obstruction, the First Responder should attempt to clear the airway using back blow, chest thrust, and abdominal thrust procedures as previously discussed. Attempt artificial ventilation with the mouth-to-mask technique.

b. Respiratory Emergencies

More than 80% of cardiac arrests in infants and children are the result of a primary respiratory arrest. Respiratory distress is a condition of increased work of breathing, ultimately leading to respiratory failure if untreated. Several signs and symptoms indicate respiratory distress: a respiratory rate greater than 60 in infants or 30/40 in children, nasal flaring, intercostal muscle retractions (between the ribs), supraclavicular muscle retractions (neck), subcostal muscle retractions (below the margin of the rib), stridor on inspiration, cyanosis (blue skin color), an altered mental status (combative, unresponsive), and grunting.

Respiratory failure/arrest follows respiratory distress if the underlying cause is not treated. Signs and symptoms of respiratory failure include a breathing rate of less than 20 in an infant and a respiratory rate less than 10 in a child, unresponsiveness, limp muscle tone, slow or absent heart rate, weak or absent distal pulses, as well as cyanosis.

The role of the First Responder is to complete the First Responder assessment. Complete a scene size-up before initiating emergency medical care. Complete an initial assessment on all patients. Complete a physical exam as needed. Complete ongoing assessments. Note the heart rate. Provide mouth-to-mask barrier device ventilations. Comfort, calm, and reassure the patient and family.

c. Circulatory Failure

Uncorrected circulatory failure results in shock followed by death. Uncorrected circulatory failure is a cause of cardiac arrest in infants and children. Common causes of circulatory failure and shock in infants and children include dehydration from vomiting and diarrhea, infection, trauma, and blood loss. Signs and symptoms of circulatory failure include an increased heart rate, unequal central and distal pulses, poor skin perfusion resulting in pallor or cyanosis, and mental status changes.

The role of the First Responder is to complete the First Responder assessment. Complete a scene size-up before initiating emergency medical care. Complete an initial assessment on all patients. Support oxygenation and ventilation. Observe signs of cardiac arrest. Complete a physical exam as needed. Complete ongoing assessments. Comfort, calm, and reassure the patient and family.

d. *Seizures*

Seizures are among the most common pediatric patient complaints the First Responder will encounter. All seizures, including febrile seizures, should be considered potentially life threatening. They may be brief or prolonged. Brief seizures usually result in only temporary neurologic impairment. These seizures, however, may be associated with respiratory compromise and injuries sustained during the seizure. Prolonged seizures lasting longer than 30 minutes can result in permanent neurologic injury. Common causes of seizures include fever, infections, drug or alcohol poisoning, low blood sugar, trauma, decreased levels of oxygen to the brain, and unknown causes.

When evaluating an infant or child with a seizure, ask the following questions: Has the child had a prior seizure? If yes, is this the child's normal seizure pattern? Is the child taking any seizure medications? Could the child have ingested any other medications or alcohol? When did the seizure start, and how long did it last?

The role of the First Responder is to complete the First Responder assessment. Complete a scene size-up before initiating emergency medical care. Complete an initial assessment on all patients. Complete a physical exam as needed. Complete ongoing assessments. Observe and describe the seizure. Comfort, calm, and reassure the patient and family while awaiting additional EMS personnel.

Always attempt to protect the seizing patient from the environment. Ask bystanders, except the parents, to leave the area. The first priority is assessing the patency of the patient's airway. Place the patient in the recovery position if there is no possibility of spinal trauma. If the patient is blue, ensure airway patency and ventilate, if possible. Have suction available. Never put anything into the patient's mouth (including fingers). Never restrain the patient. Instead, protect the patient from his/her surroundings. Report the above assessment and management to additional EMS personnel as they arrive.

e. *Altered Mental Status*

Another pediatric complaint the First Responder will encounter is altered mental status. Causes of altered mental status in infants and children include low blood sugar, drug or alcohol poisoning, post-seizure, infection, head trauma, and decreased oxygen levels.

The role of the First Responder is to complete the First Responder assessment. Complete a scene size-up before initiating emergency medical care. Complete an initial assessment on all patients. Complete a physical exam as needed. Complete ongoing assessments. Comfort, calm, and reassure the patient and family until additional EMS personnel arrive. Ensure the patency of the airway. Artificially ventilate and suction, as necessary. Place in the recovery position if breathing and circulation are effective.

f. *Sudden Infant Death Syndrome*

Sudden infant death syndrome is the sudden death of an infant generally less than 1 year old. The infant is usually found dead in the early morning. The causes of sudden infant death syndrome remain unidentified. It is the leading cause of death in this age group.

The role of the First Responder is to complete the First Responder assessment. Complete a scene size-up before initiating emergency medical care. Complete an initial assessment on all patients. Comfort, calm, and reassure the patient and family until additional EMS personnel arrive. Try to resuscitate the infant unless the patient is stiff.

Remember that parents will be in agony from emotional distress, remorse, and guilt. Avoid making any comments that might suggest blame to the parents. Always have a debriefing following an event like this. Discuss the case objectively and address any emotionally stressful concerns.

7. Pediatric Trauma

Trauma is the leading cause of death in children and adolescents. Blunt trauma is most common. However, penetrating trauma also is a serious concern. Injury patterns are different in infants and children when compared with adults. In general, traumatic forces are spread throughout the smaller body size of the child, risking damage to multiple organ systems. The bones of a child are less calcified and more resilient than adult bones, which makes the muscles and bones less likely to absorb a traumatic impact. More force is transmitted to the internal organs. In pediatric trauma, the First Responder should always consider multiple body systems when evaluating the patient.

Children are often injured as passengers in motor vehicle accidents. In many cases, the child is improperly restrained. Unrestrained passengers commonly sustain head and neck injuries. Restrained passengers have abdominal and lower spine injuries. Significant injuries may result in infants and children when child safety seats are either improperly used or not used at all.

Children also can sustain traumatic injuries in many other ways. If a child is struck by a car while riding his/her bicycle, injuries to the head, spine, and abdomen are common. Children pedestrians struck by a vehicle may sustain internal abdominal injuries, chest injuries, and significant head, spine, and extremity injuries. Children may injure themselves by falling from heights or diving into shallow water, sustaining head and spinal injuries. Sport injuries also are common. Accidental thermal or electrical burns are other injuries common in the infant and child. And, unfortunately, child abuse and neglect can often lead to multiple physical, as well as emotional, injuries.

a. Specific Body Systems

Head Trauma

The head in infants and children is proportionately larger and more easily injured. Head injury is the most common cause of death in pediatric trauma patients. Patients with head injury who become unresponsive are at risk of airway obstruction from the tongue or vomiting. It is vitally important to ensure an open airway by means of a jaw-thrust maneuver. Always assume a cervical-spine injury when evaluating and treating a pediatric head trauma patient.

Chest Trauma

Soft, pliable ribs form the chest wall in infants and children, which gives the pediatric chest wall resiliency against traumatic forces. When a child is injured in the chest, much of the force is transmitted to the internal structures of the heart, lungs, and blood vessels. There may be significant internal injury, despite a relative lack of external signs of injury.

Abdominal Trauma

The abdomen is commonly injured in pediatric patients. These injuries often result from bicycle accidents, automobile accidents, and sporting activities. Injuries are often hidden because of a relative lack of external evidence of injury. The spleen and liver are the most commonly involved internal organs. Internal injury may result in significant, life-threatening blood loss. Always maintain a high suspicion for internal organ injury in a patient with unstable vital signs. Physical exam may only show distension. Abdominal pain may be undetectable if the patient is unconscious or has an altered mental status.

Extremity Trauma
Extremity trauma in pediatric patients is managed in the same way as in adults. Manually stabilize the injured extremity, and splint accordingly. Always remember that the airway, breathing, and circulation take priority over injured extremities. Manual stabilization and splinting of an injured extremity, however, will help limit any further blood loss and provide some reduction in pain for the patient.

Role of the First Responder
Complete the First Responder assessment. Complete a scene size-up before initiating emergency medical care. Complete an initial assessment on all patients. Complete a physical exam as needed. Complete ongoing assessments. Comfort, calm, and reassure the patient while waiting for additional EMS personnel.

With any pediatric trauma patient, try to maintain the patient's head in a neutral position, and do not move the patient unless the scene is unsafe. Ensure that the airway is open and the patient is breathing adequately. Use only the jaw-thrust maneuver to assist in opening the airway. Suction the airway as necessary with a large catheter. Provide spinal immobilization. Assess for any other injuries, and manually stabilize any injured extremities.

8. Child Abuse and Neglect

Child abuse is the improper use of excessive action by parents, guardians, or caretakers that causes harm or injury to an infant or child. The abuse may be physical, sexual, or emotional. Child neglect is defined as giving insufficient attention or respect to someone who has a claim to that attention. Suspicion for neglect would be warranted in a child who is malnourished, improperly clothed for a given environment, or a child who is not receiving appropriate health care. The First Responder must be aware of these conditions to be able to recognize the problem.

The range of signs and symptoms of child abuse is extensive. Signs and symptoms of abuse include:

1. Multiple bruises in various stages of healing.
2. An injury inconsistent with the mechanism described by the adult caretaker.
3. Patterns of injury such as cigarette burns, hand prints, whip marks.
4. Repeated calls to the same address for sustained injuries.
5. Fresh burns that have not been treated, such as scalding burns from excessively hot water or dip pattern burns consistent with an extremity dipped into hot water.
6. Parents may seem inappropriately unconcerned.
7. Parents may delay in seeking treatment for the child.
8. Stories of the child and parents may conflict.
9. The child may be afraid to discuss how the injury occurred.
10. Central nervous system injuries may show no evidence of external trauma. However, central nervous system injuries may present with an unresponsive or seizing child.

Vigorous shaking of a baby may show no external injury. However, “shaken baby syndrome” may be lethal because of serious brain injury.

Signs and symptoms of neglect include:

1. Lack of adult supervision
2. Malnourished-appearing child
3. Unsafe living environment
4. Untreated chronic illness, such as an asthmatic child without medications
5. Untreated soft tissue injuries

It is important that the First Responder does not accuse parents of abuse or neglect at the scene. The care of the ill or injured infant or child patient always takes priority. Report objective information to transporting EMS personnel. Describe the environment in which you find the patient, and record remarks made by the parent or caregiver. Report only what you actually see and hear, not what you might think.

9. First Responder Debriefing

The First Responder will often feel anxiety when evaluating an ill or injured pediatric patient. Cases of child abuse or neglect may be especially difficult because of the emotional stress these cases create. Serious child injury or death also invokes a great deal of stress.

Always remember that the skills you learn in this course will help you to adequately care for the pediatric patient. Many of the same principles you apply to taking care of adult patients are the same for children. It is, however, important that you remember the anatomic and physiologic differences discussed in this section. Following a stressful case, a First Responder debriefing should be held to discuss the case objectively. Psychological and emotional concerns should also be addressed.

Infants and Children

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Pediatric Anatomy and Physiology

- Smaller airway
- Tongue is relatively large - can obstruct the airway
- Positioning the airway - do not hyperextend the neck
- Infants are nose breathers - suctioning secretions helps improve breathing
- Children compensate for respiratory problems and shock by increasing their respiratory rate and respiratory effort
- Compensation is rapidly followed by decompensation from respiratory muscle fatigue and general fatigue

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Pediatric Airway

- **Opening the Airway**:
  - Head tilt-chin lift or jaw thrust with spinal immobilization; do not hyperextend the neck
- **Suctioning**:
  - Do not stimulate the back of the throat; can decrease the heart rate or cause gagging and vomiting
- **Airway Adjuncts**:
  - Oral airways are sized from the corner of the mouth to the tip of the ear; child should not have a gag reflex
- First Responders do not usually use nasal airways in children

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Pediatric Assessment

- Involve the parents
- Mental status
- Behavior: normal, playing, moving around, attentive, eye contact, recognizes and responds to parents
- Color and tone
- Effort of breathing
- Quality of cry or speech
- Emotional state
- Body position

Airway Obstructions

- **Partial Airway Obstruction**:
  - Patient is alert, but may have inspiratory stridor, muscle retractions on inspiration
  - Allow position of comfort; do not let lie down, do not agitate, may sit on parent's lap
- **Complete Airway Obstruction**:
  - No crying or speaking and cyanosis, inspiratory stridor, ineffective cough, altered mental status followed by loss of responsiveness
  - Clear the airway using the infant and child foreign body removal procedures

Signs and Symptoms of Respiratory Distress

- Respiratory rate >60 in infants and >40 in children
- Nasal flaring
- Intercostal, supraclavicular, and subcostal muscle retractions
- Stridor
- Cyanosis
- Altered mental status
- Grunting

Signs and Symptoms of Respiratory Failure

- Respiratory rate <20/min in an infant, <10/min in a child
- Limp muscle tone
- Unresponsive
- No gag reflex
- Slow or absent heart rate
- Weak or absent pulses
- Cyanosis and a slow heart rate

Signs and Symptoms of Circulatory Failure

- Increased heart rate
- Unequal central and distal pulses
- Poor skin perfusion
- Mental status changes

Role of the First Responder

- Complete the First Responder assessment
- Scene size-up
- Initial assessment on all patients
- Physical exam as needed
- Ongoing assessments
- Provide mouth-to-mask or barrier device ventilations
- Observe heart rate and signs of cardiac arrest

Causes of Seizures

- Fever
- Infection
- Poisoning with drugs or alcohol
- Low blood sugar
- Trauma
- Decreased levels of oxygen
- Cause unknown in many

Seizures: Role of the First Responder

- Complete the First Responder assessment
- Observe and describe the seizure
- Protect the patient from the environment
- Ensure airway patency
- Never restrain the patient
- Do not put anything in the patient's mouth
- Suction and artificially ventilate as necessary
- Place the patient in the recovery position if no spinal trauma is suspected

Causes of Altered Mental Status

- Infection
- Post-seizure
- Low blood sugar
- Drug or alcohol poisoning
- Head trauma
- Decreased levels of oxygen
- First Responder should ensure airway patency, ventilate and suction as necessary, and place in the recovery position

Sudden Infant Death Syndrome (SIDS)

- Sudden death of infants in the first year of life
- Causes not clearly understood
- Baby is most commonly discovered in the morning
- First Responder should try to resuscitate the baby, unless it is stiff
- Comfort parents
- Avoid any comments that might suggest blame

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Pediatric Trauma

- Leading cause of death in infants and children
- Blunt injury most common
- Motor vehicle crashes
- Bicycle accidents
- Pedestrian struck by vehicle
- Falls, diving accidents
- Sport injuries
- Burns
- Child abuse and neglect

Continued

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Pediatric Trauma

- **Head**:
  - Proportionately larger and more easily injured; remember to open the airway using the jaw thrust
- **Chest**:
  - Pliable ribs, suspect internal injuries
- **Abdomen**:
  - Common site, hidden injuries; spleen is injured most, followed by the liver
- **Extremities**:
  - Manage as in adults

- First Responder should complete an initial assessment
- Ensure airway patency using the jaw-thrust maneuver
- Suction as necessary
- Immobilize the spine
- Manually stabilize/splint injured extremities

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Signs and Symptoms of Child Abuse

- Multiple bruises in various stages of healing
- Injury inconsistent with mechanism
- Patterns of injury: cigarette burns, whip marks
- Repeated calls to the same address
- Fresh burns: scalding water, glove and dip patterns; burns inconsistent with the history, untreated burns
- Parents seem inappropriately unconcerned
- Conflicting stories
- CNS injuries: unresponsive/seizure, internal injuries, no evidence of external injuries (Shaken Baby Syndrome)

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Signs and Symptoms of Neglect

- Lack of adult supervision
- Malnourished-appearing child
- Unsafe living environment
- Untreated chronic illness, e.g., asthmatic without medications
- Untreated soft tissue injuries
- Do not accuse parents at the scene
- Remain objective and appropriately care for the injured child

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EMS Operations

Contents

1. Objectives

a. Cognitive Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Discuss the equipment needed to respond to a call.
2. List the phases of an out-of-hospital call.
3. Discuss the role of the First Responder in extrication and how to gain access to the patient.
4. Describe what the First Responder should do if there is a hazard at the scene.
5. Describe the role of the First Responder at a hazardous material scene.
6. Describe the criteria for a multiple casualty situation.
7. Summarize the components of basic triage.

b. Affective Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Explain the rationale for having the unit prepared to respond.

c. Psychomotor Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Perform triage, given a mass casualty scenario.

2. Preparation for the Call

Your responsibility is to be prepared to perform First Responder duties for any out-of-hospital emergency call. Being prepared involves having the appropriate personnel, training, and equipment. Personnel should be adequately trained and there should be enough people available when an emergency response is necessary. You must also have the necessary medical and non-medical supplies. Medical supplies include basic wound care supplies, ventilation devices, suction equipment, airways, and splinting equipment. Non-medical equipment includes personal safety equipment, flashlights, tools, and any other safety equipment such as flares that may be necessary at a scene.

3. Dispatch

Dispatch is the communications system that processes calls from the outside to provide you with the information you need to arrive prepared at a call. Most dispatch systems are centralized and operate 24 hours a day with specially trained personnel. Your dispatcher should provide you with certain information about the call. This information includes the nature of the call; name, location, and callback number of the caller; and location of the patient. Dispatch should also inform you if there is more than one patient, the severity of the patient's condition, and any other special problems. The dispatcher is also your link to the rest of the system. Update dispatch when you are en route, upon scene arrival, and if the situation has changed. Notify dispatch if you require additional help.

4. Scene Operations

Before starting toward the scene, make sure you have your seatbelt on and all equipment you need with you. Notify dispatch when you depart for the scene and when you arrive. On arrival at the scene, evaluate the situation to make sure it is safe for you to approach. If the scene is not safe, do not approach. Notify dispatch and request the necessary help. Entering an unsafe scene may potentially turn you from a First Responder into another patient. This will increase the number of patients your system has to treat while reducing available personnel.

Use the necessary safety equipment before approaching the scene. If on initial assessment you determine that additional help is necessary, notify dispatch. You may need help because of the number of patients, severity of the patient's condition, need for extrication, or because of hazards. Once you determine that the scene is safe, begin patient treatment unless you need to move the patient before treatment because of hazards. If the patient is in a position or situation that you consider dangerous you must get the patient to safety so you can initiate care.

Your job is not over even after the arrival of personnel with higher training. Assist emergency medical technicians or paramedics as needed. The First Responder will assist the ambulance crew in preparing the patient for transport. After the run, clean and replace necessary equipment to prepare for the next call.

5. Extrication

Sometimes it will be necessary for the First Responder to extricate a patient from a scene. Make sure the scene is safe for you to approach. Administer necessary care to the patient before extrication and remove the patient in a way that minimizes further injury. If the situation presents a hazard to the patient, it might be necessary to extricate the patient before providing further care. The ease with which the patient can be extricated may vary greatly.

Simple access involves extrication of the patient without the need for specialized equipment. Try opening doors, rolling down windows, and having patients unlock doors. If you are extricating a patient from a vehicle with the engine running, turn the engine off and make sure the vehicle is in park. Always try simple methods first. Try opening or, if necessary, breaking a window before trying to pry open a door. Before prying open a door check to see if you can open or unlock it.

Complex access requires the use of special equipment to extricate the patient. This situation often involves the use of specialized equipment and often involves specially trained personnel.

6. Air Medical Transport

Special considerations apply when air medical transport is used. Most air medical scene responses involve rotor wing craft. Consider the use of air medical transport in situations where transport to a specialty center will be faster by air than by ground. Other reasons to use air medical transport are when patients are inaccessible by ground transport and when the patient needs a high level of care that the air ambulance crew but not the ground crew can provide.

Select a landing area clear of obstacles of at least 60 feet by 60 feet. Illuminate and mark off the area and remove personnel from the area. Inform the aeromedical crew of the location of both the patient and the landing zone. Keep the patient in a sheltered area and do not bring the patient to the helicopter until instructed to do so by the helicopter crew. Do not approach the helicopter until instructed to do so. When approaching a helicopter follow the directions of the crew. Approach the helicopter from the front when at all possible, which allows the pilot to see you as you approach. Don't approach the helicopter from the back because the tail rotor is extremely dangerous and is difficult to see when it is moving.

7. Hazardous Materials

Your role as the First Responder at a hazardous material scene is to first protect yourself. Keep bystanders away from the scene to minimize the number of people exposed. Contact dispatch with available information so specially trained individuals can be mobilized into the hazardous material area. All contaminated victims must remain in the hot or contaminated zone until properly decontaminated by specially trained personnel. Once they are decontaminated, you can initiate care of the patients. The first step in the care of these patients is decontamination. Approaching a contaminated patient without appropriate safety equipment will mean you also will be contaminated and will no longer be able to perform your job.

Set up a hot or contaminated area where the patients and hazardous material are located. Keep bystanders away from this area. Set up a cold zone for patient treatment after decontamination that is upwind and preferably uphill from the hot zone. A separate decontamination zone must also be set up.

When contacting dispatch to request specialized personnel, try to provide them with as much information as possible. This information includes scene location and the physical makeup of the scene; number of patients and their acuity; type of material; and whether the material is stable or if it is vaporizing, flaming, or blowing into the air. Also report weather conditions and additional scene hazards.

8. Mass Casualty Incidents

When the number of patients exceeds the capabilities of the providers, a system of triage must be instituted to decide in what order to treat patients. The concept is to treat the most critical but still salvageable patients first. Patients are sorted into three different triage categories. The highest priority is given to those patients with changed mental status, uncontrolled bleeding, or airway difficulties. Second priority is given to patients with burns in the absence of airway problems, extremity injuries, or back injuries. These are patients with serious injuries but no immediate life threat. The lowest priority patients are those with minor injuries as well as patients who are already dead or expected to die despite interventions.

Upon arrival at a mass casualty incident a command post should be set up, dispatch notified, and a triage officer designated. The centralization of operations will reduce the duplication of labor and increase the efficiency of the operation.

Patient triage is a continuous process because patients that are initially of low priority can deteriorate. Different systems have different ways of approaching the patient evaluation, but it is important that a method is chosen by the system as opposed to leaving it up to the individual.

One simple way to rapidly triage is as follows:

1. Identify the walking wounded by asking everyone who can move under his or her own power to move to a specified location. These are low-priority patients until further evaluation.
2. Assess the respirations of all patients who could not walk. If the patient is not breathing, open the airway. If still not breathing, this patient is dead, so move on. If respirations are above 30 or labored, this patient belongs to the immediate category. Patients with respirations below 30 are placed in the delayed category.
3. Assess circulation. Any patient who is breathing but does not have a palpable radial pulse is tagged in the immediate category.
4. Assess mental status. Patients with adequate respirations and perfusion who can’t follow simple commands are triaged to the immediate category.

This system is a stepwise system, and the steps must be performed in order.

EMS Operations

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Preparation for the Call

- Personnel
- Training
- Medical and non-medical equipment

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Slide 1

Dispatch

- Communications system that processes outside calls
- Nature of call
- Name, location, and callback number of caller
- Location of patient

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Scene Operations

- Make sure the scene is safe before approaching
- Notify dispatch of any additional help that might be necessary
- Begin patient treatment and assist ambulance crew as needed

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Slide 3

Extrications

- Administer necessary care to the patient before extrication
- If a hazard exists, extricate first
- Simple access
- Complex access

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Slide 4

Air Medical Transport

- Consider air medical transport when it will reduce transport time of an unstable patient, when ground access is not possible, and when the air ambulance crew can provide a necessary higher level of care
- 60 ft by 60 ft landing area free of obstacles
- Only approach the helicopter when instructed by the crew
- Do not approach the helicopter from behind

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Slide 5

Hazardous Materials

- Keep yourself safe first
- Activate personnel trained in dealing with hazardous materials
- Patients must be decontaminated before treatment

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Slide 6

Mass Casualty Incidents

- If the number of patients exceeds the capabilities of the providers a triage system must be instituted
- Treat those that are sickest but still salvageable first
- Centralized system of triage

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EMS Operations
Slide 7

Documentation and Quality Management

Contents

1. Objectives

a. Cognitive Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Understand the system's documentation practices.
2. Explain the process of quality improvement.

b. Affective Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Explain the rationale for quality improvement.

c. Psychomotor Objectives

None for this lesson.

2. Introduction

Within a particular healthcare system, the goal is to maximize the resources available to provide the highest quality care possible. Systems vary greatly in staffing, equipment, and funding; therefore, no two systems are alike and no two systems are optimized in the same way. Through analysis of your particular system, goals for improvement in particular areas can be set so as to utilize available resources with the greatest efficiency possible.

3. Planning

Before you can control the quality of your system you have to design a system that targets the needs of your patients given your available resources. To do this you must determine who your patients are and what their needs are. For example, consider two different patient mixes. One city has a large population living within relatively small city limits; the other has a much smaller population but many live outside of city limits. Given the same resources available in your system you would have to structure them quite differently if you wanted to serve these two patient populations.

Geography is only one of the things that must be considered. Other considerations include the age mix of your population, what the major complaints generating a transport are, times of day when the number of calls to the emergency medical services system peak. Some considerations may be particular to your system.

After determining the needs of patients, you can set about developing features in your system to serve these needs. To produce these particular features in your system a process must be developed that takes into consideration your available resources. Once the process is developed, your personnel must be trained in the process to achieve success.

Scene response time is one of the most common targets for improvement. Scene response times can be reduced in a variety of ways. The easiest way is to place more units in areas of high population density, which will reduce average scene response time but will do so at the expense of those patients who live away from high-density areas. These latter people will then experience scene response times much higher than the average. Another way to impact scene response time is to set a limit for response times and set up the system to ensure that most scene times fall below this limit. This method is known as fractile response time. The benefit of this second approach is that most patients will benefit from a response time below the set limit and, when compared with the system driven by average response times, the maximum response time will be shorter. This example shows how a system process must be developed that takes into account patient needs within the framework of the system resources.

4. Examination of the Process

Once the process has been implemented, you must find out if it is achieving what you wanted to achieve. The process deals with the activities between practitioners and patients. The presence of a process allows uniformity of practice, which is a necessary first step if changes are to be made for improvement.

The process can be examined by direct observation and by utilizing the documentation associated with patient care. First, you must examine if the process is operating in the way it was designed or if there are barriers that prevent this. Only after consistency of the process is achieved can you examine if the process is providing the desired outcomes. If the process is not consistent, break it down to see if you can identify the source of variability. Some sources of variability will be outside your control but you must first know the sources of variability to see how to improve consistency.

Once you judge your process to be as consistent as possible you can determine if it is achieving its goals. The difference between the performance of your process and your performance goal is the area for improvement. How to go about improvement can vary depending on the actual process and goals.

5. Quality Improvement

Acting on the difference between actual performance and performance goals is what is known as quality improvement. Once you identify the difference between your actual process achievements and your process goals, you can begin to act on this difference. It is best to achieve improvement by incremental change. Instead of trying to achieve a quick fix by radically changing one element of your process, it is normally more effective to make many small improvements in different areas of the process. When you add up all these small improvements the result is a significant gain.

Identify concrete, specific projects that target a measurable outcome. Once you have designed a plan for improvement, re-training of the First Responders to apprise them of changes should follow. After a period of time to allow the new process to stabilize, perform a new measurement of the performance to see if an improvement was achieved. If so, methods to reinforce the new process are put into place. This will continue reinforcing the new process to maintain the new gains.

6. Information

To be able to make improvements you must start with reliable information. Information can be obtained through direct observation or through patient care documentation. Patient care documentations generate the bulk of the data for performance analysis. Improper or poor documentation makes this tool much less useful. Consistent and complete documentation is part of the job of the First Responder.

Familiarize yourself with your particular system's form of documentation. At a minimum, the call report sheets should contain certain information fields:

a. Call Data

Information regarding the particular call is recorded under this heading. This information includes the recording of various times such as time call received from dispatch, time unit under way, and time of arrival at scene. The location of the call and the First Responders involved also should be listed under this heading.

b. Situation

Information about the scene should be under this heading. This information should include where and how the patient is found and other factors relevant to initial treatment. In case of a motor vehicle accident, this section should contain information about the condition of the vehicle and the location of the patient within the vehicle.

c. Patient Information

Here you record information pertaining to the patient, including the patient's name and age, past medical history, allergies, and any other information your system deems important. You can also include history of present illness under this heading.

d. Patient Exam

The results of your physical exam are listed under this heading. If the elements of the physical are clearly separated in your system's run report, it will aid the First Responder in being thorough in his/her exam and collection of information.

e. Treatment

Information regarding your interventions belongs in this section.

f. Transport Data

This section should contain information about patient transport. This information is needed whether the patient remained at the scene, was transported by ambulance, or was transported by the First Responder to a hospital.

Documentation and Quality Management

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Planning

- Design the system
- Patient population
- Patient needs
- Available resources

Process

- Activities between practitioners and patients
- Observation
- Documentation

Quality Improvement

- Consistency of the process
- Performance
- Performance goals

Quality Improvement Projects

- Focused project
- Target a measurable outcome
- Plan for improvement
- Measure new outcomes
- Incremental change vs radical change

Information

- Reliable data is the basis for making assessments of quality
- Direct observation of processes
- Patient care documentation

Run Reports

- Call data
- Situation
- Patient information
- Patient exam
- Treatment
- Transport data

Practical Lab: Airway

Objectives

1. Cognitive Objectives

At the completion of this lesson, the First Responder student will be able to demonstrate the cognitive objectives of Chapter 6: Airway.

2. Affective Objectives

At the completion of this lesson, the First Responder student will be able to demonstrate the affective objectives of Chapter 6: Airway.

3. Psychomotor Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Demonstrate the steps in the head –tilt-chin lift.
2. Demonstrate the steps in the jaw thrust.
3. Demonstrate the techniques of suctioning.
4. Demonstrate the steps in mouth-to-mouth ventilation with body substance isolation (barrier shields).
5. Demonstrate how to use a resuscitation mask to ventilate a patient.
6. Demonstrate how to ventilate a patient with a stoma.
7. Demonstrate how to measure and insert an oropharyngeal (oral) airway.
8. Demonstrate how to measure and insert a nasopharyngeal (nasal) airway.
9. Demonstrate how to ventilate infant and child patients.
10. Demonstrate how to clear a foreign body airway obstruction in a responsive adult.
11. Demonstrate how to clear a foreign body airway obstruction in a responsive child.
12. Demonstrate how to clear a foreign body airway obstruction in a responsive infant.
13. Demonstrate how to clear a foreign body airway obstruction in an unresponsive adult.
14. Demonstrate how to clear a foreign body airway obstruction in an unresponsive child.
15. Demonstrate how to clear a foreign body airway obstruction in an unresponsive infant.

Practical Lab: Patient Assessment

Objectives

1. Cognitive Objectives

At the completion of this lesson, the First Responder student will be able to demonstrate the cognitive objectives of Chapter 7: Patient Assessment.

2. Affective Objectives

At the completion of this lesson, the First Responder student will be able to demonstrate the affective objectives of Chapter 7: Patient Assessment.

3. Psychomotor Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Demonstrate the ability to differentiate various scenarios and identify potential hazards.
2. Demonstrate the techniques for assessing mental status.
3. Demonstrate the techniques for assessing the airway.
4. Demonstrate the techniques for assessing if the patient is breathing.
5. Demonstrate the techniques for assessing if the patient has a pulse.
6. Demonstrate the techniques for assessing the patient for external bleeding.
7. Demonstrate the techniques for assessing the patient's skin color, temperature, condition, and capillary refill (infants and children only).
8. Demonstrate questioning a patient to obtain a “SAMPLE” history.
9. Demonstrate the skills involved in performing the physical exam.
10. Demonstrate the ongoing assessment

Practical Lab: Circulation

Objectives

1. Cognitive Objectives

At the completion of this lesson, the First Responder student will be able to demonstrate the cognitive objectives of Chapter 8: Circulation

2. Affective Objectives

At the completion of this lesson, the First Responder student will be able to demonstrate the affective objectives of Chapter 8: Circulation

3. Psychomotor Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Demonstrate the proper technique of chest compressions on an adult.
2. Demonstrate the proper technique of chest compressions on a child.
3. Demonstrate the proper technique of chest compressions on an infant.
4. Demonstrate the steps of adult one-rescuer CPR.
5. Demonstrate the steps of adult two-rescuer CPR.
6. Demonstrate child CPR.
7. Demonstrate infant CPR.

Practical Lab: Illness and Injury

Objectives

1. Cognitive Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Demonstrate the cognitive objectives of Chapter 9: Medical Emergencies
2. Demonstrate the cognitive objectives of Chapter 10: Bleeding and Soft Tissue Injuries
3. Demonstrate the cognitive objectives of Chapter 11: Injuries to Muscles and Bones

2. Affective Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Demonstrate the affective objectives of Chapter 9: Medical Emergencies
2. Demonstrate the affective objectives of Chapter 10: Bleeding and Soft Tissue Injuries
3. Demonstrate the affective of Chapter 11: Injuries to Muscles and Bones

3. Psychomotor Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Demonstrate the steps in providing emergency medical care to a patient with a general medical complaint.
2. Demonstrate the steps in providing emergency medical care to a patient with an altered mental status.
3. Demonstrate the steps in providing emergency medical care to a patient with seizures.
4. Demonstrate the steps in providing emergency medical care to a patient with an exposure to cold.
5. Demonstrate the steps in providing emergency medical care to a patient with an exposure to heat.
6. Demonstrate the steps in providing emergency medical care to a patient with a behavioral change.
7. Demonstrate the steps in providing emergency medical care to a patient with a psychological crisis.
8. Demonstrate direct pressure as a method of emergency medical care for external bleeding.
9. Demonstrate the use of diffuse pressure as a method of emergency medical care for external bleeding.
10. Demonstrate the use of pressure points as a method of emergency medical care for external bleeding.
11. Demonstrate the care of the patient exhibiting signs and symptoms of internal bleeding.
12. Demonstrate the steps in the emergency medical care of open soft tissue injuries.
13. Demonstrate the steps in the emergency medical care of a patient with an open chest wound.
14. Demonstrate the steps in the emergency medical care of a patient with open abdominal wounds.
15. Demonstrate the steps in the emergency medical care of a patient with an impaled object.
16. Demonstrate the steps in the emergency medical care of a patient with an amputation.

17. Demonstrate the steps in the emergency medical care of an amputated part.
18. Demonstrate the emergency medical care of a patient with a painful, swollen, deformed extremity.
19. Demonstrate opening the airway in a patient with suspected spinal cord injury.
20. Demonstrate evaluating a responsive patient with a suspected spinal cord injury.
21. Demonstrate how to stabilize the cervical spine.
22. The student should practice the emergency medical care of a patient with an electrical burn.
23. The student should practice assessing an injured extremity.
24. The student should practice manual stabilization following the general rules of stabilization.

Practical Lab: Childbirth and Children

Objectives

1. Cognitive Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Demonstrate the cognitive objectives of Chapter 12: Childbirth
2. Demonstrate the cognitive objectives of Chapter 13: Infants and Children

2. Affective Objectives

At the completion of this lesson, the First Responder student will be able to:

1. Demonstrate the affective objectives of Chapter 12: Childbirth
2. Demonstrate the affective objectives of Chapter 13: Infants and Children

3. Psychomotor Objectives

1. At the completion of this lesson, the First Responder student will be able to:
2. Demonstrate the steps to assist in the normal cephalic delivery.
3. Demonstrate necessary care procedures of the fetus as the head appears.
4. Attend to the steps in the delivery of the placenta.
5. Demonstrate the post-delivery care of the mother.
6. Demonstrate the care of the newborn.
7. Demonstrate assessment of the infant and child.

Practical Lab: Lifting and Moving Patients

Objectives

1. **Cognitive Objectives**
   At the completion of this lesson, the First Responder student will be able to demonstrate the cognitive objectives of Chapter 5: Lifting and Moving Patients.

2. **Affective Objectives**
   At the completion of this lesson, the First Responder student will be able to demonstrate the affective objectives of Chapter 5: Lifting and Moving Patients.

3. **Psychomotor Objectives**
   At the completion of this lesson, the First Responder student will be able to:
   1. Demonstrate an emergency move.
   2. Demonstrate how to stabilize the cervical spine.
   3. Demonstrate a non-emergency move.
   4. Demonstrate the use of equipment to move patients in the out-of-hospital arena.
   5. Demonstrate techniques for transfer of a supine patient from a bed to a stretcher.
   6. Demonstrate basic techniques for preventing personal injury during lifting.
   7. Demonstrate proper positioning for injured patients.

Skill Descriptions: Airway

Note: All skills assume proper precautions are already taken, including gloves and face mask if appropriate.

1. Techniques for Opening the Airway

a. Head-tilt chin-lift

1. Place your hand that is closer to the patient's head on his/her forehead; apply firm backward pressure to tilt the head back.
2. Place the fingers of your hand that is closer to the patient's feet on the bony part of his/her chin.
3. Lift the chin forward and support the jaw, helping to tilt the head back.
4. Finger must not press deeply into the soft tissues of the chin as this may lead to airway obstruction.
5. The thumb should not be used for lifting the chin.
6. The mouth must not be closed.

b. Jaw thrust

1. Grasp the angles of the patient's lower jaw.
2. Lift with both hands displacing the mandible forward.
3. If the lips close, open the lower lip with your gloved thumb.

2. Airway Adjuncts

a. Insertion of oropharyngeal airway

1. Select the proper size. Measure from the corner of the patient's lips to the tip of the earlobe or angle of jaw.
2. Open the patient's mouth.
3. Insert the airway upside down, with the tip facing toward the roof of the patient's mouth.
4. Advance the airway gently until resistance is encountered.
5. Turn the airway 180 degrees so that it comes to rest with the flange on the patient's teeth.

b. Alternate technique for use with infants and children

1. Select the proper size. Measure from the corner of the patient's lips to the bottom of the earlobe or angle of jaw.
2. Open the patient's mouth.
3. Use a tongue blade to press tongue down and away.
4. Insert airway in upright (anatomic) position.

c. Insertion of nasopharyngeal (nasal) airway

1. Select the proper size. Measure from the tip of the nose to the tip of the patient's ear.
2. Also consider diameter of airway in the nostril. Nasopharyngeal airway should not be so large that it causes blanching of the nostril.
3. Lubricate the airway with a water soluble lubricant.

4. Insert it posteriorly. Bevel should be toward the base of the nostril or toward the septum.
5. If the airway cannot be inserted into one nostril, try the other nostril.
6. Do not force this airway.

3. Techniques for Clearing the Compromised Airway and Maintaining an Open Airway

a. The recovery position

1. Raise the patient's left arm above his/her head and cross the patient's right leg over the left.
2. Support the face and grasp the patient's right shoulder.
3. Roll the patient toward you onto his/ her left side.
4. Place the patient's right hand under the side of his/her face.
5. The patient's head, torso, and shoulders should move simultaneously without twisting.
6. The head should be in as close to a midline position as possible.

b. Finger sweeps

1. If uninjured, roll the patient to his/her side
2. Wipe out liquids or semi-liquids with the index and middle fingers covered with a cloth.
3. Remove solid objects with a hooked index finger.

c. Suctioning

1. Observe body substance isolation.
2. A hard or rigid "tonsil sucker" or "tonsil tip" is preferred to suction the mouth of an unresponsive patient.
3. The tip of the suction catheter should not be inserted deeper than the base of the tongue.
4. Because air and oxygen are removed during suction, it is recommended that you suction for no more than 15 seconds or as long as you can hold your own breath.
   - Decrease the time in infants and children.
   - Infants 5 seconds
   - Children 10 seconds
5. Watch for decreased heart rate in infants.
6. If you note a decrease in heart rate, stop suctioning and provide ventilation.

4. Techniques for Ventilation

a. Mouth-to-mask technique

1. Place the mask around the patient's mouth and nose using the bridge of the nose as a guide for correct position. Mask position is critical since the wrong size mask will leak.
2. Seal the mask by placing the heel and thumb of each hand along the border of the mask and compressing firmly around the margin.
3. Place your index fingers on the portion of the mask that covers the chin.
4. Place your other fingers along the bony margin of the jaw and lift the jaw while performing a head tilt.

5. Give one slow (1- to 2-second) breath of sufficient volume to make the chest rise (usually 800 to 1200 ml in the average adult).
6. Too great a volume of air and too fast an inspiratory time are likely to allow air to enter the stomach.
7. Adequate ventilation is determined by:
8. Observing the chest rise and fall
9. Hearing and feeling the air escape during exhalation
10. Continue at the proper rate:
11. 10 to 12 breaths per minute for adults with 1- to 2-second ventilation time
12. 20 breaths per minute for children and infants with 1- to 2-second inspiratory time
13. 40 breaths per minute for newborns with 1- to 2-second inspiratory time
14. If the ventilation cannot be delivered, consider the possibility of an airway obstruction.

b. *Mouth-to-barrier technique*

1. If ventilation is necessary, position the device over the patient's mouth and nose ensuring an adequate seal.
2. Keep the airway open by the head tilt-chin lift or jaw-thrust maneuver.
3. Give one slow (1- to 2-second) breath of sufficient volume to make the chest rise (usually 800 to 1200 ml in the average adult).
4. Too great a volume of air and too fast an inspiratory time are likely to allow air to enter the stomach.
5. Adequate ventilation is determined by:
    - Observing the chest rise and fall
    - Hearing and feeling the air escape during exhalation
6. Continue at the proper rate:
    - 10 to 12 breaths per minute for adults, with 1- to 2-second inspiratory time
    - 20 breaths per minute for children and infants, with 1- to 2-second inspiratory time
    - 40 breaths per minute for newborns, with 1- to 2-second inspiratory time
7. If the ventilation cannot be delivered, consider the possibility of an airway obstruction.

c. *Mouth-to-mouth technique*

1. Keep the airway open by the head tilt-chin lift or jaw-thrust maneuver.
2. Gently squeeze the patient's nostrils closed with the thumb and index finger of your hand on the patient's forehead.
3. When ventilating an infant, cover the infant’s mouth and nose.
4. Take a deep breath and seal your lips to the patient's mouth, creating an airtight seal.
5. Give one slow (1- to 2-second) breath of sufficient volume to make the chest rise.
    - Too great a volume of air and too fast an inspiratory time are likely to allow air to enter the stomach.
    - Adequate ventilation is determined by:
      – Observing the chest rise and fall
      – Hearing and feeling the air escape during exhalation
6. Continue at the proper rate:
    - 12 breaths per minute for adults

- 20 breaths per minute for children and infants
- 40 breaths per minute for newborns

7. If the ventilation cannot be delivered, consider the possibility of an airway obstruction.

5. Techniques for Relieving Foreign Body Airway Obstructions in Adults

a. Heimlich maneuver with responsive victim standing or sitting

1. Stand behind the victim.
2. Wrap your arms around the victim's waist.
3. Make a fist with one hand.
4. Place the thumb side of your fist against the victim's abdomen, in the midline slightly above the navel and well below the tip of the xiphoid process.
5. Grasp the fist with your other hand and press the fist into the victim's abdomen with a quick inward and upward thrust.
6. Repeat the thrusts until the object is expelled from the airway or the victim becomes unresponsive.
7. Each new thrust should be a separate and distinct movement administered with the intent of relieving the obstruction.

b. Chest thrusts for responsive pregnant or obese victim

1. Chest thrusts may be used as an alternative to the Heimlich maneuver when the victim is in the late stages of pregnancy or is markedly obese.
2. Stand behind the victim, with your arms directly under the victim's armpits, and encircle the victim's chest.
3. Place the thumb side of one fist on the middle of the victim's breastbone, taking care to avoid the xiphoid process and the margins of the rib cage.
4. Grab the fist with your other hand and perform backward thrusts until the foreign body is expelled or the victim becomes unresponsive.
5. If you cannot reach around the pregnant or extremely obese person, you can perform chest thrusts with the victim supine.
6. Place the victim on his/her back and kneel close to the victim's side.
7. The hand position and technique for the application of chest thrusts are the same as for chest compressions during cardiopulmonary resuscitation (CPR).
8. In the adult, for example, the heel of the hand is on the lower half of the sternum.
9. Deliver each thrust with the intent of relieving the obstruction.

c. Responsive victim who becomes unresponsive

1. Activate the emergency response system at the proper time in the CPR sequence. If a second rescuer is available, send the second rescuer to activate the emergency medical services (EMS) system while you remain with the victim. Be sure the victim is supine.
2. Perform a tongue-jaw lift, followed by a finger sweep to remove the object.
3. Open the airway and try to ventilate. If you are unable to make the victim's chest rise, reposition the head and try to ventilate again.
4. If you cannot deliver effective breaths (the chest does not rise) even after attempts to reposition the airway, consider foreign body airway obstruction (FBAO). Straddle the victim's thighs and perform the Heimlich maneuver (up to five times).

5. Repeat the sequence of tongue-jaw lift, finger sweep, attempt (and reattempt) to ventilate, and Heimlich maneuver (steps 2 through 4) until the obstruction is cleared and the chest rises with ventilation or advanced procedures are available (i.e., Kelly clamp, Magill forceps, cricothyrotomy) to establish a patent airway.
6. If the FBAO is removed and the airway is cleared, check breathing. If the victim is not breathing, provide slow rescue breaths. Then check for signs of circulation (pulse check and evidence of breathing, coughing, or movement). If there are no signs of circulation, begin chest compressions.

d. Victim found unresponsive

1. Activate the emergency response system at the appropriate time in the CPR sequence. If a second rescuer is available, send that rescuer to activate the EMS system while you remain with the victim.
2. Open the airway and attempt to provide rescue breaths. If you are unable to make the chest rise, reposition the victim's head (reopen the airway) and try to ventilate again.
3. If the victim cannot be ventilated even after attempts to reposition the airway, straddle the victim's knees (see Figure 40) and perform the Heimlich maneuver (up to five times).
4. After five abdominal thrusts, open the victim's airway using a tongue-jaw lift and perform a finger sweep to remove the object.
5. Repeat the sequence of attempts (and reattempts) to ventilate, Heimlich maneuver, and tongue-jaw lift and finger sweep (steps 2 through 4) until the obstruction is cleared or advanced procedures are available to establish a patent airway (i.e., Kelly clamps, Magill forceps, or cricothyrotomy).
6. If the FBAO is removed and the airway is cleared, check breathing. If the victim is not breathing, provide two rescue breaths. Then check for signs of circulation (pulse check and evidence of breathing, coughing, or movement). If there are no signs of circulation, begin chest compressions.

6. Techniques for Relief of Foreign Body Airway Obstruction in Infants and Children

a. Back blows and chest thrusts in the responsive infant

1. Hold the infant prone with the head slightly lower than the chest, resting on your forearm. Support the infant's head by firmly supporting the jaw. Take care to avoid compressing the soft tissues of the infant's throat. Rest your forearm on your thigh to support the infant.
2. Deliver up to five back blows forcefully in the middle of the back between the infant's shoulder blades, using the heel of the hand. Each blow should be delivered with sufficient force to attempt to dislodge the foreign body.
3. After delivering up to five back blows, place your free hand on the infant's back, supporting the occiput of the infant's head with the palm of your hand. The infant will be effectively cradled between your two forearms, with the palm of one hand supporting the face and jaw, while the palm of the other hand supports the occiput.
4. Turn the infant as a unit while carefully supporting the head and neck. Hold the infant in the supine position, with your forearm resting on your thigh. Keep the infant's head lower than the trunk.
5. Provide up to five quick downward chest thrusts in the same location as chest compressions, i.e., lower third of the sternum, approximately one finger's breadth below the intermammary line. Chest thrusts are delivered at a rate of approximately

one per second, each with the intention of creating enough of an "artificial cough" to dislodge the foreign body.

6. If the airway remains obstructed, repeat the sequence of up to five back blows and up to five chest thrusts until the object is removed or the victim becomes unresponsive.

b. *Abdominal thrusts (Heimlich maneuver) in the responsive child*

1. Stand or kneel behind the victim, arms directly under the victim's armpits, encircling the victim's torso.
2. Place the flat, thumb side of one fist against the victim's abdomen in the midline slightly above the navel and well below the tip of the xiphoid process.
3. Grasp the fist with the other hand and exert a series of up to five quick inward and upward thrusts. Do not touch the xiphoid process or the lower margins of the rib cage, because force applied to these structures may damage internal organs.
4. Each thrust should be a separate, distinct movement, delivered with the intent to relieve the obstruction. Continue the series of up to five thrusts until the foreign body is expelled or the victim becomes unresponsive.

c. *Unresponsive infant*

1. Open the victim's airway using a tongue-jaw lift and look for an object in the pharynx. If an object is visible, remove it with a finger sweep. Do not perform a blind finger sweep.
2. Open the airway with a head tilt-chin lift and attempt to provide rescue breaths. If the breaths are not effective, reposition the head and reattempt ventilation.
3. If the breaths are still not effective, perform the sequence of up to five back blows and up to five chest thrusts.
4. Repeat steps 1 through 3 until the object is dislodged and the airway is patent or for approximately 1 minute. If the infant remains unresponsive after approximately 1 minute, activate the EMS system.
5. If breaths are effective, check for signs of circulation and continue CPR as needed, or place the infant in a recovery position if the infant demonstrates adequate breathing and signs of circulation.

d. *Unresponsive child*

1. Open the victim's airway using a tongue-jaw lift and look for an object in the pharynx. If an object is visible, remove it with a finger sweep. However, do not perform a blind finger sweep.
2. Open the airway with a head tilt-chin lift, and attempt to provide rescue breaths. If breaths are not effective, reposition the head and reattempt ventilation.
3. If the breaths are still not effective, kneel beside the victim or straddle the victim's hips and prepare to perform the Heimlich maneuver abdominal thrusts as follows:
   - Place the heel of one hand on the child's abdomen in the midline slightly above the navel and well below the rib cage and xiphoid process. Place the other hand on top of the first.
   - Press both hands onto the abdomen with a quick inward and upward thrust. Direct each thrust upward in the midline and not to either side of the abdomen. If necessary, perform a series of up to five thrusts. Each thrust should be a separate and distinct movement of sufficient force to attempt to dislodge the airway obstruction.
4. Repeat steps 1 through 3 until the object is retrieved or rescuer breaths are effective.

5. Once effective breaths are delivered, assess for signs of circulation and provide additional CPR as needed or place the child in a recovery position if the child demonstrates adequate breathing and signs of circulation.

Skill Descriptions: Patient Assessment

Note: All skills assume proper precautions are already taken, including gloves and face mask if appropriate.

1. Technique for Performing First Responder Physical Exam

Inspect (look) and palpate (feel) for the following signs of injury:

1. Deformities
2. Open injuries
3. Tenderness
4. Swelling
5. The mnemonic "DOTS" is helpful in remembering the signs of injury.

Briefly assess the following body in a logical manner:

1. Head
2. Neck
3. Chest
4. Abdomen
5. Pelvis
6. All four extremities

2. Technique for Obtaining First Responder History from Patient, Family, or Bystanders

Perform "SAMPLE" history (**S**igns, **A**llergies, **M**edications, **P**ertinent medical history, **L**ast oral intake, **E**vents leading to illness or injury).

1. **S**igns/Symptoms
   - "Why did you call EMS today?"
   - Sign – Any medical or trauma condition displayed by the patient and identifiable by the First Responder:
     - Hearing – respiratory distress
     - Seeing – bleeding
     - Feeling – skin temperature
   - Symptom – any condition the patient describes:
     - Difficulty breathing
     - Headache
     - Pain
2. **A**llergies
   - "Are you allergic to anything?"
     - Medications
     - Environmental allergies
     - Food
3. **M**edications
   - "Do you take any prescription or non-prescription medicine?"
     - Prescription:
       Current

Recent
- Non-prescription:
  Current
  Recent

4. **P**ertinent past history
   - "Are you seeing a doctor for anything?"
   - "Have you ever been in the hospital?"
     - Medical
     - Surgical
     - Trauma
5. **L**ast oral intake: Solid or liquid
   - "When was the last time you had anything to eat or drink?"
     - Time
     - Quantity
6. **E**vents leading to the injury or illness
   - "What were you doing when this happened?"
   - "Where there any other associated symptoms?"

3. Technique for Ongoing Assessment

While awaiting additional emergency medical service resources, the First Responder should continue to assess the patient.

1. Repeat the initial assessment:
   - Repeat every 15 minutes for a stable patient.
   - Repeat every 5 minutes for an unstable patient.
   - Reassess mental status.
   - Maintain an open airway.
   - Monitor breathing for rate and quality.
   - Reassess pulse for rate and quality.
   - Monitor skin color, temperature, and condition.
2. Repeat First Responder physical exam as needed.
3. Check interventions to ensure that they are effective.
4. In addition to the continued assessments, the First Responder should calm and reassure the patient.

4. Technique for Patient “Hand-Off” Report

1. Age and sex
2. Chief complaint
3. Responsiveness
4. Airway and breathing status
5. Circulation status
6. Physical findings
7. “SAMPLE” history
8. Interventions provided

Skill Descriptions: Circulation

Note: All skills assume proper precautions are already taken, including gloves and face mask if appropriate.

1. Adult Cardiopulmonary Resuscitation (CPR) Performed by One Rescuer

a. *Assessment*
Determine unresponsiveness (tap or gently shake the victim and shout). If unresponsive,

b. *Activate the emergency medical services (EMS) system*
This should be performed according to local practice. In many countries and regions, activation of the EMS system is delayed until it has been determined that the victim is not breathing.

c. *Airway*
Position the victim and open the airway by the head tilt-]=chin lift or jaw-thrust maneuver.

d. *Breathing*
Assess breathing to identify absent or inadequate breathing.

1. If the victim is unresponsive with normal breathing, and spinal injury is not suspected, place the victim in a recovery position, maintaining an open airway.
2. If the adult victim is unresponsive and not breathing, begin rescue breathing. In the United States and many other countries, two initial breaths are provided, but up to five breaths are recommended in areas such as Europe, Australia, and New Zealand. If you are unable to give the initial breaths, reposition the head and reattempt ventilation. If you are still unsuccessful in making the chest rise with each ventilation after an attempt and reattempt, lay rescuers should provide chest compressions and begin the cycle of 15 compressions and 2 ventilations. Each time you open the airway to attempt ventilation, look for an object in the throat. If you see an object (such as a foreign body), remove it. Healthcare providers should follow the unresponsive foreign body airway obstruction (FBAO) sequence.
3. Be sure the victim's chest rises with each rescue breath you provide.
4. Once you deliver the effective breaths, assess for signs of circulation.

e. *Circulation*
Check for signs of circulation. After the initial breaths, look for normal breathing, coughing, or movement by the victim in response to the initial breaths. Healthcare providers should also feel for a carotid pulse — take no more than 10 seconds to do this. If there are no signs of circulation, begin chest compressions.

1. Locate proper hand position.
2. Perform 15 chest compressions at a rate of approximately 100 per minute. Depress the chest 1½ to 2 inches (4 to 5 cm) with each compression. Make sure you allow the chest to rebound to its normal position after each compression by removing all pressure from the chest (while still maintaining contact with the sternum and proper hand position). Count "1 and, 2 and, 3 and, 4 and, 5 and, 6 and, 7 and, 8 and, 9 and,

10 and, 11, 12, 13, 14, 15." (Any mnemonic that accomplishes the same compression rate is acceptable. For ease of recollection, use the "and" only up to the number 10.)
3. Open the airway and deliver two slow rescue breaths (2 seconds each).
4. Find the proper hand position and begin 15 more compressions at a rate of 100 per minute.
5. Perform 4 complete cycles of 15 compressions and 2 ventilations.

f. Reassessment

Reevaluate the victim according to local protocol. In the United States, this will be after 4 cycles of compressions and ventilations (15:2 ratio); elsewhere, reevaluation may be recommended only if the victim shows some sign of recovery. Check for signs of circulation (10 seconds). If there are no signs of circulation, resume CPR, beginning with chest compressions. If signs of circulation are present, check for breathing.

1. If breathing is present, place the victim in a recovery position and monitor breathing and circulation.
2. If breathing is absent but signs of circulation are present, provide rescue breathing at 10 to 12 times per minute (1 breath every 4 to 5 seconds) and monitor for signs of circulation every few minutes.
3. If there are no signs of circulation, continue compressions and ventilations in a 15:2 ratio.
4. Stop and check for signs of circulation and spontaneous breathing every few minutes (according to local protocol).
5. Do not interrupt CPR except in special circumstances.
6. If adequate spontaneous breathing is restored and signs of circulation are present, maintain an open airway and place the patient in a recovery position.

2. Adult CPR Performed by Two Rescuers

a. Roles

1. One person is positioned at the victim's side and performs chest compressions.
2. The other rescuer remains at the victim's head, maintains an open airway, monitors the carotid pulse to assess effectiveness of chest compressions, and provides rescue breathing.
3. When the person performing chest compressions becomes fatigued, the rescuers should change positions with minimal interruption of chest compressions.

b. Airway, Breathing, Circulation

1. The compression rate for two-rescuer CPR is 100 per minute.
2. The compression-ventilation ratio is 15:2, with a pause for ventilation of 2 seconds each until the airway is secured by a cuffed tracheal tube.
3. Exhalation occurs between the two breaths and during the first chest compression of the next cycle.

c. Reassessment

1. The rescuers must monitor the victim's condition to assess the effectiveness of the rescue effort.
2. The person ventilating the victim assumes the responsibility for monitoring signs of circulation and breathing.
3. To assess the effectiveness of the partner's chest compressions, the professional rescuer should check the pulse during compressions.

4. To determine whether the victim has resumed spontaneous breathing and circulation, chest compressions must be stopped for 10 seconds at approximately the end of the first minute of CPR (or per local protocol) and every few minutes thereafter.

3. Infant CPR

a. *Assessment*

1. Gently stimulate the child and ask loudly, "Are you all right?"
2. Quickly assess the presence or extent of injury and determine whether the child is responsive.
3. Do not move or shake the victim who has sustained head or neck trauma, because such handling may aggravate a spinal cord injury.
4. If the child is responsive, he or she will answer your questions or move on command.
5. Return to the child as quickly as possible and recheck the child's condition frequently.
6. Responsive children with respiratory distress will often assume a position that maintains airway patency and optimizes ventilation; they should be allowed to remain in the position that is most comfortable to them.
7. If the child must be positioned for resuscitation or moved for safety reasons, support the head and body and turn as a unit.

b. *Activate the EMS system*

1. If the child responds but is injured or needs medical assistance, you may leave the child in the position found to summon help (phone the EMS system, if needed).
2. If the child is unresponsive and you are the only rescuer present, be prepared to provide Basic Life Support (BLS), if necessary, for approximately 1 minute before leaving the child to activate the EMS system.
3. The EMS medical dispatcher may then guide you through CPR. The child must be moved if he/she is in a dangerous location (i.e., a burning building) or if CPR cannot be performed where the child was found.
4. If trauma has not occurred and the child is small, you may consider moving the child near a telephone so that you can contact the EMS system more quickly.
5. If trauma is suspected, the second rescuer should activate the EMS system and then may assist in immobilizing the child's cervical spine, preventing movement of the neck (extension, flexion, and rotation) and torso.
6. If a second rescuer is present during the initial assessment of the child, that rescuer should activate the EMS system as soon as the emergency is recognized.

c. *Airway*

1. Position the victim.
2. Open the airway.
   - Head tilt-chin lift maneuver
   - Jaw-thrust maneuver
3. Remove any obvious airway obstruction.

d. *Breathing*

1. Look
2. Listen
3. Feel
4. Two to five initial breaths sufficient to see chest wall rise

5. **Mouth-to-mouth-and-nose technique (<1 year old):**

Figure 1. Mouth-to-mouth-and-nose breathing for small infant victim

6. **Mouth-to-mouth breathing technique (1 to 8 years old):**

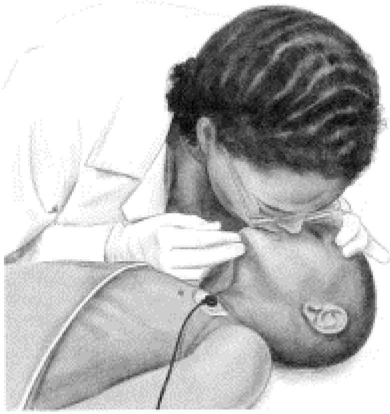


Figure 2. Mouth-to-mouth breathing for child victim

e. Circulation

1. Look for signs of circulation (normal breathing, coughing, or movement) in response to rescue breathing. Do not rely on pulse check to determine the need for chest compressions.
2. If signs of circulation are present, but spontaneous breathing is absent, provide rescue breathing at a rate of 20 breaths per minute (once every 3 seconds) until spontaneous breathing resumes.
3. If no signs of circulation, immediately begin chest compressions.
4. Chest compression in the infant (<1 year of age)
5. **Two-finger technique:**

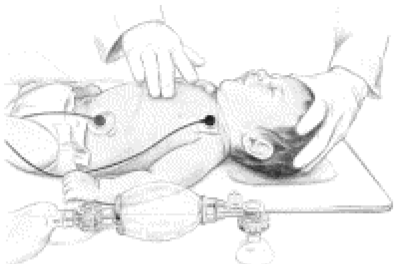


Figure 3. Two-finger chest compression technique in infant (one rescuer)

- Place the two fingers of one hand over the lower half of the sternum approximately one finger's width below the intermammary line, ensuring that you are not on or near the xiphoid process.
- Press down on the sternum to depress it approximately one third to one half the depth of the infant's chest. This will correspond to a depth of about ½ to 1 inch (1½ to 2½ cm). After each compression, completely release the pressure on the sternum and allow the sternum to return to its normal position without lifting your fingers off the chest wall.
- Compress the sternum at a rate of at least 100 times per minute (this corresponds to a rate that is slightly less than 2 compressions per second during the groups of 5 compressions).
- After five compressions, open the airway with a head tilt-chin lift (or, if trauma is present, use the jaw thrust) and give one effective breath. Be sure that the chest rises with the breath.
- Continue compressions and breaths in a ratio of 5:1 (for one or two rescuers).

6. **Two thumb-encircling hands technique (two-rescuer technique):**

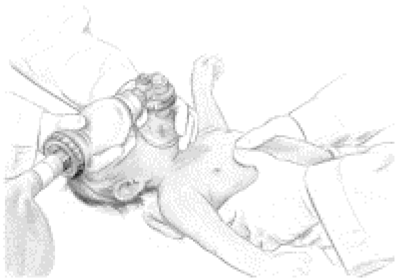


Figure 4. Two thumb-encircling hands chest compression technique in infant (two rescuers)

- Place both thumbs side by side over the lower half of the infant's sternum, ensuring that the thumbs do not compress on or near the xiphoid process.
- Encircle the infant's chest and support the infant's back with the fingers of both hands. Place both thumbs on the lower half of the infant's sternum, approximately one finger's width below the intermammary line.
- With your hands encircling the chest, use both thumbs to depress the sternum approximately one third to one half the depth of the child's chest. This will correspond to a depth of approximately ½ to 1 inch.
- After each compression, completely release the pressure on the sternum and allow the sternum to return to its normal position without lifting your thumbs off the chest wall.
- Compress the sternum at a rate of at least 100 times per minute (this corresponds to a rate that is slightly less than 2 compressions per second during the group of 5 compressions).
- After five compressions, pause briefly for the second rescuer to open the airway with a head tilt-chin lift (or, if trauma is suspected, with a jaw thrust) and give one effective breath (the chest should rise with the breath). Compressions and ventilations should be coordinated to avoid simultaneous delivery and ensure adequate ventilation and chest expansion, especially when the airway is unprotected. Continue compressions and breaths in a ratio of 5:1 (for one or two rescuers).

7. **Chest compression technique in the child (approximately 1 to 8 years of age):**

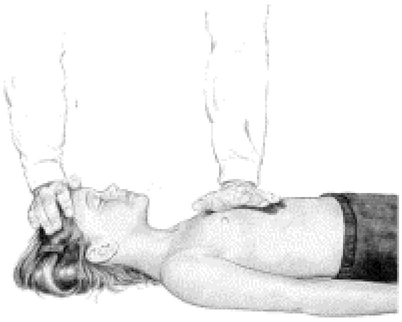


Figure 5. One-hand chest compression technique in child

- Place the heel of one hand over the lower half of the sternum, ensuring that you do not compress on or near the xiphoid process. Lift your fingers to avoid pressing on the child's ribs.
- Position yourself vertically above the victim's chest and, with your arm straight, depress the sternum approximately one third to one half the depth of the child's chest. This corresponds to a compression depth of approximately 1 to 1½ inches, but these measurements are not precise. After the compression, release the pressure on the sternum, allowing it to return to normal position, but do not remove your hand from the surface of the chest.
- Compress the sternum at a rate of approximately 100 times per minute (this corresponds to a rate that is slightly less than 2 compressions per second during the group of 5 compressions). After five compressions, open the airway and give one effective rescue breath. Be sure the chest rises with the breath.
- Return your hand immediately to the correct position on the sternum and give five chest compressions.
- Continue compressions and breaths in a ratio of 5:1 (for one or two rescuers).
- In large children and children 8 *years* of age or older, the adult two-handed method of chest compression should be used to achieve an adequate depth of compression.

Skill Descriptions: Illness and Injury

Note: All skills assume proper precautions are already taken, including gloves and face mask if appropriate.

1. Techniques for External Bleeding Control

1. Apply fingertip pressure (use flat part of fingers) directly on the point of bleeding.
2. If no injury to the muscle or bone exists, elevation of a bleeding extremity may be used secondary to and in conjunction with direct pressure.
3. Large gaping wounds may require sterile gauze and direct hand pressure if finger tip pressure fails to control bleeding.
4. If bleeding does not stop, remove dressing and assess for bleeding point to apply direct pressure. If more than one site of bleeding is discovered, apply additional pressure.
5. Pressure points may be used in upper and lower extremities.

2. Management of Open Soft Tissue Injuries

1. Expose the wound.
2. Control the bleeding.
3. Prevent further contamination.
4. Apply sterile dressing to the wound and bandage securely in place.

3. Management of Chest Injuries

1. Apply an occlusive dressing to open wounds and seal on three sides.
2. Place victim in a position of comfort if no spinal injury is suspected.

4. Management of Impaled Objects

1. Do not remove the impaled object unless it is through the cheek or it would interfere with airway management or chest compressions.
2. Manually secure the object.
3. Expose the wound area.
4. Control bleeding.
5. Use a bulky dressing to help stabilize the object.

5. Management of Eviscerations

1. Involves open injury with protruding organs.
2. Do not attempt to replace protruding organs.
3. Cover with thick moist dressing.

6. Management of Amputations

1. Involves the extremities and other body parts.
2. Massive bleeding may be present or bleeding may be limited.
3. Locate and preserve the amputated part, but do not delay transport.
   - Place the part in a plastic bag.
   - Place the plastic bag containing the part in a larger bag or container with ice and water.
     – Do not use ice alone.

    – Do not use dry ice.

7. Management of Burns

1. Comfort, calm, and reassure the patient while awaiting additional emergency medical services (EMS) resources.
2. Stop the burning process initially with water or saline.
3. Remove smoldering clothing and jewelry.
    - Be aware that some clothing may have melted to the skin.
    - If you meet resistance when removing the clothing, leave the clothing in place.
4. Maintain body substance isolation.
5. Continually monitor the airway for evidence of closure.
6. Prevent further contamination.
7. Cover the burned area with a dry sterile dressing.
8. Do not use any type of ointment, lotion, or antiseptic.
9. Do not break blisters.

8. Emergency Medical Care of Bone or Joint Injuries

1. Maintain body substance isolation.
2. After controlling life-threatening injuries, allow patient to remain in a position of comfort.
3. Apply cold pack to area of painful, swollen, deformed extremity to reduce swelling and pain.
4. Manually stabilize extremity:
    - Support above and below an injury.
    - Cover open wounds with a sterile dressing.
    - Pad to prevent pressure and discomfort to the patient.
    - When in doubt, manually stabilize the injury.
    - Do not intentionally replace the protruding bones.

9. Emergency Medical Care of Spinal Injuries

1. Maintain body substance isolation.
2. Establish and maintain manual stabilization:
    - Maintain constant manual stabilization.
    - Release when additional EMS resources have properly secured the patient to a backboard with the head stabilized.
3. Perform initial assessment:
    - Whenever possible, control airway without moving the patient's head.
    - Whenever possible, perform artificial ventilation without moving the head.
4. Assess pulse, motor, and sensation in all extremities.

10. Emergency Medical Care of Brain and Skull Injuries

1. Maintain body substance isolation.
2. Maintain airway/artificial ventilation/oxygenation.
3. Perform initial assessment with manual spinal stabilization on scene.
4. Closely monitor patient’s mental status for deterioration.
5. Control bleeding:

- Apply enough pressure to control the bleeding, without disturbing the underlying tissue.
- Dress and bandage open wound as indicated in the emergency medical care of soft tissue injuries.

6. Be prepared for changes in patient’s condition.

Skill Descriptions: Children and Childbirth

Note: All skills assume proper precautions are already taken, including gloves and face mask if appropriate.

1. Techniques for Determining if Delivery is Imminent

a. Questions

1. What is your due date?
2. Any chance of multiple births?
3. Any bleeding or discharge?
4. Do you feel as if you are having a bowel movement with increasing pressure in the vaginal area?
5. Examine for crowning if the patient answers yes to the preceding questions.

b. If crowning is present, prepare for delivery.

1. Use body substance isolation.
2. Do not touch vaginal areas except during delivery and when your partner is present.
3. Do not let the mother go to bathroom.
4. Do not hold mother's legs together.

c. If the head is not the presenting part this may be a complicated delivery.

1. Tell the mother not to push.
2. Update responding emergency medical services (EMS) resources.
3. Calm and reassure the mother.

2. Technique for Delivering a Baby

1. Ensure body substance isolation.
2. Have mother lie on her back with knees drawn up and legs spread apart.
3. Place absorbent, clean materials (sheets, towels, etc.) under the patient's buttocks.
4. Elevate buttocks with blankets or pillow.
5. When the infant's head appears, place the palm of your hand on top of the delivering baby's head and exert very gentle pressure to prevent explosive delivery.
6. If the amniotic sac does not break or has not broken, tear it with your fingers and push it away from the infant's head and mouth.
7. As the infant's head is being born, determine if the umbilical cord is around the infant's neck.
   - Attempt to slip the cord over the baby's shoulder.
   - If unsuccessful, attempt to alleviate pressure on the cord.
8. After the infant's head is born, support the head.
9. Suction the mouth and then the nostrils two or three times with a bulb syringe.
   - Use caution to avoid contact with the back of the baby's mouth.
   - If a bulb syringe is not available, wipe the baby's mouth and then the nose with gauze.
10. As the torso and full body are born, support the infant with both hands.
11. Do not pull on the infant.

12. As the feet are delivered, grasp the feet.
    - Keep the infant level with the vagina.
    - You may place the infant on the mother’s abdomen for warmth.
13. When the umbilical cord stops pulsating, it should be tied with gauze between the mother and the newborn, and the infant may be placed on the mother's abdomen.
14. Wipe blood and mucus from the baby's mouth and nose with sterile gauze; suction mouth, then the nose again.
15. Dry the infant.
16. Rub the baby's back or flick the soles of its feet to stimulate breathing.
17. Wrap the infant in a warm blanket and place the infant on its side, head slightly lower than trunk.
18. There is no need to cut the cord in a normal delivery. Keep the infant warm and wait for additional EMS resources who will have the proper equipment to clamp and cut the cord.
19. Record time of delivery.
20. If there is a chance of multiple births, prepare for second delivery.
21. Observe for delivery of placenta. This may take up to 30 minutes.
22. If the placenta is delivered, wrap it in a towel with 3/4 of the umbilical cord and place in a plastic bag, and keep the bag at the level of the infant.
23. Place sterile pad over vaginal opening, lower mother's legs, help her hold them together.

Skill Descriptions: Lifting and Moving Patients

Note: All skills assume proper precautions are already taken, including gloves and face mask if appropriate.

1. Safety Precautions

1. Use legs, not back, to lift.
2. Keep weight as close to body as possible.

2. Guidelines for Lifting

1. Consider weight of patient and the need for additional help.
2. Know physical ability and limitations.
3. Lift without twisting.
4. Have feet positioned properly.
5. Communicate clearly and frequently with partner and other emergency medical service providers.

3. Emergency Moves

1. Pull on the patient's clothing in the neck and shoulder area.
2. Put the patient on a blanket and drag the blanket.
3. Put your hands under the patient's armpits (from the back), grasp the patient's forearms, and drag the patient.
4. Never pull the patient's head away from the neck and shoulders.

4. Non-Urgent Moves

a. Direct ground lift

1. Two or three rescuers line up on one side of the patient.
2. Rescuers kneel on one knee (preferably the same for all rescuers).
3. The patient's arms are placed on his/her chest if possible.
4. The rescuer at the head places one arm under the patient's neck and shoulder and cradles the patient's head. The rescuer places his/her other arm under the patient's lower back.
5. The second rescuer places one arm under the patient's knees and one arm above the buttocks.
6. If a third rescuer is available, he/she should place both arms under the waist and the other two rescuers slide their arms either up to the mid-back or down to the buttocks as appropriate.
7. On signal, the rescuers lift the patient to their knees and roll the patient in toward their chests.
8. On signal, the rescuers stand and move the patient to the stretcher.
9. To lower the patient, reverse the steps.

b. Extremity lift

1. One rescuer kneels at the patient's head and one kneels at the patient's side by the knees.

2. The rescuer at the head places one hand under each of the patient's shoulders while the rescuer at the foot grasps the patient's wrists.
3. The rescuer at the head slips his/her hands under the patient's arms and grasps the patient's wrists.
4. The rescuer at the patient's foot slips his/her hands under the patient's knees.
5. Both rescuers move up to a crouching position.
6. The rescuers stand up simultaneously and move with the patient to a stretcher.

5. Transfer Techniques

a. Direct carry

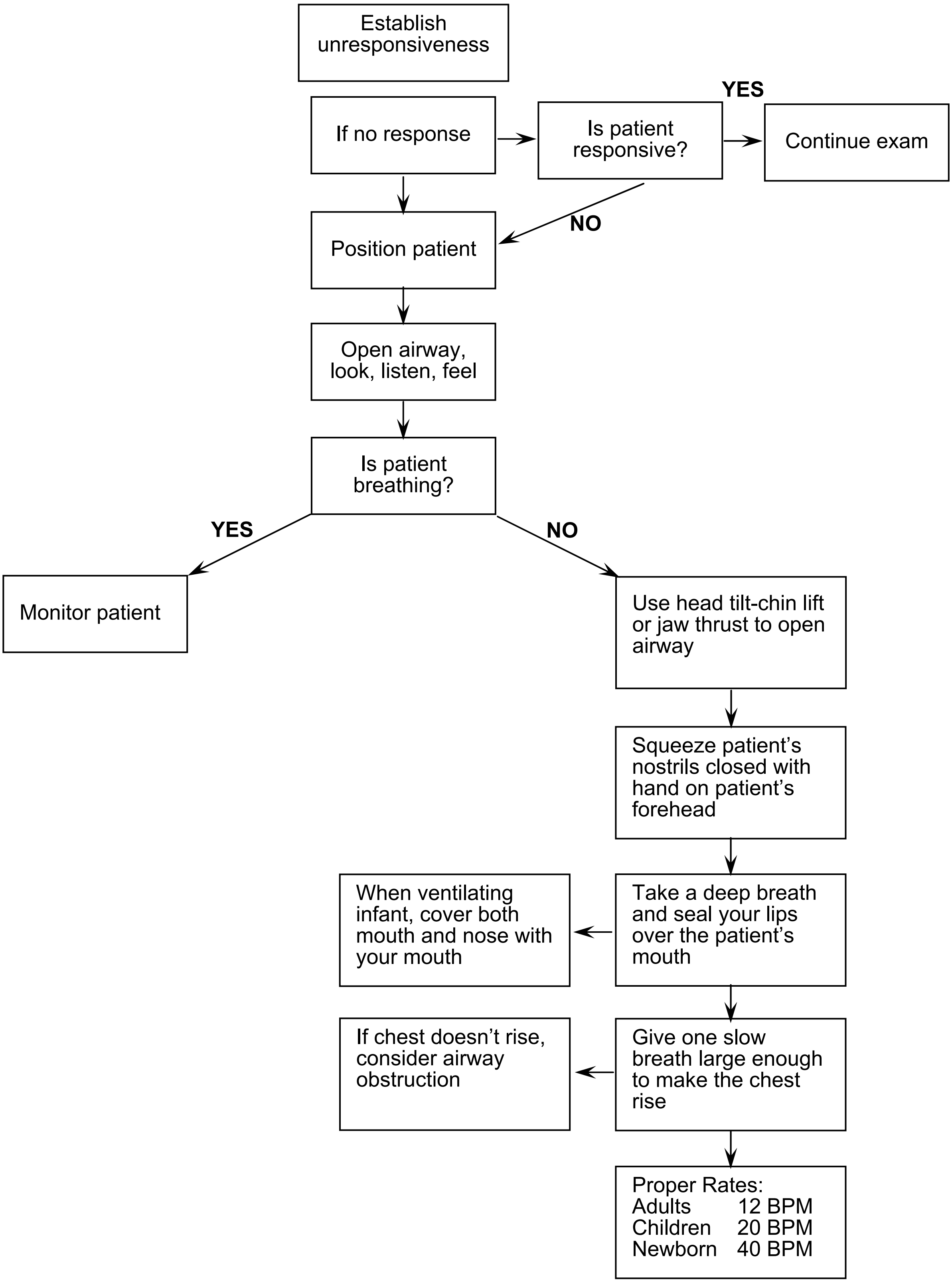
1. Position stretcher perpendicular to bed with head end of stretcher at foot of bed.
2. Prepare stretcher by unbuckling straps and removing other items.
3. Both rescuers stand between bed and stretcher, facing patient.
4. First rescuer slides arm under patient's neck and cups patient's shoulder.
5. Second rescuer slides hand under hip and lifts slightly.
6. First rescuer slides other arm under patient's back.
7. Second rescuer places arms underneath hips and calves.
8. Rescuers slide patient to edge of bed.
9. Patient is lifted/curled toward the rescuers' chests.
10. Rescuers rotate and place patient gently onto stretcher.

b. Draw sheet method

1. Loosen bottom sheet of bed.
2. Position stretcher next to bed.
3. Prepare stretcher. Adjust height, lower rails, unbuckle straps.
4. Reach across stretcher and grasp sheet firmly at patient's head, chest, hips, and knees.
5. Slide patient gently onto stretcher.

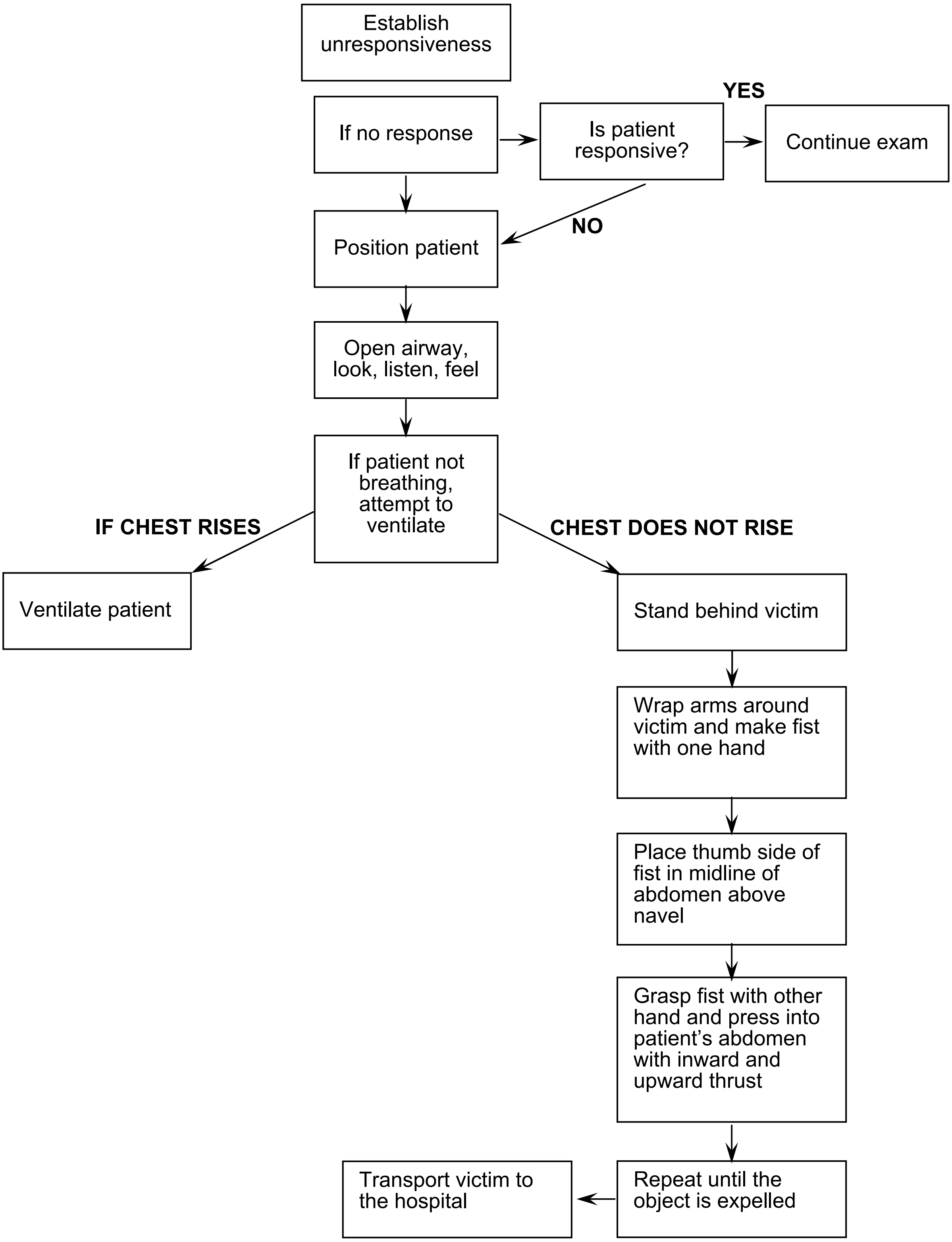
Skill Algorithms: Airway

Mouth-to-Mouth Ventilation



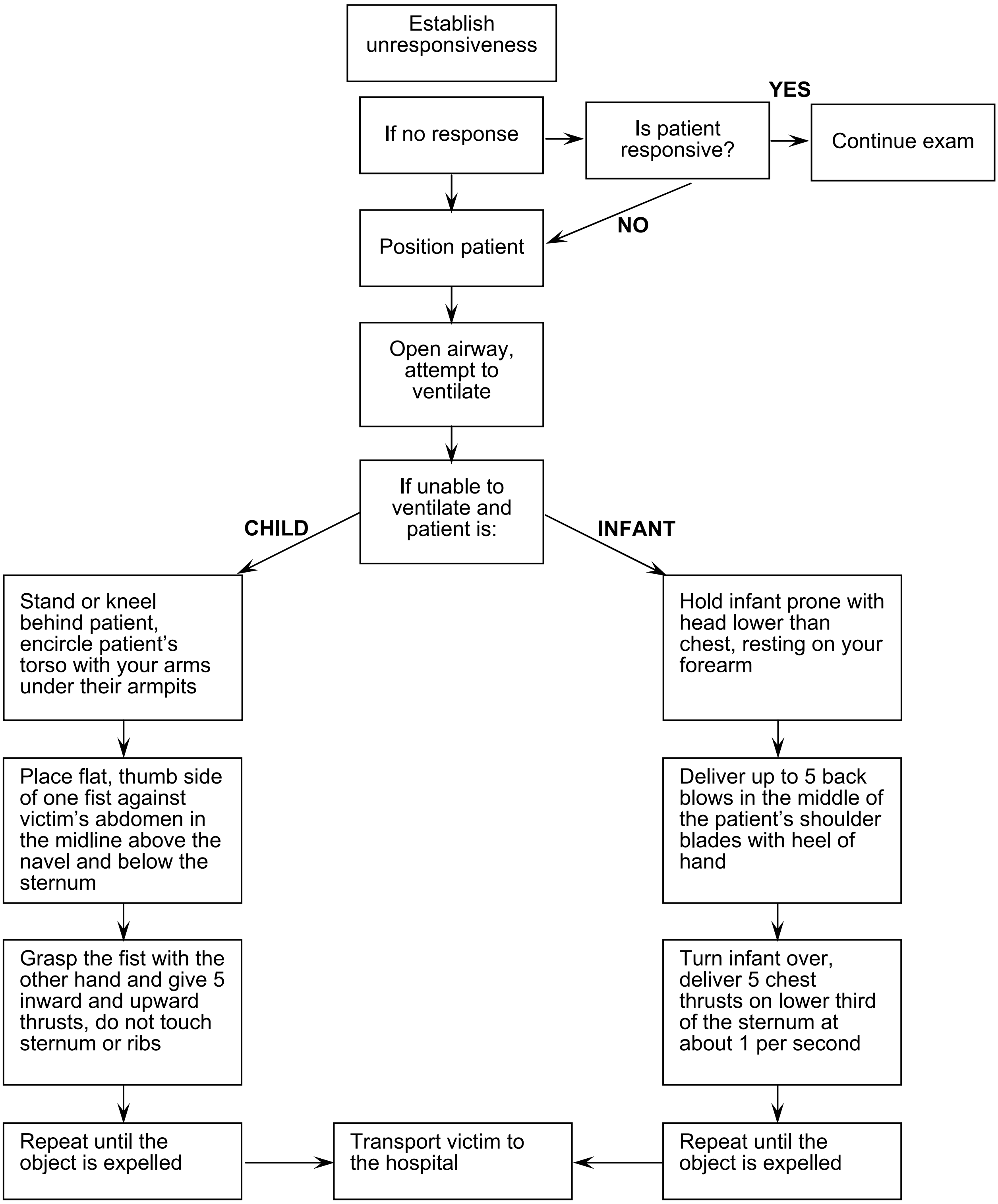
Skill Algorithms: Airway

Foreign Body Airway Obstruction
Victim Standing or Sitting



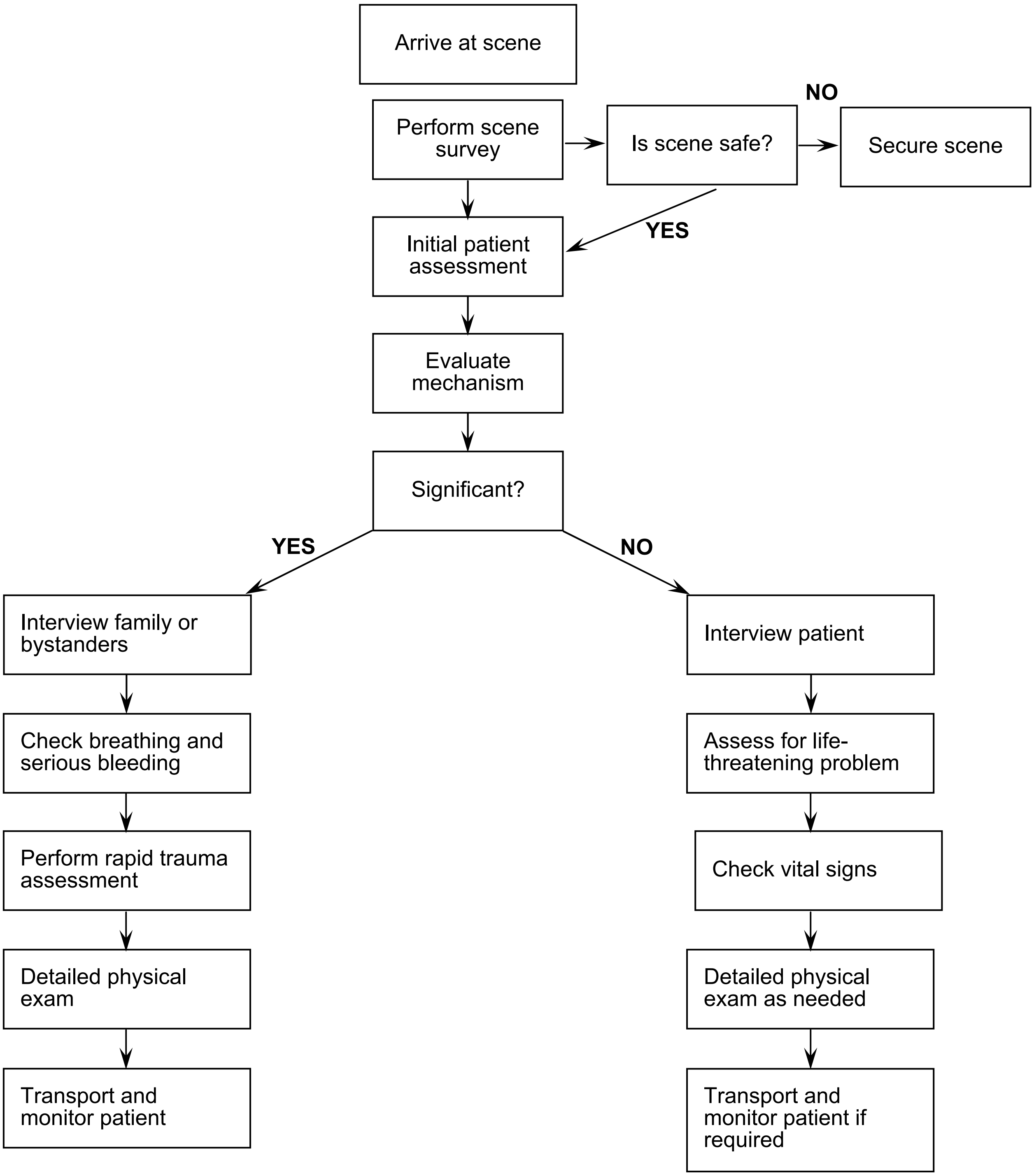
Skill Algorithms: Airway

Foreign Body Airway Obstruction in Responsive Infant or Child



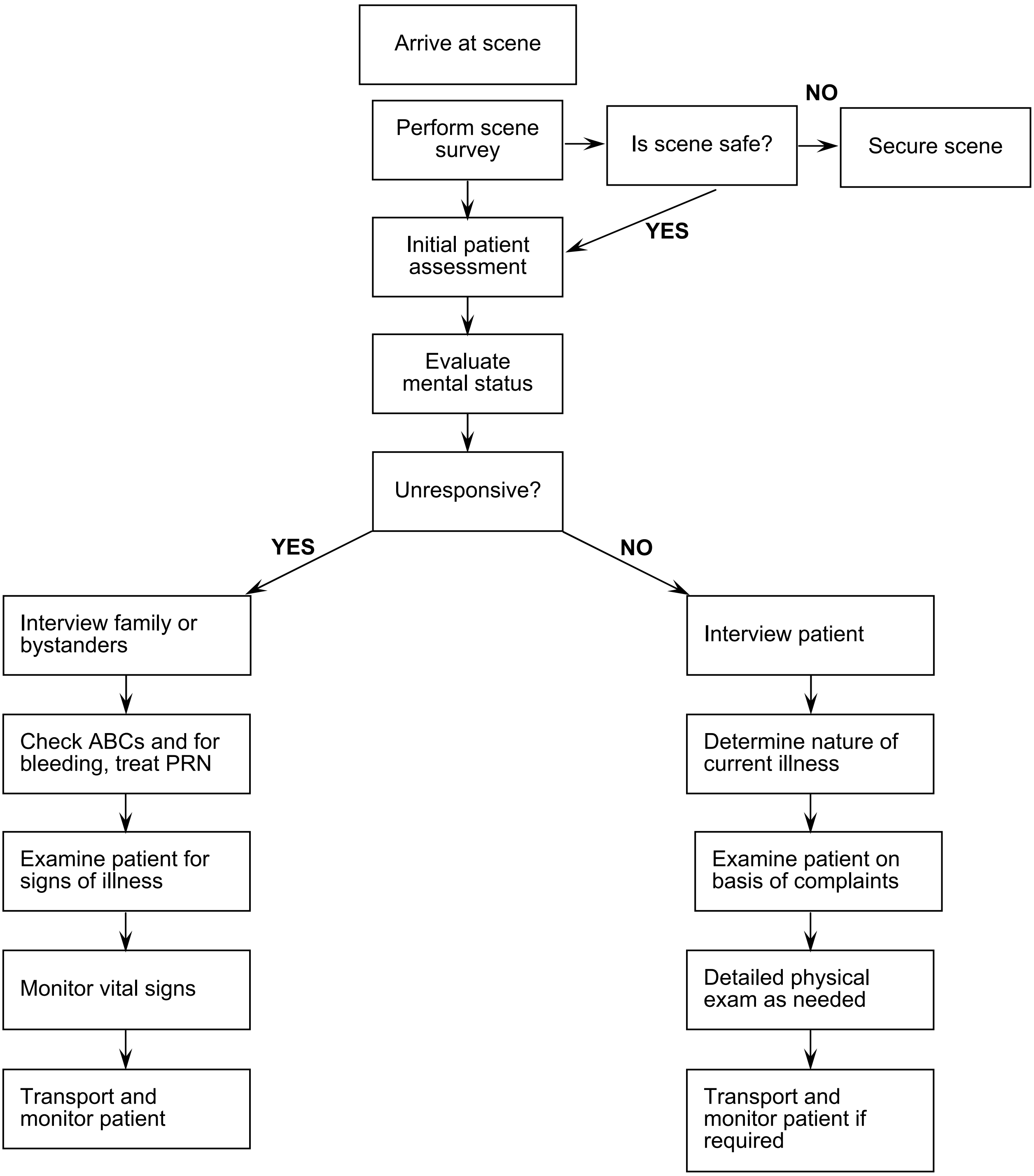
Skill Algorithms: Patient Assessment

Trauma Patient



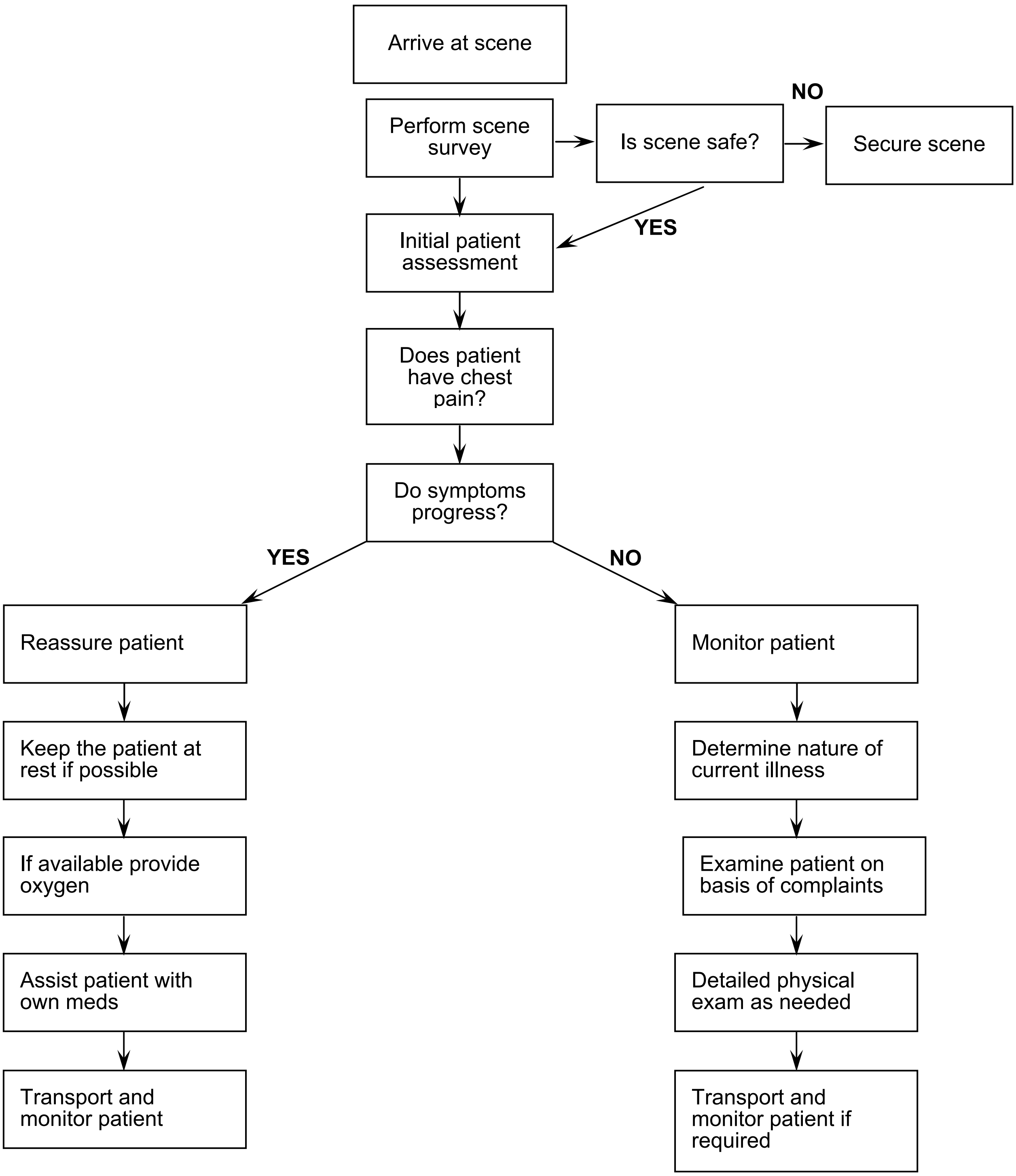
Skill Algorithms: Patient Assessment

Medical Patient



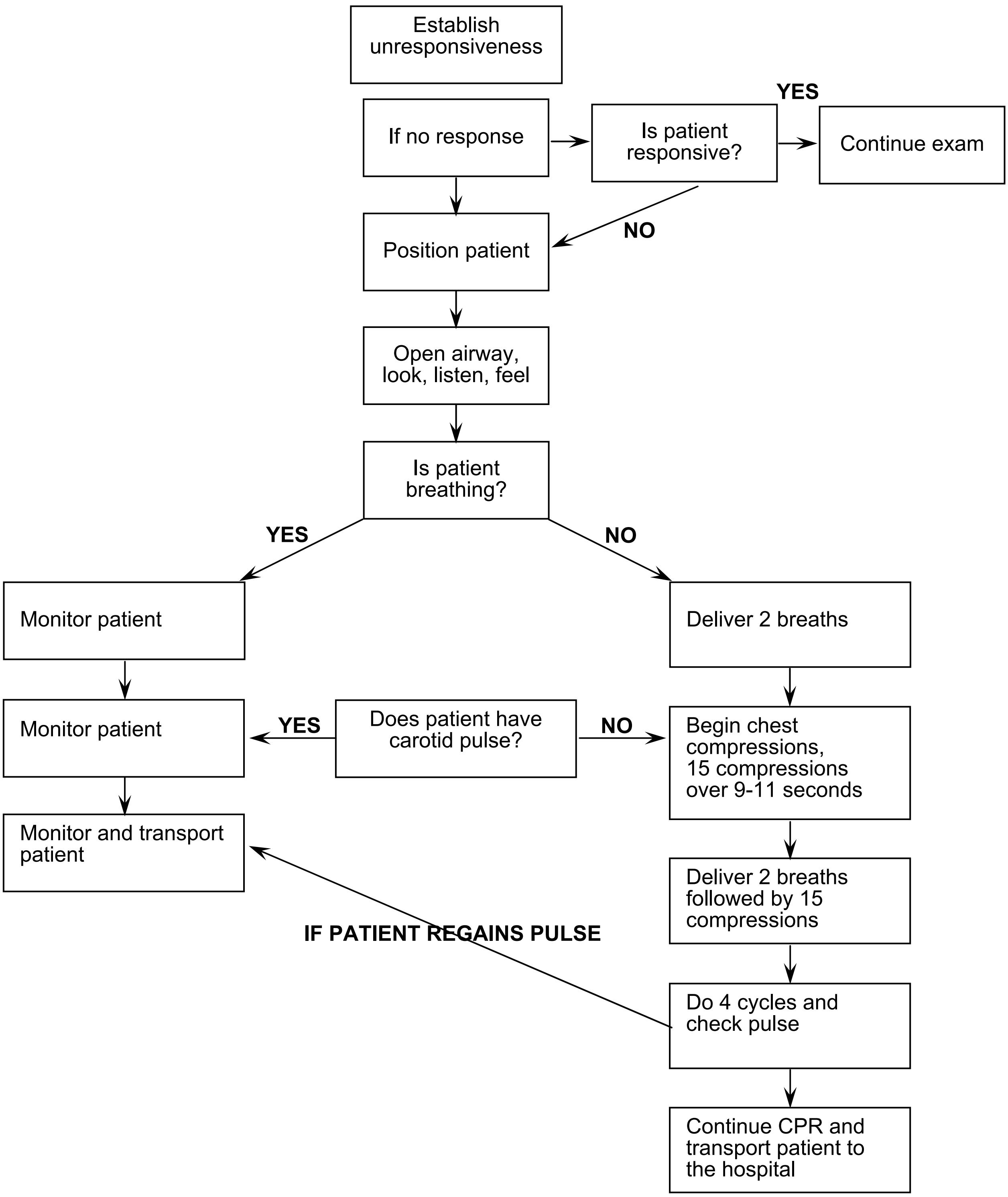
Skill Algorithms: Patient Assessment

Patient with Chest Pain



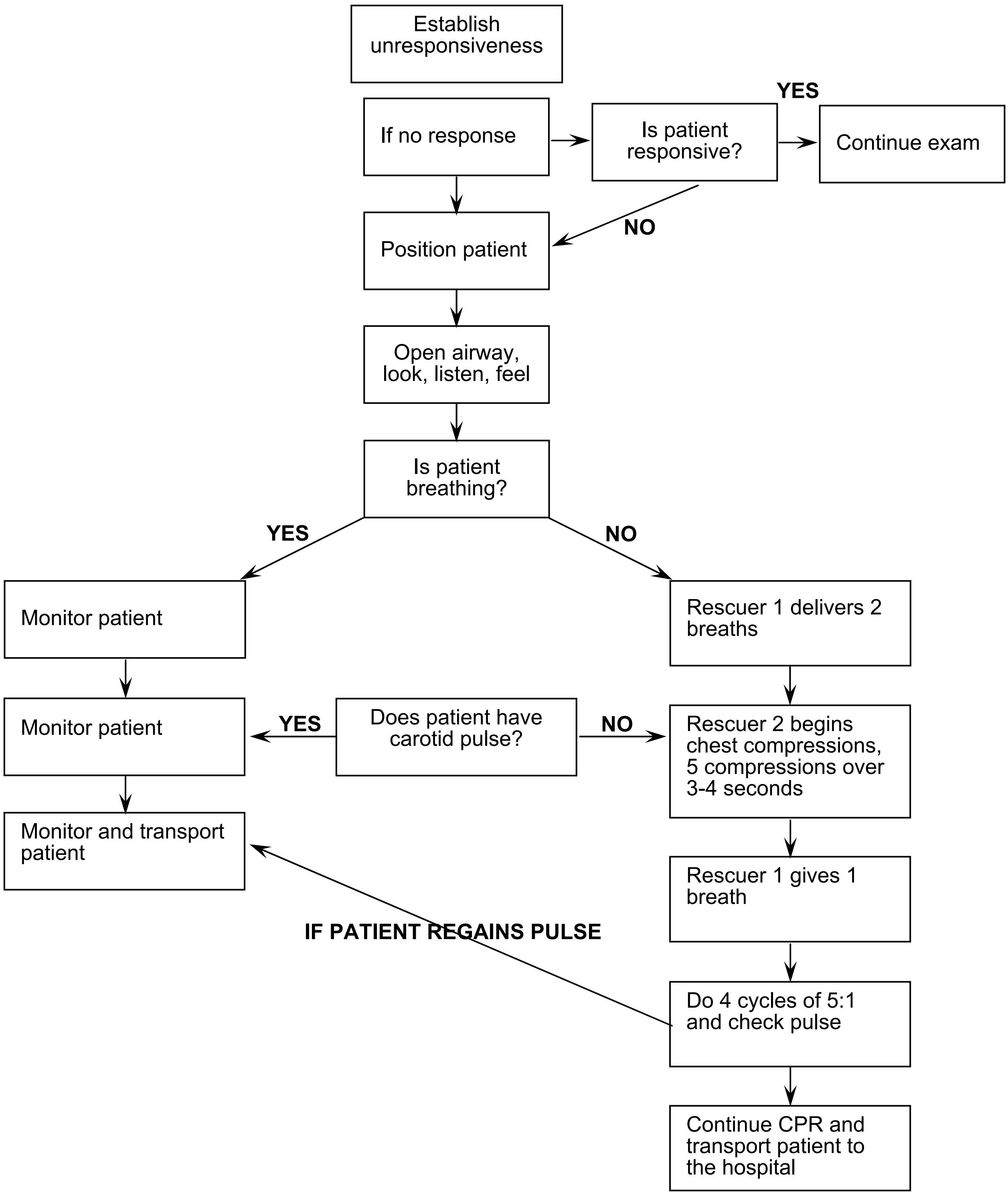
Skill Algorithms: Circulation

One-Person CPR



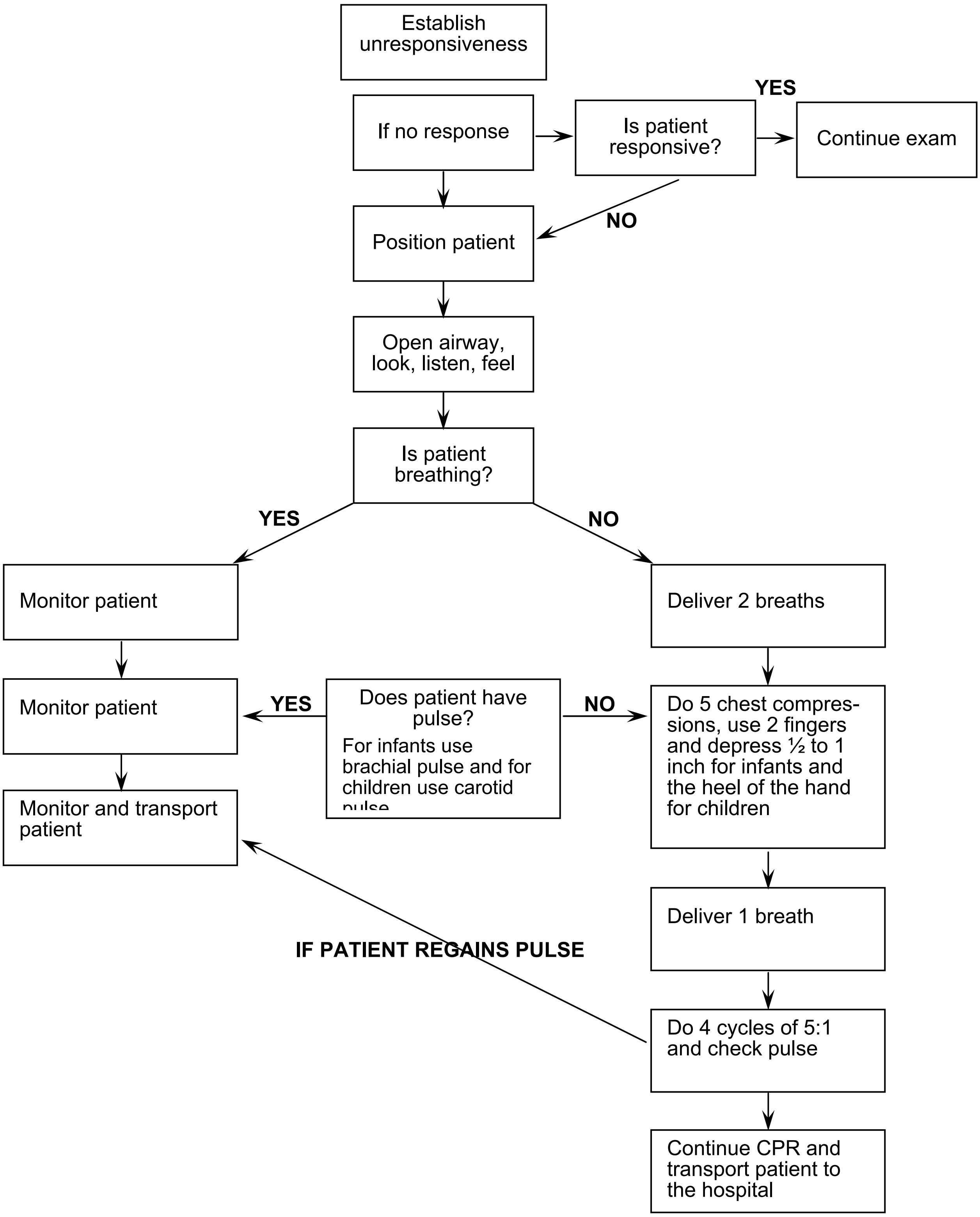
Skill Algorithms: Circulation

Two-Person CPR



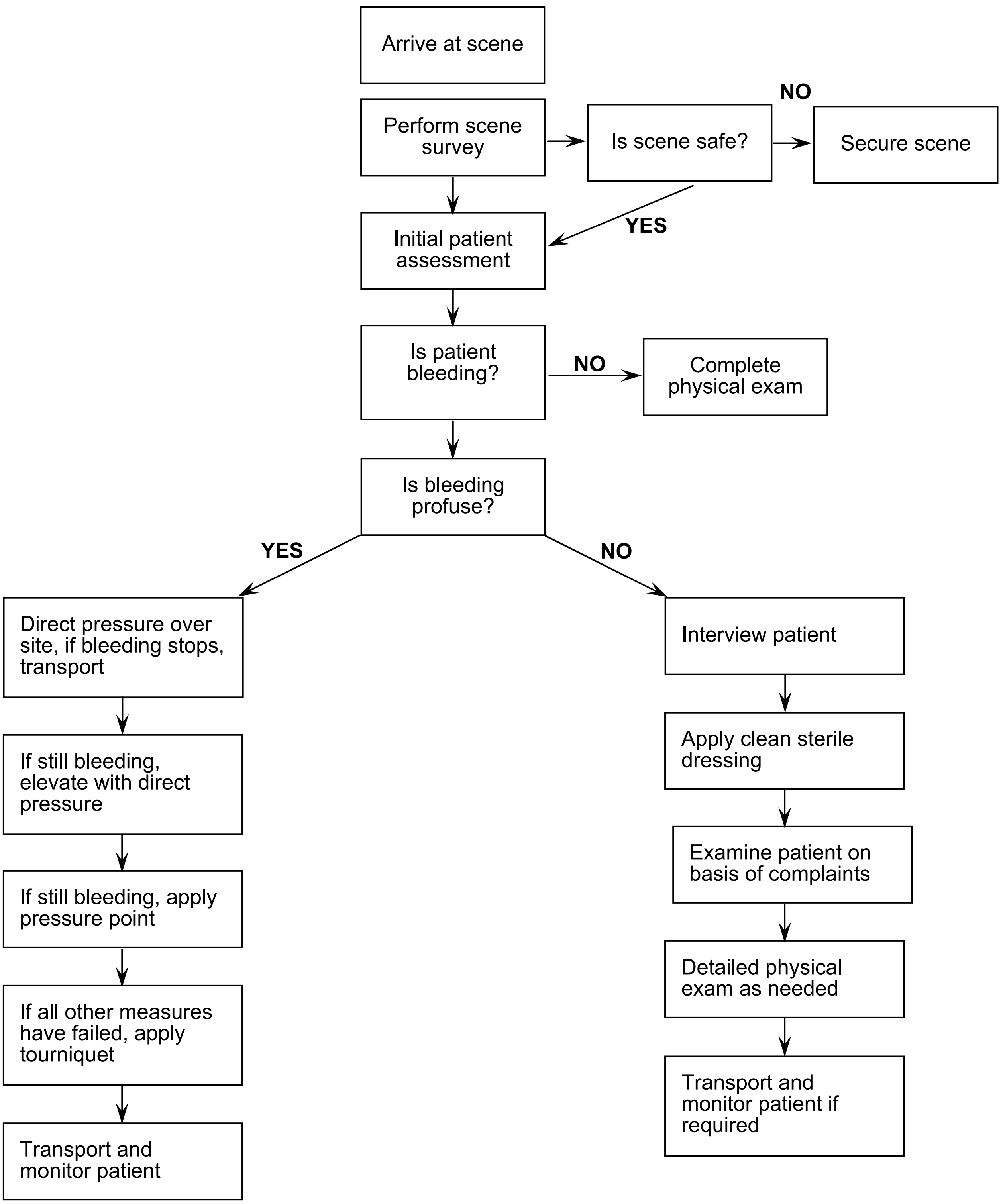
Skill Algorithms: Circulation

Child and Infant CPR



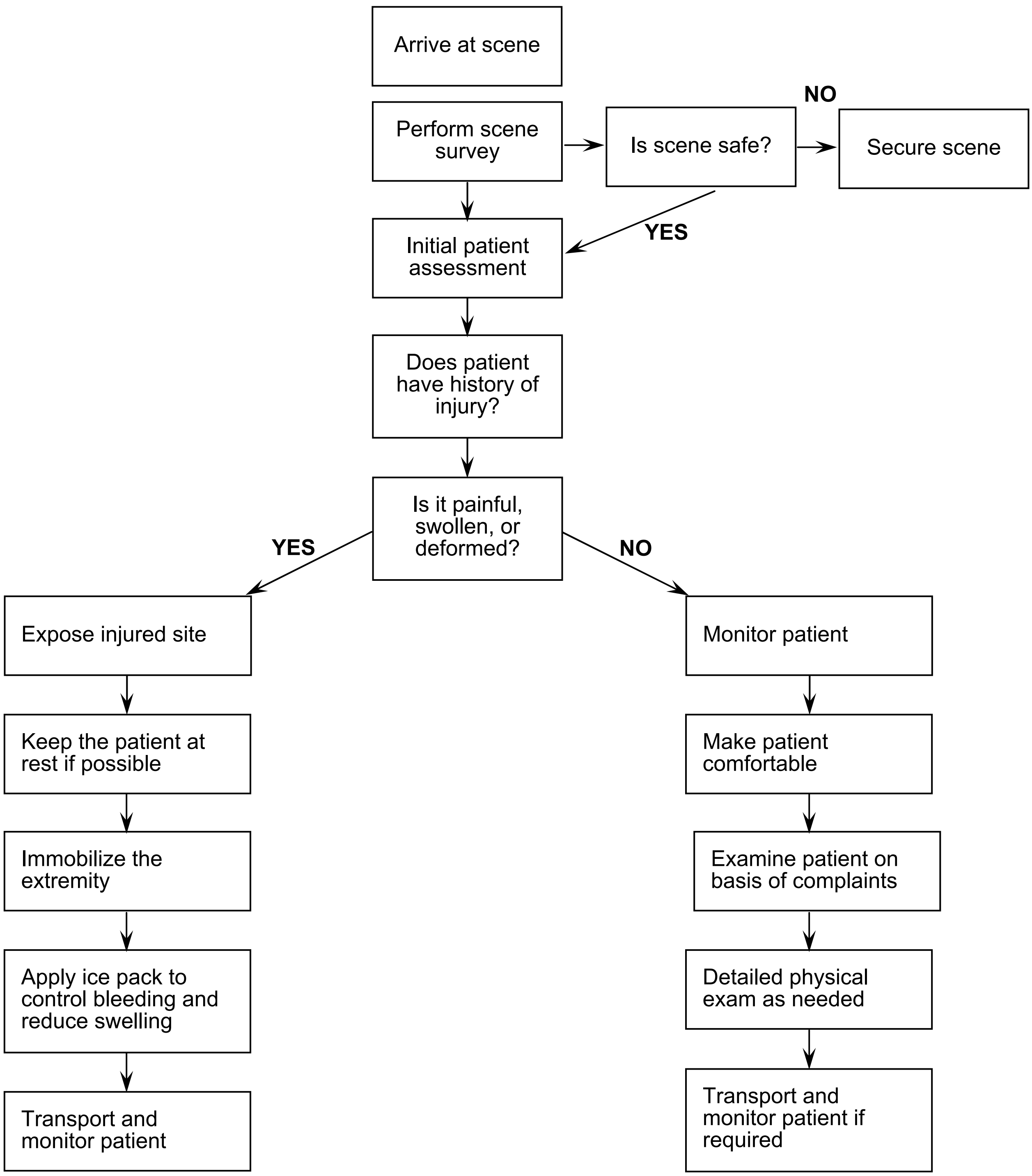
Skill Algorithms: Illness and Injury

External Bleeding



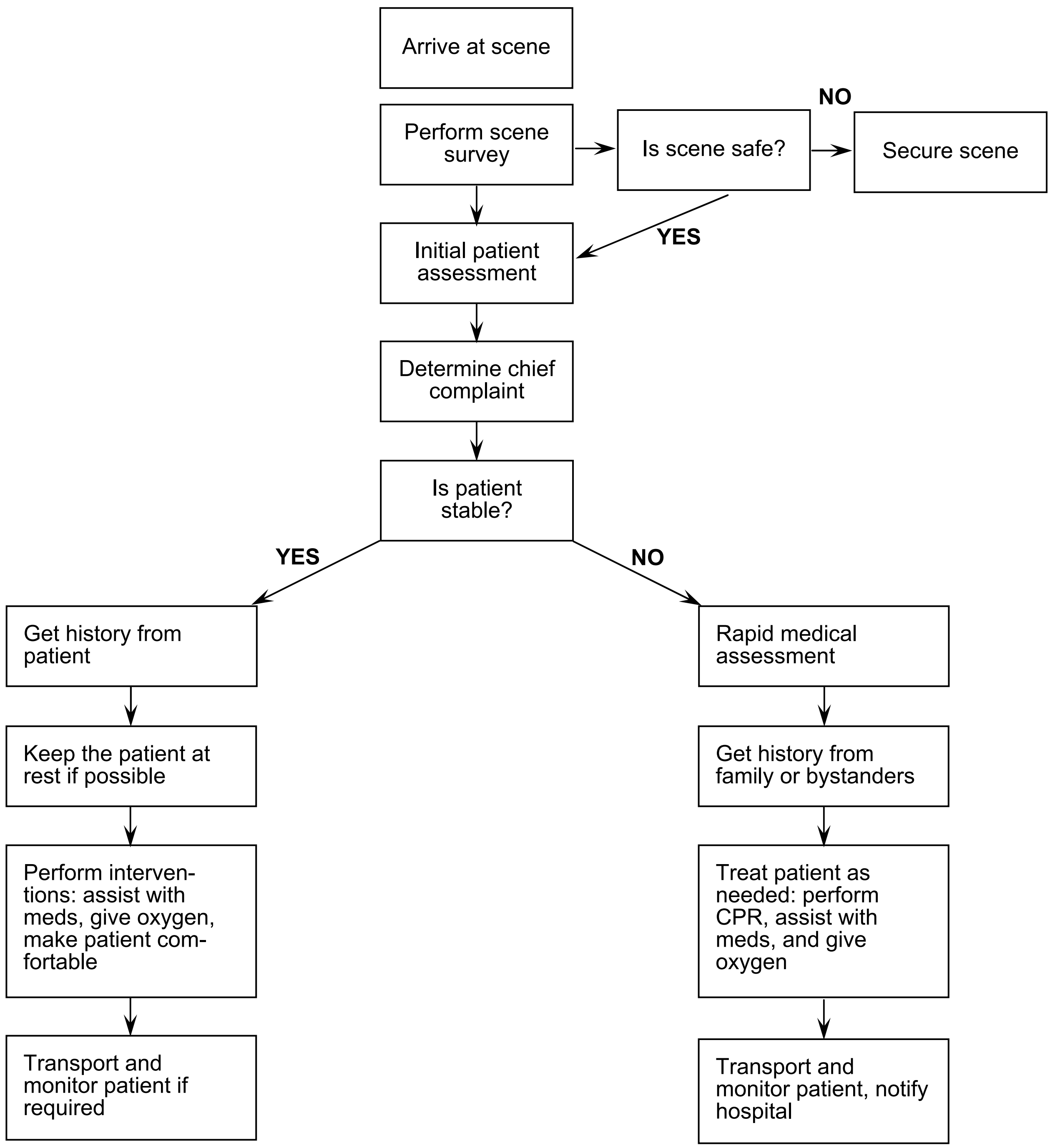
Skill Algorithms: Illness and Injury

Patient with Musculoskeletal Injury



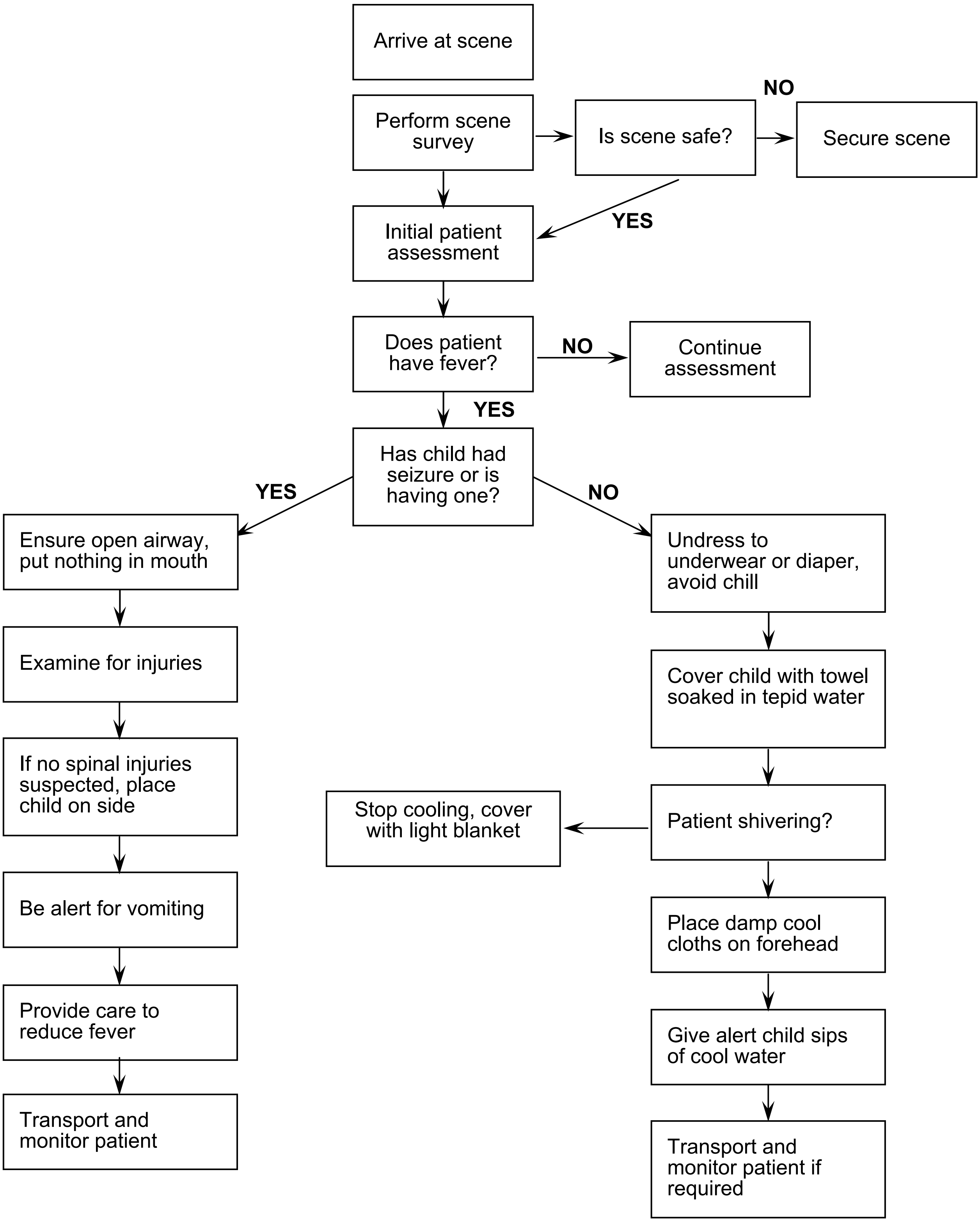
Skill Algorithms: Illness and Injury

Patients with Medical Illness



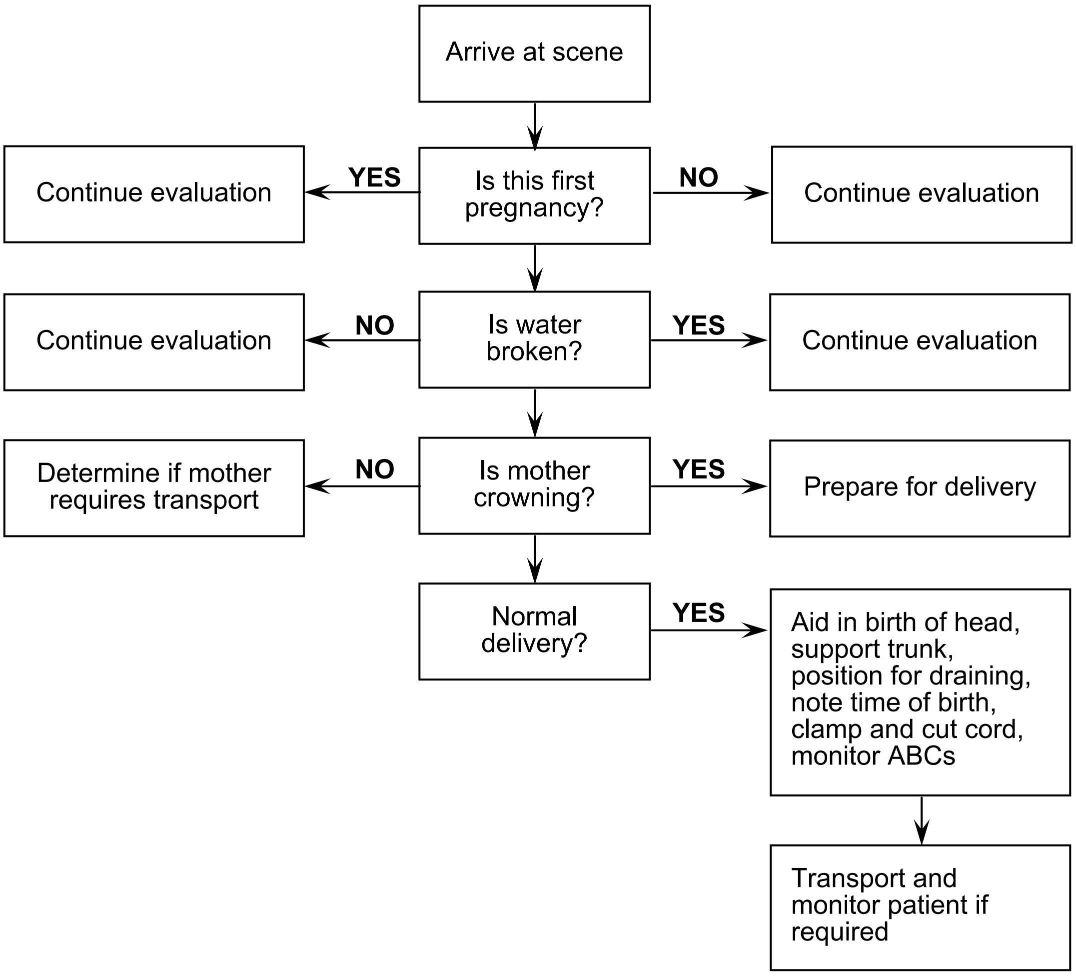
Skill Algorithms: Childbirth and Children

Pediatric Patient with Fever



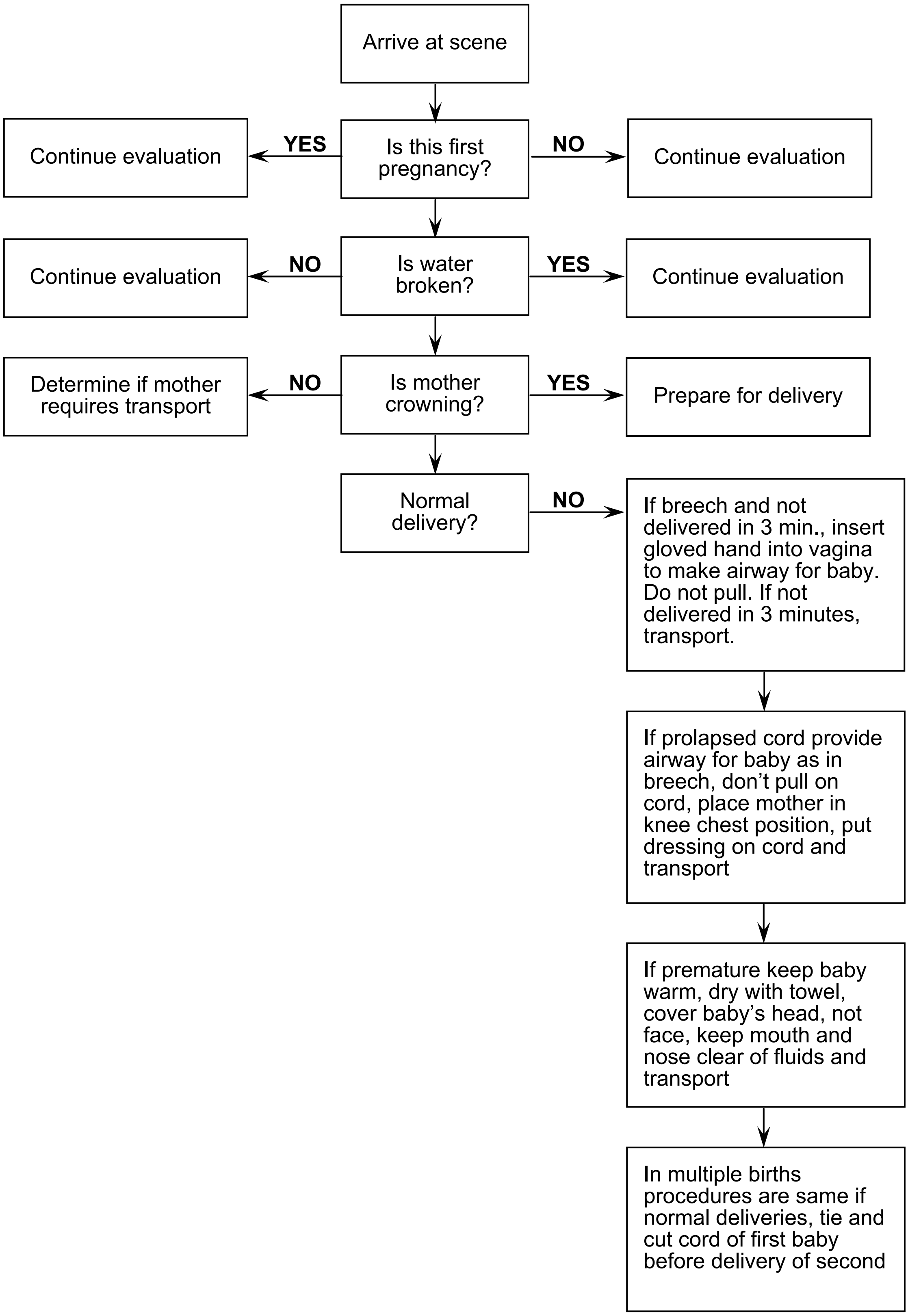
Skill Algorithms: Childbirth and Children

Normal Childbirth



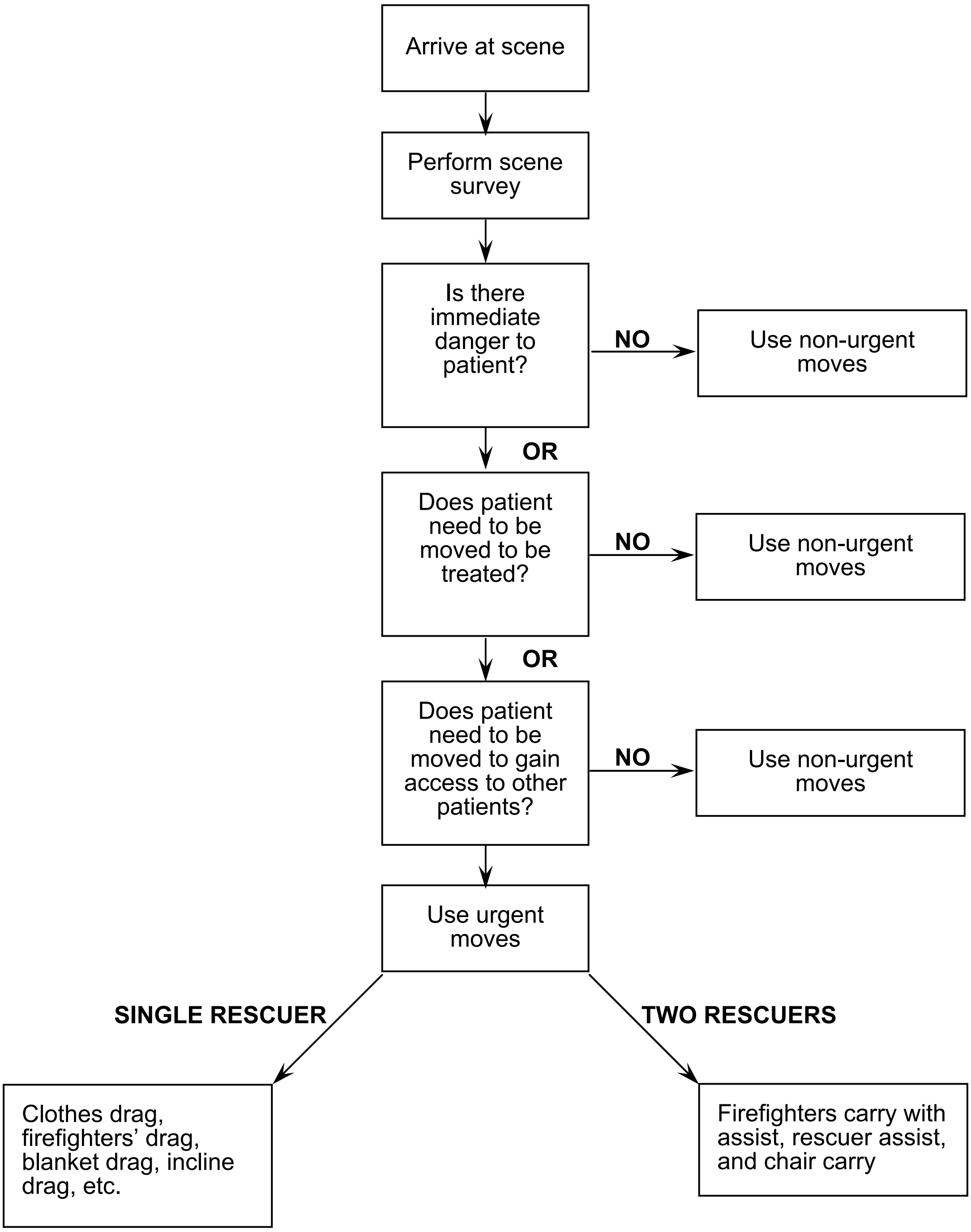
Skill Algorithms: Childbirth and Children

Abnormal Childbirth



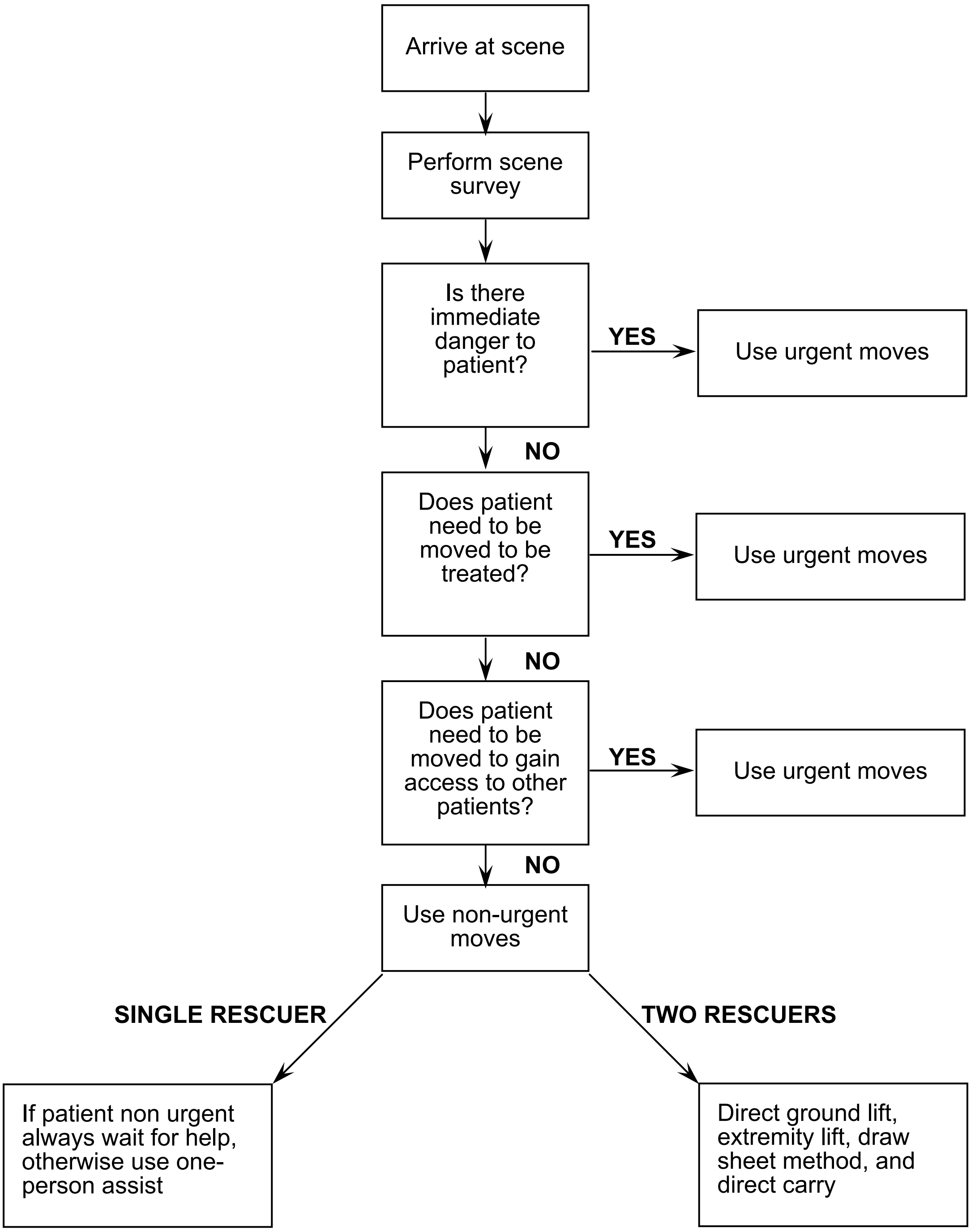
Skill Algorithms: Lifting and Moving Patients

Emergency Moves



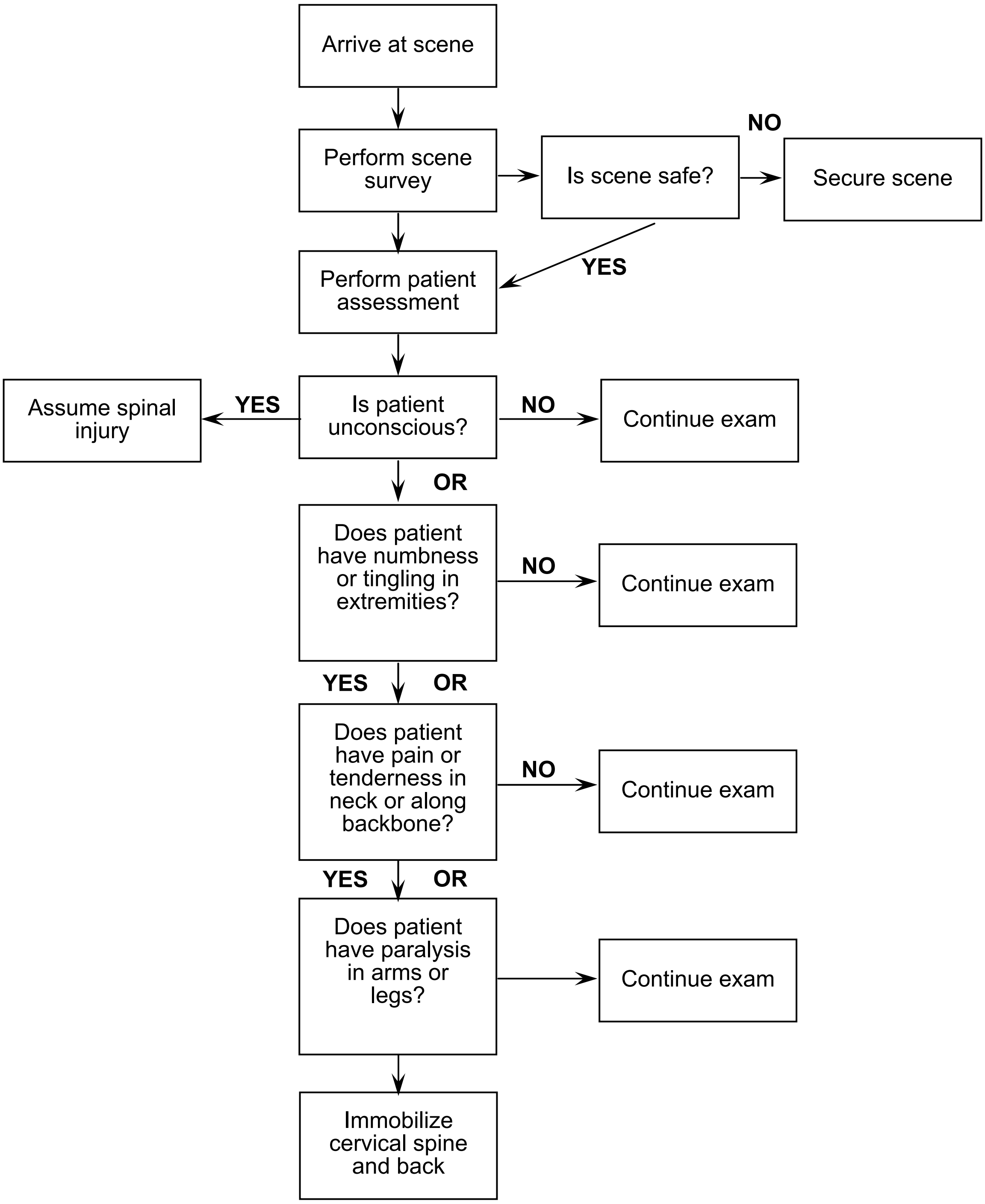
Skill Algorithms: Lifting and Moving Patients

Non-Emergency Moves



Skill Algorithms: Lifting and Moving Patients

Moving Patient with Suspected Cervical Spine Injury



APPENDIX A

The Sequence of BLS: Assessment, EMS Activation, the ABCs of CPR, and the "D" of Defibrillation

(Taken from: "Part 3: Adult Basic Life Support" *Circulation*. 102(8) (Supplement):I-22-I-59, August 22, 2000.)

The BLS sequence described in this section applies to victims >8 years old. This sequence will be applied to older children, adolescents, and adults. For simplicity, the victim is consistently referred to as an "adult" to differentiate the victim from a "pediatric" victim who is <8 years old.

Resuscitation Sequence

BLS consists of a series of skills performed sequentially. These skills include assessment skills and support/intervention skills. The assessment phases of BLS are crucial. No victim should undergo the more intrusive procedures of CPR (positioning, opening the airway, rescue breathing, or chest compressions) until need has been established by the appropriate assessment. Assessment also involves a more subtle, constant process of observing the victim and the victim's response to rescue support. The importance of the assessment phases should be stressed in teaching CPR.

Each of the ABCs of CPR-airway, breathing, and circulation-begins with an assessment phase: assess responsiveness, breathing, and signs of circulation. In the United States, the EMS system should be activated if any adult is found to be suddenly unresponsive. Outside the United States, EMS activation may be recommended if the victim is found to be unresponsive and not breathing, or activation may be delayed until after delivery of rescue breaths and determination that the victim has no signs of circulation. In all countries the EMS system should be activated as soon as it has been established that emergency care is needed. Whenever >2 rescuers are present, 1 rescuer remains with the victim to provide CPR while the second rescuer activates the EMS.

Hospitals and medical facilities and some businesses or building complexes will have an established emergency medical response system that provides a first response or early response on site. Such a response system notifies rescuers of the location of an emergency and the type of response needed. If the cardiopulmonary emergency occurs in a facility with an established medical response system, that system should be notified of the emergency, because it will provide more rapid response than EMS personnel arriving from outside the facility. For rescuers in these facilities, the emergency medical response system should replace the EMS system in the sequences below.

Assess Responsiveness

After determining that the scene is safe, the rescuer arriving at the side of the collapsed victim must quickly assess any injury and determine whether the person is responsive. Tap or gently shake the victim and shout, "Are you all right?" If the victim has sustained trauma to the head and neck or if neck trauma is suspected, move the victim only if absolutely necessary. Improper movement may cause paralysis in the victim with injury to the spine or spinal cord.

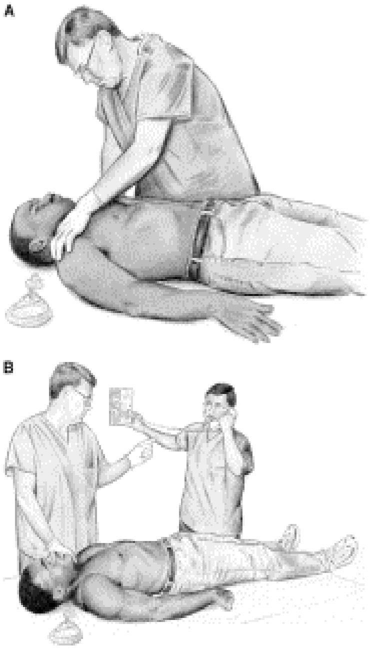


Figure 6. Check for unresponsiveness and EMS activation. The rescuer should tap the victim's shoulder and shout, "Are you all right?" If the victim does not respond, the rescuer directs someone to activate the emergency medical response system (telephone 911 or appropriate emergency telephone number).

Activate the EMS System

Activate the EMS system by calling the appropriate local emergency response system telephone number. This number should be widely publicized in each community. The person who calls the EMS system should be prepared to give the following information as calmly as possible:

1. Location of the emergency (with names of office or room number or cross streets or roads, if possible)
2. Telephone number from which the call is being made
3. What happened: heart attack, auto crash, etc
4. Number of persons who need help
5. Condition of the victim(s)
6. What aid is being given to the victim(s) (i.e., "CPR is being performed" or "we're using an AED")?
7. Any other information requested. To ensure that EMS personnel have no more questions, the caller should hang up only when instructed to do so by the EMD.

The stage in the rescue process at which EMS activation is appropriate is determined by each country's resuscitation council and is based on the facilities available, the remoteness from those facilities of the scene of collapse, and national and local practice. In the United States, for example, the EMS should be activated as soon as the adult victim is found to be unresponsive. In many countries in Europe, the EMS system is activated after the airway is opened, breathing is assessed, and the unresponsive victim is found to be not breathing. In Australia, the EMS system is activated after the rescuer delivers rescue breaths.

Airway

If the victim is unresponsive, the rescuer will need to determine whether the victim is breathing adequately. To assess breathing, the victim should be supine (lying on his or her back) with an open airway.

Position the Victim
For resuscitative efforts and evaluation to be effective, the victim must be supine and on a firm, flat surface. If the victim is lying face down, roll the victim as a unit so that the head, shoulders, and torso move simultaneously without twisting. The head and neck should remain in the same plane as the torso, and the body should be moved as a unit. The non-breathing victim should be supine with the arms alongside the body. The victim is now appropriately positioned for CPR.

Rescuer Position
The trained rescuer should be at the victim's side, positioned to perform both rescue breathing and chest compression. The rescuer should anticipate the arrival of an AED, if appropriate, and should be prepared to operate it when it arrives.

Open the Airway
When the victim is unresponsive/unconscious, muscle tone is decreased and the tongue and epiglottis may obstruct the pharynx. The tongue is the most common cause of airway obstruction in the unresponsive victim. Because the tongue is attached to the lower jaw, when you move the lower jaw forward you will lift the tongue away from the back of the throat and open the airway. The tongue or the epiglottis, or both, may also create an obstruction when negative pressure is created in the airway by spontaneous inspiratory effort; this creates a valve-type mechanism that can occlude the entrance to the trachea.

Figure 7. Obstruction by the tongue and epiglottis. When a victim is unconscious, the tongue and epiglottis can block the upper airway. The head tilt-chin lift opens the airway by lifting the tongue and epiglottis.

If there is no evidence of head or neck trauma, use the head tilt-chin lift maneuver described below to open the airway. Remove any visible foreign material or vomitus from the mouth. Wipe liquids or semi liquids out of the mouth with fingers covered with a glove or piece of cloth. Extract solid material with a hooked index finger while keeping the tongue and jaw supported with the other hand.

Figure 8. Head tilt-chin lift. This maneuver lifts the tongue to relieve airway obstruction.

Head Tilt-Chin Lift Maneuver
To accomplish the head tilt maneuver, place one hand on the victim's forehead and apply firm, backward pressure with your palm, tilting the head back. To complete the head tilt-chin lift maneuver, place the fingers of your other hand under the bony part of the lower jaw near the chin. Lift the jaw upward to bring the chin forward and the teeth almost to occlusion. This maneuver supports the jaw and helps tilt the head back. Do not press deeply into the soft tissue under the chin, because this might obstruct the airway. Do not use your thumb to lift the chin. Open the victim's mouth to facilitate spontaneous breathing and to prepare for mouth-to-mouth breathing.
If the victim's dentures are loose, head tilt-chin lift facilitates creation of a solid mouth-to-mouth seal. Remove the dentures if they cannot be kept in place.

Jaw-Thrust Maneuver
The jaw-thrust without head tilt maneuver for airway opening should be taught to both lay rescuers and healthcare providers. Place one hand on each side of the victim's head, resting your elbows on the surface on which the victim is lying. Grasp the angles of the victim's lower jaw and lift with both hands. If the lips close, you can retract the lower lip with your thumb. If mouth-to-mouth breathing is necessary while you maintain the jaw thrust, close the victim's nostrils by placing your cheek tightly against them. This technique is very effective for opening the airway but fatiguing and technically difficult for the rescuer.

Figure 9. Jaw thrust without head tilt. The jaw is lifted without tilting the head. This is the airway maneuver of choice for a victim suspected of having sustained a cervical spine injury.

The jaw-thrust technique *without* head tilt is the safest initial approach to opening the airway of the victim with suspected neck injury because it usually can be done without extending the neck. Carefully support the head without tilting it backward or turning it from side to side.

Recommendations for Opening the Airway
The recommended technique for opening the airway must be simple, safe, easily learned, and effective. Because head tilt-chin lift meets these criteria, it should be the method of choice for lay rescuers performing BLS, and lay rescuers should use this technique unless trauma is suspected. Although all rescuers are taught both head tilt-chin lift and jaw thrust methods of opening the airway, the professional rescuers (BLS ambulance providers and other healthcare providers) should be proficient in both head tilt-chin lift and jaw thrust.

Breathing

Assessment: Check for Breathing
To assess breathing, place your ear near the victim's mouth and nose while maintaining an open airway. Then, while observing the victim's chest, (1) *look* for the chest to rise and fall, (2) *listen* for air escaping during exhalation, and (3) *feel* for the flow of air. If the chest does not rise and

fall and no air is exhaled, the victim is not breathing. This evaluation procedure should take no more than 10 seconds.

Most victims with respiratory or cardiac arrest have no signs of breathing. Occasionally, however, the victim will demonstrate abnormal and inadequate breathing. Some victims demonstrate apparent respiratory efforts with signs of upper airway obstruction. These victims may resume effective breathing when you open the airway. Some victims may have a patent airway but may make only weak, inadequate attempts to breathe. Reflex gasping respiratory efforts (agonal respirations) are another form of inadequate breathing that may be observed early in the course of primary cardiac arrest. Absent or inadequate respirations require rapid intervention with rescue breathing. If you are not confident that respirations are adequate, proceed immediately with rescue breathing. Lay rescuers are taught to provide rescue breathing if "normal" breathing is absent.

If a victim resumes breathing and regains signs of circulation (pulse, normal breathing, coughing, or movement) during or after resuscitation, continue to help the victim maintain an open airway. Place the victim in a recovery position if the victim maintains breathing and signs of circulation.

Recovery Position

The recovery position is used in the management of victims who are unresponsive but are breathing and have signs of circulation (Class Indeterminate). When an unresponsive victim is lying supine and breathing spontaneously, the airway may become obstructed by the tongue or mucus and vomit. These problems may be prevented when the victim is placed on his or her side, because fluid can drain easily from the mouth.

Some compromise is needed between ideal position for maximum airway patency and optimal position to allow monitoring and support with good body alignment. A modified lateral position is used because a true lateral posture tends to be unstable, involves excessive lateral flexion of the cervical spine, and results in less free drainage from the mouth. A near-prone position, on the other hand, can hinder adequate ventilation because it splints the diaphragm and reduces pulmonary and thoracic compliance. Several versions of the recovery position exist, each with its own advantages. No single position is perfect for all victims. When deciding which position to use, consider 6 principles:

1. The victim should be in as near a true lateral position as possible, with the head dependent to allow free drainage of fluid.
2. The position should be stable.
3. Avoid any pressure on the chest that impairs breathing.
4. It should be possible to turn the victim on his or her side and to return to the back easily and safely, with concern for a possible cervical spine injury.
5. Good observation of and access to the airway should be possible.
6. The position itself should not cause an injury to the victim.

It is particularly important to avoid injury to the victim when turning the victim. If trauma is present or suspected, the victim should be moved only if an open airway cannot otherwise be maintained. This might be the case if, for example, a lone rescuer needs to leave the victim to get

Figure 10. The recovery position.

help. Monitor the victim, particularly for impairment of blood flow in the lowermost arm. If the victim remains in the recovery position for >30 minutes, turn the victim to the opposite side. Although no single specific recovery position can be recommended, the one illustrated is suitable for training purposes.

Provide Rescue Breathing
When providing rescue breathing, you must inflate the victim's lungs adequately with each breath.

Mouth-to-Mouth Breathing
Mouth-to-mouth rescue breathing is a quick, effective way to provide oxygen and ventilation to the victim. Your exhaled breath contains enough oxygen to supply the victim's needs. To provide rescue breaths, hold the victim's airway open, pinch the nose, and make a seal with your mouth over the victim's mouth. Rest the palm of one hand on the victim's forehead and pinch the victim's nose closed with your thumb and index finger. Pinching the nose will prevent air from escaping through the victim's nose. Take a deep breath and seal your lips around the victim's mouth, creating an airtight seal. Give slow breaths, delivering each breath over 2 seconds, making sure the victim's chest rises with each breath. Be prepared to deliver approximately 10 to 12 breaths per minute (1 breath every 4 to 5 seconds) if rescue breathing alone is required.

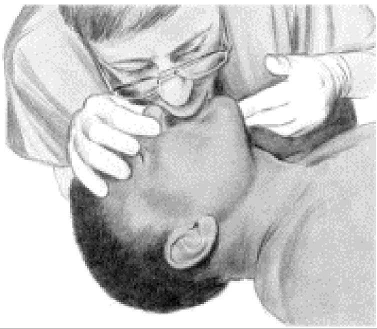


Figure 11. Mouth-to-mouth rescue breathing.

The number of breaths delivered to initiate rescue breathing/ventilation varies throughout the world, and there is no data to suggest superiority of one number over the other. In the United States, 2 breaths are provided. In Europe, Australia, and New Zealand, 5 breaths are provided to initiate resuscitation. Each approach has its advantages. Delivery of fewer breaths will shorten the time to assessment of circulation/pulse and attachment of an AED (and possible defibrillation), but delivery of a greater number of breaths may help to correct hypoxia and hypercarbia. In the absence of data to support one number of breaths over another, it is appropriate to deliver 2 to 5 initial breaths, according to local custom.

Gastric inflation frequently develops during mouth-to-mouth ventilation. Gastric inflation can produce serious complications, such as regurgitation, aspiration, or pneumonia. It also increases intragastric pressure, elevates the diaphragm, restricts lung movements, and decreases respiratory system compliance. Gastric inflation occurs when the pressure in the esophagus exceeds the lower esophageal sphincter opening pressure, causing the sphincter to open so that air delivered during rescue breaths enters the stomach instead of the lungs. During cardiac arrest, the likelihood of gastric inflation increases because the lower esophageal sphincter relaxes. Factors that contribute to creation of a high esophageal pressure and gastric inflation during rescue breathing include a short inspiratory time, a large tidal volume, and a high peak airway pressure.

Previous guidelines recommended that rescue breaths provide a tidal volume of 800 to 1200 mL delivered over 1 to 2 seconds. With respect to gastric inflation, a substantially smaller tidal volume would be safer but is ineffective in maintaining adequate arterial oxygen saturation unless supplemental oxygen can be delivered via a facemask or bag-valve mask.

To reduce the risk of gastric inflation during mouth-to-mouth ventilation, deliver slow breaths at the lowest tidal volume that will still make the chest visibly rise with each ventilation. For mouth-to-mouth ventilation in most adults, this volume will be approximately 10 mL/kg (approximately 700 to 1000 mL) and should be delivered over 2 seconds (Class IIa). This recommendation represents a slightly decreased range of tidal volume compared with previous guidelines, and it uses the upper limit of inspiratory time recommended in the previous guidelines. This new recommendation is intended to reduce the risk of gastric inflation (and its serious consequences) while maintaining adequate arterial oxygen saturation during respiratory and cardiac arrest.

If you take a deep breath before each ventilation, you will optimize your exhaled gas composition, ensuring that you will provide as much oxygen as possible to the victim. You are providing adequate ventilation if you see the chest rise and fall with each breath and you hear and feel the air escape during exhalation. When possible (i.e., during 2-rescuer CPR), maintain airway patency to allow unimpeded exhalation between rescue breaths.

If initial (or subsequent) attempts to ventilate the victim are unsuccessful, reposition the victim's head and reattempt rescue breathing. Improper chin and head positioning is the most common cause of difficulty with ventilation. If the victim cannot be ventilated after repositioning of the head, the healthcare provider (but *not* the lay rescuer) should proceed with maneuvers to relieve FBAO (see "Foreign-Body Airway Obstruction Management" below).

Mouth-to-Nose Breathing

The mouth-to-nose method of ventilation is recommended when it is impossible to ventilate through the victim's mouth, the mouth cannot be opened (trismus), the mouth is seriously injured, or a tight mouth-to-mouth seal is difficult to achieve. Mouth-to-nose breathing may be the best method of providing ventilation while rescuing a submersion victim from the water. The rescuer's hands often will be used to support the victim's head and shoulders during rescue. The mouth-to-nose technique may enable the rescuer to begin rescue breathing as soon as the victim's head is out of the water.

To provide mouth-to-nose breathing, tilt the victim's head back with one hand on the forehead and use the other hand to lift the victim's mandible (as in head tilt-chin lift) and close the victim's mouth. Take a deep breath, seal your lips around the victim's nose, and exhale into the victim's nose. Then remove your lips from the victim's nose, allowing passive exhalation. It may be

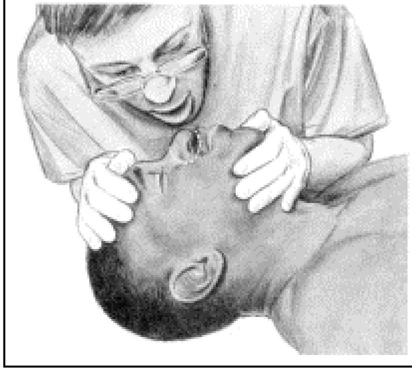


Figure 12. Mouth-to-nose rescue breathing.

necessary to open the victim's mouth intermittently and separate the lips with the thumb to allow free exhalation; this is particularly important if partial nasal obstruction is present.

Mouth-to-Stoma Breathing

A tracheal stoma is a permanent opening at the front of the neck that extends from the surface of the skin into the trachea. When a person with a tracheotomy requires rescue breathing, direct mouth-to-stoma ventilation should be performed. Place your mouth over the stoma, making an airtight seal around the stoma. Blow into the stoma until the chest rises. Then remove your mouth from the patient, allowing passive exhalation.

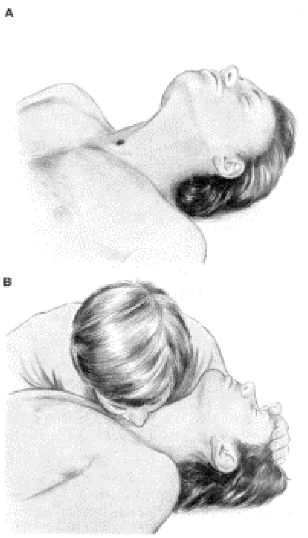


Figure 13. Mouth-to-stoma rescue breathing. A, Stoma; B, mouth-to-stoma.

A tracheotomy tube may be present in the tracheal stoma. This tube must be patent for either spontaneous ventilation or rescue breathing to occur. If the tube is not patent and you are unable to clear an obstruction or any secretions, remove and replace the tube. If a second tube is unavailable and the original tube is obstructed, remove the tube and provide rescue breathing through the stoma. If a significant volume of air escapes through the victim's nose and mouth during ventilation through the tracheotomy, seal the victim's mouth and nose with your hand or a tightly fitting facemask. Air escape is alleviated if you can provide ventilation through a tracheotomy tube with an inflated cuff.

Mouth-to-Barrier Device Breathing

Some rescuers prefer to use a barrier device during mouth-to-mouth ventilation. The use of barrier devices should be encouraged for rescuers who may perform CPR in areas outside the home, such as the workplace. Two broad categories of barrier devices are available: mouth-to-mask devices and face shields. Mouth-to-mask devices typically have a 1-way valve so that the victim's exhaled air does not enter the rescuer's mouth. Face shields usually have no exhalation valve, and the victim's expired air escapes between the shield and the victim's face. Barrier devices should have a low resistance to gas flow so that they do not impede ventilation.

Mouth-to-Face Shield Rescue Breathing

Unlike mouth-to-mask devices, face shields have only a clear plastic or silicone sheet that separates the rescuer from the victim. The opening of the face shield is placed over the victim's mouth. In some models a short (1- to 2-inch) tube is part of the shield. If a tube is present, insert the tube in the victim's mouth, over the tongue. Pinch the victim's nose closed and seal your mouth around the center opening of the face shield while maintaining head tilt-chin lift or jaw thrust. Provide slow breaths (2 seconds each) through the 1-way valve or filter in the center of the face shield, allowing the victim's exhaled air to escape between the shield and the victim's face when you lift your mouth off the shield between breaths.

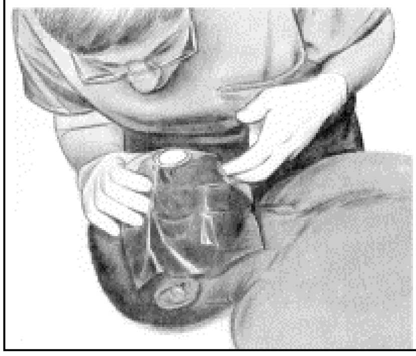


Figure 14. Face shield. The shield is placed over the mouth and nose with the opening at the center of the shield placed over the victim's mouth. The technique of rescue breathing is the same as for mouth-to-mouth.

The face shield should remain on the victim's face during chest compressions and ventilations. If the victim begins to vomit during rescue efforts, immediately turn the victim onto his side, remove the face shield, and clear the airway. Proximity to the victim's face and the possibility of contamination if the victim vomits are major disadvantages of face shields. In addition, the efficacy of face shields has not been documented conclusively. For these reasons, healthcare professionals and rescuers with a duty to respond should use face shields only as a substitute for mouth-to-mouth breathing and should use mouth-to-mask or bag-mask devices at the first opportunity.

Tidal volumes and inspiratory times for rescuer breathing through barrier devices should be the same as those for mouth-to-mouth breathing (in an adult, a tidal volume of approximately 10 mL/kg or 700 to 1000 mL delivered over 2 seconds and sufficient to make the chest rise clearly).

Mouth-to-Mask Rescue Breathing

A transparent mask with or without a 1-way valve is used in mouth-to-mask breathing. The 1-way valve directs the rescuer's breath into the victim while diverting the victim's exhaled air away from the rescuer. Some devices include an oxygen inlet that permits administration of supplemental oxygen.

Mouth-to-mask ventilation is particularly effective because it allows the rescuer to use 2 hands to create a mask seal. There are 2 possible techniques for using the mouth-to-mask device. The first technique positions the rescuer above the victim's head (cephalic technique). A single rescuer can use this technique when the patient is in respiratory arrest (but not cardiac arrest) or during performance of 2-rescuer CPR. A jaw thrust is used in the cephalic technique, which has the advantage of positioning the rescuer so that the rescuer is facing the victim's chest while performing rescue breathing.

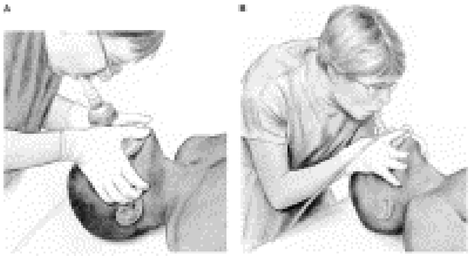


Figure 15. Mouth-to-mask, cephalic technique. A, Using thumb and thenar eminence on the top of the mask. B, Circling the thumb and first finger around the top of the mask

In the second technique (lateral technique), the rescuer is positioned at the victim's side and uses head tilt-chin lift. The lateral technique is ideal for performing 1-rescuer CPR, because the rescuer can maintain the same position for both rescue breathing and chest compressions.

Figure 16. Mouth-to-mask, lateral technique. The lateral technique allows the rescuer to perform 1-rescuer CPR from a fixed position at the side of the victim.

Cephalic technique. Position yourself directly above the victim's head and perform the following steps:

- Apply the mask to the victim's face, using the bridge of the nose as a guide for correct position.
- Place your thumbs and thenar eminence (portion of the palm at the base of the thumb) along the lateral edges of the mask.
- Place the index fingers of both hands under the victim's mandible and lift the jaw into the mask as you tilt the head back. Place your remaining fingers under the angle of the jaw.
- While lifting the jaw, squeeze the mask with your thumbs and thenar eminence to achieve an airtight seal (see jaw thrust).
- Provide slow rescue breaths (2 seconds) while observing for chest rise.

An alternative method for the cephalic technique is to use the thumb and first finger of each hand to make a complete seal around the edges of the mask. Use the remaining fingers to lift the angle of the jaw and extend the neck. With either variation of the cephalic technique, the rescuer uses both hands to hold the mask and open the airway. In victims with suspected head or neck (potential cervical spine) injury, lift the mandible at the angles of the jaw but do not tilt the head.

Lateral technique. Position yourself beside the victim's head to provide rescue breathing and chest compressions:

- Apply the mask to the victim's face, using the bridge of the nose as a guide for correct position.
- Seal the mask by placing your index finger and thumb of the hand closer to the top of the victim's head along the border of the mask and placing the thumb of your other hand along the lower margin of the mask.
- Place your remaining fingers on the hand closer to the victim's feet along the bony margin of the jaw and lift the jaw while performing a head tilt-chin lift.
- Compress firmly and completely around the outside margin of the mask to provide a tight seal.
- Provide slow rescue breaths while observing for chest rise.

Effective use of the mask requires instruction and supervised practice. During 2-rescuer CPR, the mask can be used in a variety of ways. The most appropriate method will depend on the experience of personnel and equipment available. Oral airways and cricoid pressure may be used with mouth-to-mask and any other form of rescue breathing.

If oxygen is not available, tidal volumes and inspiratory times for mouth-to-mask ventilation should be the same as for mouth-to-mouth breathing (in an adult, a tidal volume of approximately 10 mL/kg or 700 to 1000 mL delivered over 2 seconds and sufficient to make the chest rise clearly). If supplemental oxygen is used with the facemask, a minimum flow rate of 10 L/min provides an inspired concentration of oxygen >40%. When oxygen is provided, lower tidal volumes are recommended (tidal volume of approximately 6 to 7 mL/kg or 400 to 600 mL given over 1 to 2 seconds until the chest rises) (Class IIb). The smaller tidal volumes are effective for maintaining adequate arterial oxygen saturation, provided that supplemental oxygen is delivered to the device, but these smaller volumes will not maintain normocarbia. These volumes will reduce the risk of gastric inflation and its serious consequences.

Bag-Mask Device

Bag-mask devices used in the prehospital setting consist of a self-inflating bag and a nonrebreathing valve attached to a facemask. These devices provide the most common method of delivering positive-pressure ventilation in both the EMS and hospital settings. Most commercially available adult bag-mask units have a volume of approximately 1600 mL, which is usually adequate to produce lung inflation. In several studies, however, many rescuers were unable to deliver adequate tidal volumes to unintubated manikins. Adult bag-mask units may provide a smaller tidal volume than mouth-to-mouth or mouth-to-mask ventilation because the lone rescuer may have difficulty obtaining a leak-proof seal to the face while squeezing the bag and maintaining an open airway. For this reason, self-inflating bag-mask units are most effective when 2 trained and experienced rescuers work together, one sealing the mask to the face and the other squeezing the bag slowly over 2 seconds. In fact, in some countries (i.e., Australia), bag-mask ventilation during BLS CPR is performed by 2 rescuers.

Figure 17. Two-rescuer use of the bag mask. The rescuer at the head uses the thumb and first finger of each hand to provide a complete seal around the edges of the mask. Use the remaining fingers to lift the mandible and extend the neck while observing chest rise. The other rescuer slowly squeezes the bag (over 2 seconds) until he observes chest rise.

There are significant advantages to the use of small tidal volumes during resuscitation. Small tidal volume will reduce the risk of gastric inflation and its consequences, but it does risk the development of hypoxia and hypercarbia and their complications. The use of small tidal volumes with oxygen supplementation during resuscitation has been evaluated in laboratory and clinical settings. With smaller tidal volumes, airway pressure does not exceed the victim's lower esophageal sphincter pressure, so lower tidal volumes will reduce gastric inflation and its potential consequences of regurgitation, aspiration, and pneumonia. Supplementary oxygen will ensure maintenance of oxygen saturation at these smaller tidal volumes.

If supplementary oxygen (minimum flow rate of 8 to 12 L/min with oxygen concentration >40%) is available, the rescuer skilled in bag-mask ventilation should attempt to deliver a smaller tidal volume (6 to 7 mL/kg or approximately 400 to 600 mL) over 1 to 2 seconds (Class IIb). Of course, in the clinical setting, the actual tidal volume delivered is impossible to determine. Tidal volume can be titrated to provide sufficient ventilation to maintain oxygen saturation and produce visible chest expansion. The tidal volume should be sufficient to make the chest rise. It is important to note that this smaller tidal volume may be associated with the development of hypercarbia.

If oxygen is not available, the rescuer should attempt to deliver the same tidal volume recommended for mouth-to-mouth ventilation (10 mL/kg, 700 to 1000 mL) over 2 seconds. This tidal volume should result in very obvious chest rise.

An adult bag-mask device should have the following features:

- A nonjam inlet valve system allowing a maximum oxygen inlet flow of 30 L/min
- Either no pressure relief valve or, if a pressure relief valve is present, the pressure relief valve must be capable of being closed
- Standard 15-mm/22-mm fittings
- An oxygen reservoir to allow delivery of high concentrations of oxygen
- A nonrebreathing outlet valve that cannot be obstructed by foreign material
- Ability to function satisfactorily under common environmental conditions and extremes of temperature

Technique. Bag-mask ventilation technique requires instruction and practice. The rescuer should be able to use the equipment effectively in a variety of situations.

If you are the only rescuer providing respiratory support, position yourself at the top of the victim's head. If there is no concern about neck injury, tilt the victim's head back and place it on a towel or pillow to achieve the sniffing position. Apply the mask to the victim's face with one hand, using the bridge of the nose as a guide for correct position. Place the third, fourth, and fifth fingers of that hand along the bony portion of the mandible, and place the thumb and index fingers of the same hand on the mask. Maintain head tilt and jaw thrust to keep the airway patent and snug against the mask.

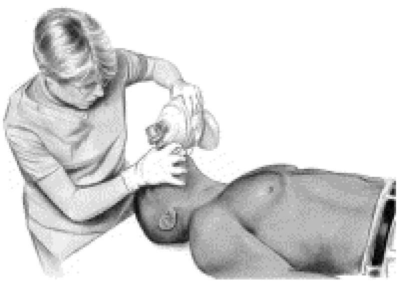


Figure 18. One-rescuer use of the bag mask. The rescuer circles the top edges of the mask with her index and first finger and lifts the jaw with the remaining fingers. The bag is squeezed while the rescuer observes chest rise. Mask seal is key to the successful use of the bag mask.

Compress the bag with your other hand and watch the chest to be sure it rises, indicating that ventilation is adequate. Deliver each breath over 2 seconds (using 1 to 2 seconds when you deliver smaller tidal volumes with oxygen supplementation). You may want to compress the bag against your body to achieve the selected tidal volume. It is critical to maintain an airtight seal during delivery of each breath.

Effective ventilation is more likely to be provided when 2 rescuers use the bag-mask system: 1 rescuer holds the mask and 1 rescuer squeezes the bag. The techniques for holding the mask are the same as for mouth-to-mask devices described above. If a third rescuer is available, cricoid pressure may be applied.

Bag-mask ventilation is a complex technique that requires considerable skill and practice. Such skill is difficult to maintain when used infrequently. Accordingly, alternative airway devices such as the laryngeal mask airway and the esophageal-tracheal Combitube are being introduced within the scope of BLS practice for healthcare providers. These devices are generally easier to insert than tracheal tubes, but they allow similar support of ventilation. These devices may provide acceptable alternatives to bag-mask ventilation for healthcare providers who are well trained and have sufficient opportunities to use these devices (Class IIb). A detailed explanation of these devices is found in Part 6 of this document (see "Adjuncts for Oxygenation, Ventilation, and Airway Control").

Cricoid Pressure

The cricoid pressure technique applies pressure to the victim's cricoid cartilage. This pushes the trachea posteriorly, compressing the esophagus against the cervical vertebrae during rescue breathing. Cricoid pressure is effective in preventing gastric inflation, reducing the risk of regurgitation and aspiration. It should be used only if the victim is unconscious. Proper use of the cricoid pressure technique requires an additional rescuer to provide cricoid pressure alone, without diversion to other resuscitation activities. As a result, only healthcare professionals should use this technique when an extra rescuer is present. This means that during "2"-rescuer CPR, 3 rescuers would actually be required: 1 rescuer to perform rescue breathing, 1 to perform chest compressions, and 1 to apply cricoid pressure.

The technique for applying cricoid pressure is as follows:

1. Locate the thyroid cartilage (Adam's apple) with your index finger.
2. Slide your index finger to the base of the thyroid cartilage and palpate the prominent horizontal ring below (cricoid cartilage).
3. Using the tips of your thumb and index finger, apply firm backward pressure to the cricoid cartilage.

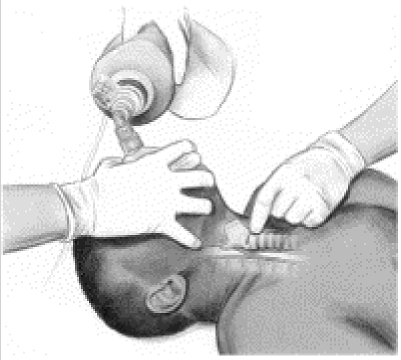


Figure 19. Cricoid pressure (Sellick maneuver).

Apply moderate rather than excessive pressure on the cricoid. Use of moderate pressure is particularly important if the victim is small.

Rescue Breathing Without Chest Compressions

Deliver 2 initial breaths slowly over 2 seconds each, allowing complete exhalation between breaths to diminish the likelihood of exceeding the esophageal opening pressure. This technique should result in less gastric inflation, regurgitation, and aspiration. For respiratory arrest, when chest compressions are not being performed, provide approximately 10 to 12 breaths per minute (1 breath every 4 to 5 seconds). Check every few minutes to ensure that the victim continues to show signs of circulation (see next section).

Circulation

Assessment: No Pulse Check for Lay Rescuers

Since the first resuscitation guidelines were published in 1968, the pulse check has been the "gold standard" method of determining whether the heart was beating. In the sequence of CPR, the absence of a pulse indicates cardiac arrest and the need to provide chest compressions. In the current era of early defibrillation, absence of a pulse is an indication for the attachment of the AED. Since 1992 several published studies have called into question the validity of the pulse check as a test for cardiac arrest, particularly when used by laypersons. This research has used manikin simulation, unconscious patients undergoing cardiopulmonary bypass, unconscious mechanically ventilated patients, and conscious "test persons." These studies conclude that as a diagnostic test for cardiac arrest, the pulse check has serious limitations in accuracy, sensitivity, and specificity.

When laypersons use the pulse check, they require a long time to decide whether a pulse is present. They then fail in 1 of 10 times to recognize the absence of a pulse or cardiac arrest (poor sensitivity). When lay rescuers assess unresponsive victims who do have a pulse, the rescuers miss the pulse in 4 of 10 times (poor specificity). Details of the published studies include the following conclusions:

1. Rescuers require far too much time to perform the pulse check: The majority of all rescue groups, including laypersons, medical students, paramedics, and physicians, take much longer than the recommended 5 to 10 seconds to check for the carotid pulse. In one study, half of the rescuers required more than 24 seconds to decide whether a pulse was present. With survival from VF falling by 7% to 10% for every minute defibrillation is delayed, time allotted to assessment of circulation must be brief. Only 15% of the participants correctly confirmed the presence of a pulse within 10 seconds, the maximum time currently allotted for a pulse check.
2. When considered as a diagnostic test, the pulse check is extremely inaccurate. This accuracy can be expressed in a classic 2×2 matrix, based on results from a representative study and summarized as follows:

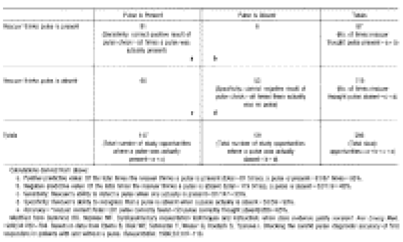


Figure 20. Sensitivity, Specificity, and Reliability of Pulse Check: Performance of Pulse Check as a Diagnostic Test

a. Specificity (ability to correctly identify victims who have NO pulse and ARE in cardiac arrest) is only 90%: When *subjects were pulseless*, rescuers thought a pulse was present approximately 10% of the time. By mistakenly thinking a pulse IS present when it is not, rescuers will fail to provide chest compressions and will not attach an AED for 10 of every 100 people in cardiac arrest. The consequences of such errors would be death without possibility of resuscitation for 10 of every 100 victims of cardiac arrest.

b. Sensitivity (ability to correctly recognize victims who HAVE a pulse and ARE NOT in cardiac arrest) was only 55%. When the pulse was *present*, the rescuers assessed the pulse as being *absent* approximately 45% of the time. By erroneously thinking a pulse was absent, rescuers would provide chest compressions for approximately 4 of 10 potential victims who do not need them and would attach an AED, if available.

3. The overall accuracy was only 65%, leaving an error rate of 35%.

On review of this and other data, the experts and delegates at the 1999 Evidence Evaluation Conference and the International Guidelines 2000 Conference concluded that the pulse check could not be recommended as a tool for lay rescuers to identify victims of cardiac arrest in the CPR sequence. If rescuers use the pulse check to identify victims of cardiac arrest, they will "miss" true cardiac arrest at least 10 times out of 100. In addition, rescuers will provide unnecessary chest compressions (and may attach an AED) for many victims who are not in cardiac arrest and do not require such intervention. This error is less serious but still undesirable. The more serious error in this situation is clearly the potential failure to intervene for victims of cardiac arrest who require immediate intervention to survive.

Therefore, *the lay rescuer should not rely on the pulse check to determine the need for chest compressions* or use of an AED. Lay rescuers should not perform the pulse check and will not be taught the pulse check in CPR courses (Class IIa). Instead, lay rescuers will be taught to assess for "signs of circulation," including normal breathing, coughing, or movement, in response to the rescue breaths. This guideline recommendation applies to *victims of any age. Healthcare providers should continue to use the pulse check as one of several signs of circulation*. Other signs of circulation include breathing, coughing, or movement.

It is expected that this guideline change will result in more rapid and more accurate identification of cardiac arrest. It should eliminate delays in provision of chest compressions and use of the AED. Most important, it should reduce the missed opportunities to provide CPR and early defibrillation for victims in cardiac arrest.

Assessment: Check for Signs of Circulation

These guidelines often refer to assessment of "signs of circulation." For the *lay rescuer*, this means the following: deliver initial rescue breaths and evaluate the victim for normal breathing, coughing, or movement in response to the rescue breaths. The lay rescuer will look, listen, and feel for breathing while scanning the victim for signs of other movement. Lay rescuers should look for "normal breathing" to minimize confusion with agonal respirations.

When healthcare professionals assess signs of circulation, they add a pulse check while simultaneously evaluating the victim for breathing, coughing, or movement. Professional rescuers are instructed to look for "breathing" because they are trained to distinguish between agonal breathing and other forms of ventilation not associated with cardiac arrest.

In practice, the assessment for signs of circulation for the lay rescuer is performed as follows:

1. Provide initial rescue breaths to the unresponsive, non-breathing victim.
2. Look for signs of circulation.
   a. With your ear near the victim's mouth, look, listen, and feel for normal breathing or coughing.
   b. Quickly scan the victim for any signs of movement.
3. If the victim is not breathing normally, coughing, or moving, immediately begin chest compressions.

This assessment should take no more than 10 seconds. Healthcare providers should perform a pulse check in conjunction with assessment for signs of circulation. If you are not *confident* that circulation is present, begin chest compressions immediately.

When a pulse check is performed for the victim >1 year of age, the carotid artery is the preferred artery to palpate, although the femoral artery may be used as an alternative. Pulses will persist in these arteries even when hypotension and poor perfusion cause peripheral pulses to disappear. To locate the carotid artery, maintain a head tilt with one hand on the victim's forehead and locate the trachea with 2 or 3 fingers of the other hand. Slide these 2 or 3 fingers into the groove between the trachea and the muscles at the side of the neck, where the carotid pulse can be felt. Use only gentle pressure so that you do not compress the artery. The artery on the side of the neck toward you is typically most readily palpated.

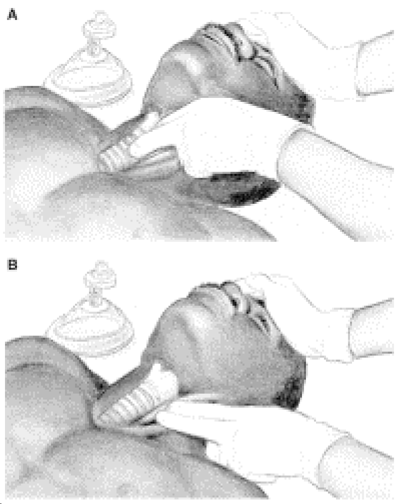


Figure 21. Checking the carotid pulse. A, Locate the trachea. B, Gently feel for the carotid pulse.

Provide Chest Compressions

Chest compressions for CPR are serial, rhythmic applications of pressure over the lower half of the sternum. These compressions create blood flow by increasing intrathoracic pressure or directly compressing the heart. Blood circulated to the lungs by chest compressions, accompanied by properly performed rescue breathing, will most likely deliver adequate oxygen to the brain and other vital organs until defibrillation can be performed.

Theoretical, animal, and human data supports a rate of chest compression >80 per minute to achieve optimal forward blood flow during CPR. For this reason, a compression rate of 100 per minute is recommended (Class IIb). The compression rate refers to the *speed* of compressions, *not to the actual number* of compressions delivered in 1 minute. A compression rate of approximately 100 per minute will result in delivery of *fewer than* 100 compressions per minute by the single rescuer who must interrupt chest compressions to deliver rescue breaths. The actual number of chest compressions delivered per minute depends on the accuracy and consistency of the rate of chest compressions and the time the rescuer requires to open the airway and deliver rescue breaths.

Previous versions of the adult BLS guidelines recommended a ratio of 15 compressions to 2 ventilations for 1-rescuer CPR and a ratio of 5 compressions to 1 ventilation for 2-rescuer CPR. A ratio of 15:2 provides more chest compressions per minute (approximately 64 versus 50) than a ratio of 5:1. There is evidence to suggest that adult cardiac arrest victims are more likely to be saved if a higher number of chest compressions are delivered during CPR, even if the victims receive fewer ventilations. The quality of rescue breathing and chest compressions is not affected by compression-ventilation ratio.

During cardiac arrest, the coronary perfusion pressure gradually rises with the performance of sequential compressions. This pressure is higher after 15 uninterrupted chest compressions than it is after 5 chest compressions. Therefore, after each pause for ventilation, several compressions must be performed before previous levels of brain and coronary perfusion are reestablished. For these reasons, a ratio of 15 compressions to 2 ventilations is recommended for 1 *or* 2 rescuers (Class IIb) until the airway is secured. This applies to adult BLS provided by both laypersons and healthcare providers. Research is ongoing to determine the benefits of further increasing the number of compressions between ventilations during CPR. Once the airway is secured (protected) with a cuffed tracheal tube (as discussed in the ACLS guidelines), compressions may be continuous and ventilations may be asynchronous, with a ratio of 5 compressions to 1 ventilation.

During actual CPR, rescuers often compress at a slower rate than 100 per minute. For teaching and during performance of CPR, therefore, some form of audio timing prompt may help to achieve the recommended compression rate of approximately 100 per minute (Class IIb).

The victim must be in the horizontal, supine position on a firm surface during chest compressions to optimize the effect of the compressions and blood flow to the brain. When the head is elevated above the heart, blood flow to the brain is reduced or eliminated. If the victim cannot be removed from a bed, place a rigid board, preferably the full width of the bed, under the victim's back to avoid diminished effectiveness of chest compression.

Chest Compression Technique

Proper hand placement is established by identifying the lower half of the sternum. The guidelines below may be used, or you may choose alternative techniques to identify the lower sternum.

1. Place your fingers on the lower margin of the victim's rib cage on the side nearer you.

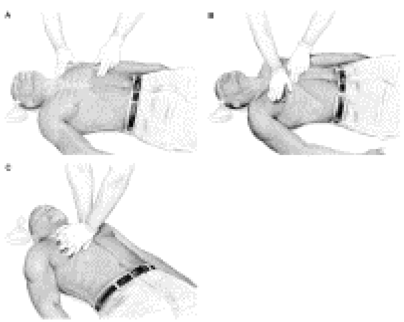


Figure 22. Positioning the rescuer's hands on the lower half of the sternum. The rescuer should (A) locate the margin of the rib using first and second finger of the hand closer to the victim's feet, (B) follow the rib margin to the base of the sternum (xiphoid process) and place his or her hand above the fingers (on the lower half of the sternum), and (C) place the other hand directly over the hand on the sternum.

2. Slide your fingers up the rib cage to the notch where the ribs meet the lower sternum in the center of the lower part of the chest.
3. Place the heel of one hand on the lower half of the sternum and the other hand on top of the first, so that the hands are parallel. Be sure the long axis of the heel of your hand is placed on the long axis of the sternum. This will keep the main force of compression on the sternum and decrease the chance of rib fracture. Do not compress over the lowest portion of the base of the sternum (the xiphoid process).
4. Your fingers may be either extended or interlaced but should be kept off the chest. If you have difficulty creating sufficient force during compressions, an acceptable alternative hand position is to grasp the wrist of the hand on the chest with your other hand and push downward with both. This technique is helpful for rescuers with arthritic hands and wrists.

A simplified method of achieving correct hand position has also been used in various settings for teaching laypersons the chest compression technique. To find a position on the lower half of the sternum, the rescuer is instructed to place the heel of one hand in the center of the chest between the nipples. This method has been used with success for >10 years in dispatcher-assisted CPR and other settings.

Effective compression is accomplished by attention to the following guidelines:

1. Lock the elbows in position, with the arms straightened. Position your shoulders directly over your hands so that the thrust for each chest compression is straight down on the sternum. If the thrust is not in a straight downward direction, the victim's torso has a tendency to roll; if this occurs, a part of the force of compressions will be lost, and the chest compressions may be less effective.

Figure 23. Position of the rescuer during compressions

2. Depress the sternum approximately 1 1/2 to 2 inches (4 to 5 cm) for the normal-sized adult. Rarely, in very small victims, lesser degrees of compression may be sufficient to generate a palpable carotid or femoral pulse. Alternatively, in large victims, sternal compression depth of 1 1/2 to 2 inches (4 to 5 cm) may be inadequate, and a slightly greater depth of chest compression may be needed to generate a carotid or femoral pulse. Optimal sternal compression is generally gauged by identifying the compression force that generates a palpable carotid or femoral pulse. However, this validation of pulses requires at least 2 healthcare providers (one provides compressions while the other attempts to palpate the pulse), and it may yield misleading results. Detection of a pulse during CPR does not necessarily mean that there is optimal or even adequate blood flow, because a compression wave may be palpated in the absence of effective blood flow. The best method of providing adequate compression force is to depress the sternum 1 1/2 to 2 inches (4 to 5 cm) with each compression.
3. Release the pressure on the chest to allow blood to flow into the chest and heart. You must release the pressure completely and allow the chest to return to its normal position after each compression. Keep your hands in contact with the victim's sternum to maintain proper hand position. Chest compressions should be performed at a rate of approximately 100 per minute.

4. Effective cerebral and coronary perfusion has been shown to occur when 50% of the duty cycle is devoted to the chest compression phase and 50% to the chest relaxation phase. Rescuers find this ratio reasonably easy to achieve with practice.
5. To maintain correct hand position throughout the 15-compression cycle, do not lift your hands from the chest or change their position in any way. However, do allow the chest to recoil to its normal position after each compression.

Rescue breathing and chest compression must be combined for effective resuscitation of the victim of cardiopulmonary arrest. Research over the past 40 years has helped identify the mechanisms for blood flow during chest compression. In both animal models and humans, it appears that blood flow during CPR probably results from manipulation of intrathoracic pressure (thoracic pump mechanism) or direct cardiac compression. The duration of CPR affects the mechanism of CPR. In CPR of short duration, blood flow is generated more by the cardiac pump mechanism. When the duration of cardiac arrest or resuscitation with chest compressions is prolonged, the heart becomes less compliant. Only in this setting does the thoracic pump mechanism dominate. When the thoracic pump mechanism dominates, however, the cardiac output generated by chest compression decreases significantly.

Over the past 20 years, there has been important research regarding techniques and devices to improve blood flow during CPR, including pneumatic vest CPR, interposed abdominal compression CPR (IAC-CPR), and active compression-decompression CPR (ACD-CPR). Recent evaluation of these devices in humans has resulted in more specific recommendations for their use. The interested reader will find a more expanded discussion of this topic in Part 6 of this publication.

During cardiac arrest, properly performed chest compressions can produce systolic arterial blood pressure peaks of 60 to 80 mm Hg, but diastolic blood pressure is low. Mean blood pressure in the carotid artery seldom exceeds 40 mm Hg. Cardiac output resulting from chest compressions is probably only one fourth to one third of normal and decreases during the course of prolonged conventional CPR. You can optimize blood flow during chest compression if you use the recommended chest compression force and chest compression duration and maintain a chest compression rate of approximately 100 per minute.

Airway-breathing-circulation ("ABC") is the specific sequence used to initiate CPR in the United States and in the ILCOR Guidelines. In The Netherlands, however, "CAB" (compression-airway-breathing) is the common sequence of CPR, with resuscitation outcomes similar to those reported for the ABC protocol in the United States. No human studies have directly compared the ABC technique of resuscitation with CAB. Hence, a statement of relative efficacy cannot be made and a change in present teaching is not warranted. Both techniques are effective.

Compression-Only CPR

Mouth-to-mouth rescue breathing is a safe and effective technique that has saved many lives. Despite decades of experience indicating its safety for victims and rescuers alike, some published surveys have documented reluctance on the part of professional and lay rescuers to perform mouth-to-mouth ventilation for unknown victims of cardiac arrest. This reluctance is related to fear of infectious disease transmission. If a person is unwilling or unable to perform mouth-to-mouth ventilation for an adult victim, chest compression-only CPR should be provided rather than no attempt at CPR being made (Class IIa).

Current evidence indicates that the outcome of chest compression without mouth-to-mouth ventilation is significantly better than *no* CPR at all in the setting of adult cardiac arrest. Some evidence in animal models and limited adult clinical trials suggests that positive-pressure ventilation is not essential during the initial 6 to 12 minutes of adult CPR. The Cerebral Resuscitation Group of Belgium also showed no difference in outcome of CPR between victims who received mouth-to-mouth ventilation with chest compression and those who received compressions only.

Several mechanisms may account for the effectiveness of chest compression alone. Studies have demonstrated that spontaneous gasping can maintain near-normal minute ventilation, $PaCO_2$, and PaO_2 during CPR without positive-pressure ventilation. Because the cardiac output generated during chest compression is only 25% of normal, there is also a reduced requirement for ventilation to maintain optimal ventilation/perfusion relationships.

Chest compression-only CPR is recommended *only* in the following circumstances:
1. When a rescuer is unwilling or unable to perform mouth-to-mouth rescue breathing (Class IIa), or
2. For use in dispatcher-assisted CPR instructions where the simplicity of this modified technique allows untrained bystanders to rapidly intervene (Class IIa).

Cough CPR
Self-initiated CPR is possible. Its use, however, is limited to clinical situations in which the patient has a monitored cardiac arrest, the arrest was recognized before loss of consciousness, and the patient can cough forcefully. These conditions are typically present during only the first 10 to 15 seconds of the cardiac arrest. The increase in intrathoracic pressure that occurs with coughing will generate blood flow to the brain and maintain consciousness.

Defibrillation
Most adults with sudden, witnessed, nontraumatic cardiac arrest are found to be in VF. For these victims the time from collapse to defibrillation is the single greatest determinant of survival. Survival from VF cardiac arrest declines by approximately 7% to 10% for each minute without defibrillation. Healthcare providers should be trained and equipped to provide defibrillation at the earliest possible moment for victims of sudden cardiac arrest.

Early defibrillation in the community is defined as a shock delivered within 5 minutes of EMS call receipt. This 5-minute call-to-defibrillation interval in the community is a Class I recommendation.

Early defibrillation also must be provided in hospitals and medical facilities. First responders in medical facilities should be able to provide early defibrillation to collapsed patients in VF in all areas of the hospital and ambulatory care facilities (Class I recommendation). In these areas healthcare providers should be able to deliver a shock within 3±1 minutes of arrest for a high percentage of patients. To achieve these goals, BLS providers must be trained and equipped to use defibrillators and must rehearse use of the defibrillator present in their clinical area.

For further information, refer to "Part 4: The Automated External Defibrillator" and "Part 6. Section 2: Defibrillation."

APPENDIX B

Sequence of Pediatric BLS: The ABCs of CPR

(Taken from: "Part 9: Pediatric Basic Life Support" *Circulation*. 102(8) (Supplement):I-253-I-290, August 22, 2000.)

The BLS sequence described below refers to both infants (neonate outside the delivery room setting to 1 year of age) and children (1 to 8 years of age) unless specified. For information on newly born infants (resuscitation immediately after birth), see "Part 11: Neonatal Resuscitation." For BLS for children >8 years of age, see "Part 3: Adult Basic Life Support."

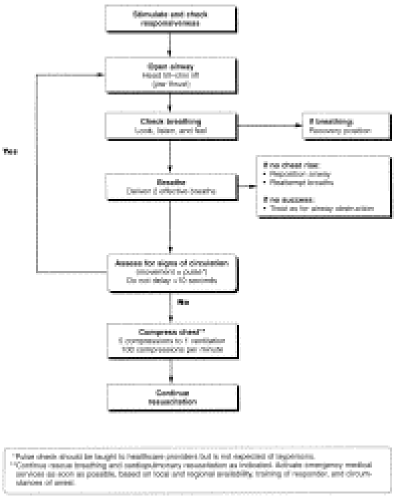


Figure 24. Pediatric BLS algorithm.

Resuscitation Sequence

To maximize survival and neurologically intact outcome following life-threatening cardiovascular emergencies, each link in the Chain of Survival must be strong, including prevention of arrest, early and effective bystander CPR, rapid activation of the EMS system, and early and effective ALS (including rapid stabilization and transport to definitive care and rehabilitation). When a child develops respiratory or cardiac arrest, immediate bystander CPR is crucial to survival. In both adult and pediatric studies, bystander CPR is linked to improved return of spontaneous circulation and neurologically intact survival. The greatest impact of bystander CPR will probably be on children with noncardiac (respiratory) causes of out-of-hospital arrest. Two studies report on the outcome of series of children who were successfully resuscitated before EMS arrival solely by bystander CPR. The true frequency of this type of resuscitation is unknown, but it is likely to be underestimated, because victims successfully resuscitated by bystanders are often excluded from studies of out-of-hospital cardiac arrest. Unfortunately, bystander CPR is provided for only approximately 30% of out-of-hospital pediatric arrests.

BLS guidelines delineate a series of skills performed sequentially to assess and support or restore effective ventilation and circulation to the child with respiratory or cardiorespiratory arrest. Pediatric resuscitation requires a process of observation, evaluation, interventions, and assessments that is difficult to capture in a sequential description of CPR. You should initially assess the victim's responsiveness and then continuously monitor the victim's response to intervention (appearance, movement, breathing, etc). Evaluation and intervention are often simultaneous processes, especially when more than 1 trained provider is present. Although this process is taught as a *sequence* of distinct steps to enhance skills retention, several actions may be accomplished *simultaneously* (i.e., begin CPR and phone EMS) if multiple rescuers are present. The appropriate BLS actions also depend on the interval since the arrest, how the victim responded to previous resuscitative interventions, and whether special resuscitation circumstances exist.

Ensure the Safety of Rescuer and Victim

When CPR is provided in the out-of-hospital setting, the rescuer should first verify the safety of the scene. If resuscitation is needed near a burning building, in water, or in proximity to electrical wires, the rescuer must first ensure that both the victim and rescuer are in a safe location. In the case of trauma, the victim should not be moved unless it is necessary to ensure the victim's or the rescuer's safety.

Although rescuer exposure during CPR carries a theoretical risk of infectious disease transmission, the risk is very low. Most out-of-hospital cardiac arrests in infants and children occur at home. If the victim has an infectious disease, it is likely that family members have already been exposed to that disease or are aware of the disease and appropriate barrier devices are available. Surveys of family members indicate that risk of infection is not a concern that would prevent delivery of CPR to a loved one.

When CPR is provided in the workplace, the rescuer is advised to use a barrier device or mask with 1-way valve to deliver ventilation. These protective devices should be available in the workplace.

Healthcare providers are required to treat all fluids from patients as potentially infectious, particularly in the hospital setting. Healthcare providers should wear gloves and protective shields during procedures that are likely to expose them to droplets of blood, saliva, or other body fluids.

Assess Responsiveness

Gently stimulate the child and ask loudly, "Are you all right?" Quickly assess the presence or extent of injury and determine whether the child is *responsive*. Do not move or shake the victim who has sustained head or neck trauma, because such handling may aggravate a spinal cord injury. If the child is responsive, he or she will answer your questions or move on command. If the child responds but is injured or needs medical assistance, you may leave the child in the position found to summon help (phone the EMS system, if needed). Return to the child as quickly as possible and recheck the child's condition frequently. Responsive children with respiratory distress will often assume a position that maintains airway patency and optimizes ventilation; they should be allowed to remain in the position that is most comfortable to them.

If the child is *unresponsive* and you are the only rescuer present, be prepared to provide BLS, if necessary, for approximately 1 minute before leaving the child to activate the EMS system. As soon as you determine that the child is unresponsive, shout for help. If trauma has not occurred and the child is small, you may consider moving the child near a telephone so that you can contact the EMS system more quickly. The EMS medical dispatcher may then guide you through

CPR. The child must be moved if he or she is in a dangerous location (i.e., a burning building) or if CPR cannot be performed where the child was found.

If a second rescuer is present during the initial assessment of the child, that rescuer should activate the EMS system as soon as the emergency is recognized. If trauma is suspected, the second rescuer should activate the EMS system and then may assist in immobilizing the child's cervical spine, preventing movement of the neck (extension, flexion, and rotation) and torso. If the child must be positioned for resuscitation or moved for safety reasons, support the head and body and turn as a unit.

Activate EMS System if Second Rescuer Is Available
Because all of the links in the Chain of Survival are connected, it is difficult to evaluate the effect of EMS system activation or specific EMS interventions in isolation. In addition, local EMS response intervals, dispatcher training, and EMS protocols may dictate the most appropriate sequence of EMS activation and early life support interventions for a given situation.

Current AHA guidelines instruct the rescuer to provide approximately 1 minute of CPR before activating the EMS system in out-of-hospital arrest for infants and children up to the age of 8 years. *In the International Guidelines 2000 the "phone first" sequence of resuscitation continues to be recommended for children* >8 *years of age and adults. The "phone fast" sequence of resuscitation continues to be recommended for children* <8 *years of age on the basis of face and construct validity (Class Indeterminate).*

The AHA Subcommittees on Pediatric Resuscitation and BLS and a panel addressing the citizen's response in the Chain of Survival debated a proposal to teach lay rescuers to tailor the CPR sequence and EMS activation to the likely cause of the victim's arrest rather than the victim's age. This proposed approach would teach lone lay rescuers to provide 1 minute of CPR before activating the EMS system if a victim of any age collapses with what is thought to be a probable breathing/respiratory problem. Lone lay rescuers would also be taught to activate the EMS system immediately if a victim of any age collapses suddenly (presumed sudden cardiac arrest). Although the proposal has appeal when considered for an individual victim, it was rejected for several reasons. First, no data was presented that indicated that a change to an etiology-based triage method for all age groups would improve survival for victims of out-of-hospital cardiac arrest. Second, the proposal would probably complicate the education of lay rescuers. CPR instruction must remain simple for lay rescuers. Retention of CPR skills and knowledge is already suboptimal. The addition of complex instructions to existing CPR guidelines would most likely make them more difficult to teach, learn, remember, and perform.

It is important to note that the "phone first" or "phone fast" sequence is applicable only to the lone rescuer. When multiple rescuers are present, 1 rescuer remains with the victim of any age to begin CPR while another rescuer goes to activate the EMS system. It is unknown how frequently 2 or more lay responders are present during initial evaluation of a pediatric cardiopulmonary emergency.

Sophisticated healthcare providers, family members, and potential rescuers of infants and children at high risk for cardiopulmonary emergencies should be taught a sequence of rescue actions tailored to the potential victim's specific high-risk condition. For example, parents and child care providers of children with congenital heart disease who are known to be at risk for arrhythmias should be instructed to "phone first" (activate the EMS system before beginning CPR) if they are alone and the child suddenly collapses.

Alternatively, there may be exceptions to the "phone first" approach for victims >8 years of age, including adults. Parents of children >8 years of age who are at high risk for apnea or respiratory failure should be instructed to provide 1 minute of CPR before activating the EMS system if they are alone and find the child unresponsive. Submersion (near-drowning) victims of all ages who are unresponsive when pulled from the water should receive approximately 1 minute of BLS support (opening of the airway and rescue breathing and chest compressions, if needed) before the lone rescuer leaves to phone the local EMS system. Trauma victims or those with a drug overdose or apparent respiratory arrest of any age may also benefit from 1 minute of CPR before the EMS system is contacted. Knowledgeable and experienced providers should use common sense and "phone first" for any apparent sudden cardiac arrest (i.e., sudden collapse at any age) and "phone fast" in other circumstances in which breathing difficulties are documented or likely to be present (i.e., trauma or an apparent choking event).

The rescuer calling the EMS system should be prepared to provide the following information:
1. Location of the emergency, including address and names of streets or landmarks
2. Telephone number from which the call is being made
3. What happened, i.e., auto accident, submersion
4. Number of victims
5. Condition of victim(s)
6. Nature of aid being given
7. Any other information requested

The caller should hang up *only* when instructed to do so by the dispatcher, and then caller should report back to rescuer doing CPR.

Hospitals and medical facilities and many businesses and building complexes have established emergency medical response systems that provide a first response or early response on-site. Such a response system notifies rescuers of the location of an emergency and the type of response needed. If the cardiopulmonary emergency occurs in a facility with an established medical response system, that system should be notified, because it can respond more quickly than EMS personnel arriving from outside the facility. For rescuers in these facilities, the emergency medical response system should replace the EMS system in the sequences below.

Airway

Position the Victim

If the child is unresponsive, move the child as a unit to the supine (face up) position, and place the child supine on a flat, hard surface, such as a sturdy table, the floor, or the ground. If head or neck trauma is present or suspected, move the child only if necessary and turn the head and torso as a unit. If the victim is an infant, and no trauma is suspected, carry the child supported by your forearm (your forearm should support the long axis of the infant's torso, with the infant's legs straddling your elbow and your hand supporting the infant's head). It may be possible to carry the infant to the phone in this manner while beginning the steps of CPR.

Open the Airway

The most common cause of airway obstruction in the unresponsive pediatric victim is the tongue. Therefore, once the child is found to be unresponsive, open the airway using a maneuver designed to lift the tongue away from the back of the pharynx, creating an open airway.

Head Tilt-Chin Lift Maneuver

If the victim is unresponsive *and trauma is not suspected*, open the child's airway by tilting the head back and lifting the chin. Place one hand on the child's forehead and gently tilt the head back. At the same time place the fingertips of your other hand on the bony part of the child's lower jaw, near the point of the chin, and lift the chin to open the airway. Do not push on the soft tissues under the chin as this may block the airway. *If injury to the head or neck is suspected, use the jaw-thrust maneuver to open the airway; do not use the head tilt-chin lift maneuver.*

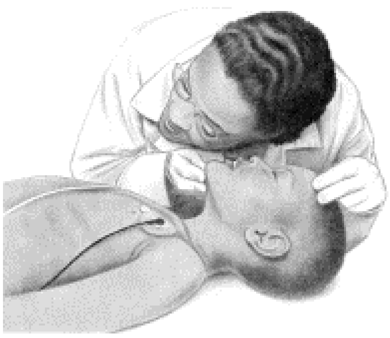


Figure 25. Head tilt-chin lift for child victim.

Jaw-Thrust Maneuver

If head or neck injury is suspected, use only the *jaw-thrust* method of opening the airway. Place 2 or 3 fingers under each side of the lower jaw at its angle, and lift the jaw upward and outward. Your elbows may rest on the surface on which the victim is lying. If a second rescuer is present, that rescuer should immobilize the cervical spine (see "BLS in Trauma" below) after the EMS system is activated.

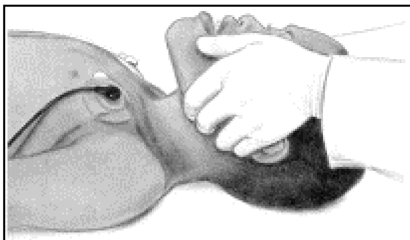


Figure 26. Jaw thrust for child victim.

Foreign-Body Airway Obstruction

If the victim becomes unresponsive with an FBAO or if an FBAO is suspected, open the airway wide and look for an object in the pharynx. If an object is present, remove it carefully (under vision). Healthcare providers should perform a tongue-jaw lift to look for obstructing objects (see next section), but this maneuver will not be taught to lay rescuers.

Techniques for Healthcare Providers

Hypoxia and respiratory arrest may cause or contribute to acute deterioration and cardiopulmonary arrest. Thus, maintenance of a patent airway and support of adequate ventilation are essential. Both the head tilt-chin lift and jaw-thrust techniques should be taught to lay rescuers. Healthcare providers should also learn additional maneuvers, such as the tongue-jaw lift, for use in unresponsive victims of FBAO. Healthcare providers are taught a sequence of actions to attempt to relieve FBAO in the unresponsive victim. If FBAO is suspected, open the airway using a tongue-jaw lift and look for the foreign body before attempting ventilation. If you see the foreign body, remove it carefully (under vision).

Breathing

Assessment: Check for Breathing

Hold the victim's airway open and look for signs that the victim is breathing. *Look* for the rise and fall of the chest and abdomen, *listen* at the child's nose and mouth for exhaled breath sounds, and *feel* for air movement from the child's mouth on your cheek for no more than 10 seconds.

It may be difficult to determine whether the victim is breathing. Care must be taken to differentiate ineffective, gasping, or obstructed breathing efforts from effective breathing. If you are not confident that respirations are adequate, proceed with rescue breathing.

If the child is breathing spontaneously and effectively and there is no evidence of trauma, turn the child to the side in a *recovery position*. This position should help maintain a patent airway. Although many recovery positions are used in the management of pediatric patients, no single recovery position can be universally endorsed on the basis of scientific studies of children. There is consensus that an ideal recovery position should be a stable position that enables the following: maintenance of a patent airway, maintenance of cervical spine stability, minimization of risk for aspiration, limitation of pressure on bony prominences and peripheral nerves, visualization of the child's respiratory effort and appearance (including color), and access to the patient for interventions.

Figure 27. Recovery position.

Provide Rescue Breathing

If no spontaneous breathing is detected, maintain a patent airway by head tilt-chin lift or jaw thrust. Carefully (under vision) remove any obvious airway obstruction, take a deep breath, and deliver rescue breaths. With each rescue breath, provide a volume sufficient for you to see the child's chest rise. Provide 2 slow breaths (1 to 1 1/2 seconds per breath) to the victim, pausing after the first breath to take a breath to maximize oxygen content and minimize carbon dioxide concentration in the delivered breaths. Your exhaled air can provide oxygen to the victim, but the rescue-breathing pattern you use will affect the amount of oxygen and carbon dioxide delivered to the victim. When ventilation adjuncts and oxygen are available (i.e., bag-mask) to assist with ventilation, provide high flow oxygen to all unresponsive victims or victims in respiratory distress.

The 1992 guidelines recommended that 2 initial breaths be delivered. The current ILCOR recommendations suggest that between 2 and 5 rescue breaths should be delivered initially to ensure that at least 2 effective ventilations are provided. *There is no data to support the choice of any single number of initial breaths to be delivered to the unresponsive, nonbreathing victim.* Most pediatric victims of cardiac arrest are both hypoxic and hypercarbic. If the rescuer is unable to establish effective ventilation with 2 rescue breaths, additional breaths may be beneficial in improving oxygenation and restoring an adequate heart rate for an apneic, brady-cardic infant or child. *There is inadequate data to recommend changing the number of initial ventilations delivered during CPR at this time. Therefore, lay rescuers and healthcare providers should administer 2 initial **effective** breaths to the unresponsive, nonbreathing infant or child (Class Indeterminate).* The rescuer should ensure that at least 2 breaths delivered are effective and produce visible chest rise.

Mouth-to-Mouth-and-Nose and Mouth-to-Mouth Breathing
If the victim is an infant (<1 year old), place your mouth over the infant's mouth and nose to create a seal. Blow into the infant's nose and mouth (pausing to inhale between breaths), attempting to make the chest rise with each breath. A variety of techniques can be used to provide rescue breathing for infants. A rescuer with a small mouth may have difficulty covering both the nose and open mouth of a large infant. Under these conditions, mouth-to-nose ventilation may be adequate. There is no convincing data to justify a change from the recommendation that the rescuer attempt *mouth-to-mouth-and-nose ventilation* for infants up to 1 year of age. During rescue breathing attempts you must maintain good head position for the infant (head tilt-chin lift to maintain a patent airway) and create an airtight seal over the airway.

Figure 28. Mouth-to-mouth-and-nose breathing for small infant victim.

The *mouth-to-nose* rescue breathing technique is a reasonable adjunctive or alternative method of providing rescue breathing for an infant (Class IIb). The mouth-to-nose breathing technique may be particularly useful if you have difficulty with the mouth-to-mouth-and-nose technique. To perform mouth-to-nose ventilation, place your mouth over the infant's nose and proceed with rescue breathing. It may be necessary to close the infant's mouth during rescue breathing to prevent the rescue breaths from escaping through the infant's mouth. A chin lift will help maintain airway patency by moving the tongue forward and may help keep the mouth closed.

If the victim is a large infant or a child (1 to 8 years of age), provide *mouth-to-mouth* rescue breathing. Maintain a head tilt-chin lift or jaw thrust (to keep the airway patent), and pinch the victim's nose tightly with thumb and forefinger. Make a mouth-to-mouth seal and provide 2 rescue breaths, making sure that the child's chest rises visibly with each breath. Inhale between rescue breaths.

Figure 29. Mouth-to-mouth breathing for child victim.

Evaluation of Effectiveness of Breaths Delivered

Rescue breaths provide essential support for a nonbreathing infant or child. Because children vary widely in size and lung compliance, it is impossible to make precise recommendations about the pressure or volume of breaths to be delivered during rescue breathing. Although the goal of assisted ventilation is delivery of adequate oxygen and removal of carbon dioxide with the smallest risk of iatrogenic injury, measurement of oxygen and CO_2 levels during pediatric BLS is often not practical. Therefore, *the volume of each rescue breath should be sufficient to cause the chest to visibly rise* without causing excessive gastric distention. *If the child's chest does not rise during rescue breathing, ventilation is not effective.* Because the small airway of the infant or child may provide high resistance to air flow, particularly in the presence of large or small airway obstruction, a relatively high pressure may be required to deliver an adequate volume of air to ensure chest expansion. The correct volume for each breath is the volume that causes the chest to rise.

If air enters freely and the chest rises, the airway is clear. If air does not enter freely (if the chest does not rise), either the airway is obstructed or greater volume or pressure is needed to provide adequate rescue breaths. Improper opening of the airway is the most common cause of airway obstruction and inadequate ventilation during resuscitation. As a result, if air does not enter freely and the chest does not rise during initial ventilation attempts, reposition the airway and reattempt ventilation. It may be necessary to move the child's head through a range of positions to obtain optimal airway patency and effective rescue breathing. The head should not be moved if neck or spine trauma is suspected; the jaw thrust should be used to open the airway in these victims. If rescue breathing fails to produce chest expansion despite repeated attempts at opening the airway, an FBAO may be present (see "Foreign-Body Airway Obstruction" below).

The ideal ventilation rate during CPR and low circulatory flow states is unknown. Current recommended ventilation (rescue breathing) rates are derived from normal respiratory rates for age, with some adjustments for the time needed to coordinate rescue breathing with chest compressions to ensure that ventilation is adequate.

Cricoid Pressure

Rescue breathing, especially if performed rapidly, may cause gastric distention. Excessive gastric distention can interfere with rescue breathing by elevating the diaphragm and decreasing lung volume, and it may result in regurgitation of gastric contents. Gastric distention may be minimized if rescue breaths are delivered slowly during rescue breathing, because slow breaths will enable delivery of effective tidal volume at low inspiratory pressure. Deliver initial breaths slowly, over 1 to 1 1/2 seconds, with a force sufficient to make the chest visibly rise. Firm but gentle pressure on the cricoid cartilage during ventilation may help compress the esophagus and decrease the amount of air transmitted to the stomach. Healthcare providers may insert a nasogastric or orogastric tube to decompress the stomach if gastric distention develops during resuscitation. Ideally this is done after tracheal intubation.

Ventilation with Barrier Devices

Mouth-to-mouth rescue breathing is a safe and effective technique that has saved many lives. Despite decades of experience indicating its safety for victims and rescuers alike, some potential rescuers may hesitate to perform mouth-to-mouth rescue breathing because of concerns about transmission of infectious diseases. Most children who require resuscitation outside the hospital arrest at home, and the primary child care provider is aware of the child's infectious status. Adults who work with children (particularly infants and preschool children) are exposed to pediatric infectious agents daily and often may experience the consequent illnesses. In contrast, the exposure of rescuers to victims is brief, and infections after mouth-to-mouth rescue breathing are extremely rare.

Although healthcare providers typically have access to barrier devices, in most lay rescue situations these devices are not immediately available. If the child is unresponsive and apneic, immediate provision of mouth-to-mouth rescue breathing may be lifesaving. Rescue breathing should not be delayed while the rescuer searches for a barrier device or tries to learn how to use it.

If an infection control barrier device is readily available, some rescuers may prefer to provide rescue breathing with such a device (Class Indeterminate). Barrier devices may improve esthetics for the rescuer but have not been shown to reduce the risk of disease transmission. In addition, barrier devices may increase resistance to gas flow. Rescuers with a duty to respond and those who respond in the work place should have a supply of barrier devices readily available for use during any attempted resuscitation and should be trained in their use.

Two broad categories of barrier devices are available; masks and face shields. Most masks have a 1-way valve, which prevents the victim's exhaled air from entering the rescuer's mouth. When barrier devices are used in resuscitation of infants and children, they are used in the same manner as in resuscitation of adults (see "Part 3: Adult BLS").

Bag-Mask Ventilation

Healthcare providers who provide BLS for infants and children should be trained to deliver effective oxygenation and ventilation with a manual resuscitator bag and mask (Class IIa). Ventilation with a bag-mask device requires more skill than mouth-to-mouth or mouth-to-mask ventilation and should be used only by personnel who have received proper training. Training should focus on selection of an appropriately sized mask and bag, opening the airway and securing the mask to the face, delivering adequate ventilation, and assessing the effectiveness of ventilation. Periodic demonstration of proficiency is recommended.

Types of Ventilation Bags (Manual Resuscitators). There are 2 basic types of manual resuscitators (ventilation bags): self-inflating and flow-inflating resuscitators. Ventilation bags should be self-inflating and available in child and adult sizes suitable for the entire pediatric age range.

Flow-inflating bags (also called *anesthesia bags*) refill only with oxygen inflow, and the inflow must be individually regulated. Since flow-inflating manual resuscitators are more difficult to use, only trained personnel should use them. Flow-inflating bags permit continuous delivery of supplemental oxygen to a spontaneously breathing victim. In contrast, self-inflating bag-mask systems that contain a fish mouth or leaf-flap outlet valve *cannot* be used to provide continuous supplemental oxygen during spontaneous ventilation. When the bag is not squeezed, the child's inspiratory effort may be insufficient to open the valve. In such a case the child will receive inadequate oxygen flow (a negligible flow of oxygen escapes through the outlet valve) and will rebreathe the exhaled gases contained in the mask.

Neonatal-size (250 mL) ventilation bags may be inadequate to support effective tidal volume and the longer inspiratory times required by full-term neonates and infants. For this reason, resuscitation bags used for ventilation of full-term newly born infants, infants, and children should have a minimum volume of 450 to 500 mL. Studies involving infant manikins demonstrated that effective infant ventilation could be achieved with pediatric (and larger) resuscitation bags.

Regardless of the size of the manual resuscitator used, *the rescuer should use only the force and tidal volume necessary to cause the chest to rise visibly*. Excessive ventilation volumes and airway pressures may have harmful effects. They may compromise cardiac output by raising intrathoracic pressure, distending alveoli and/or the stomach, impeding ventilation, and increasing the risk of regurgitation and aspiration. In patients with small-airway obstructions (i.e., asthma and bronchiolitis), excessive tidal volume and ventilation rate can result in air trapping, barotrauma, air leak, and severely compromised cardiac output. In the patient with a head injury or cardiac arrest, excessive ventilation volume and rate may result in hyperventilation with potentially adverse effects on neurological outcome. Therefore, the goal of ventilation with a bag and mask should be to approximate normal ventilation and achieve physiological oxygen and carbon dioxide levels while minimizing risk of latrogenic injury (Class IIa).

Ideally, bag-mask systems used for resuscitation should either have no pressure-relief valve or have a valve with an override feature to permit use of high pressures, if necessary, to achieve visible chest expansion. High pressures may be required during bag-mask ventilation of patients with upper or lower airway obstruction or poor lung compliance. In these patients a pressure-relief valve may prevent delivery of sufficient tidal volume.

The self-inflating bag delivers only room air (21% oxygen) unless the bag is joined to an oxygen source. At an oxygen inflow of 10 L/min, pediatric bag-valve devices without oxygen reservoirs deliver from 30% to 80% oxygen to the patient. The actual concentration of oxygen delivered is unpredictable because a variable amount of room air is pulled into the bag to replace some of the gas mixture delivered to the patient. To deliver consistently higher oxygen concentrations (60% to 95%), all bag-valve devices used for resuscitation should be equipped with an oxygen reservoir. At least 10 to 15 L/min of oxygen flow is required to maintain an adequate oxygen volume in the reservoir of a pediatric manual resuscitator, and this should be considered the minimum flow rate. The larger adult manual resuscitators require >15 L/min of oxygen flow to reliably deliver high oxygen concentrations.

Technique. To provide bag-mask ventilation, select a bag and mask of appropriate size. The mask must be able to completely cover the victim's mouth and nose without covering the eyes or overlapping the chin. Once the bag and mask are selected and connected to an oxygen supply, open the victim's airway and seal the mask to the face.

If no signs of trauma are present, tilt the victim's head back to help open the airway. If trauma is suspected, do not move the head. To open the airway of the victim with trauma, lift the jaw,

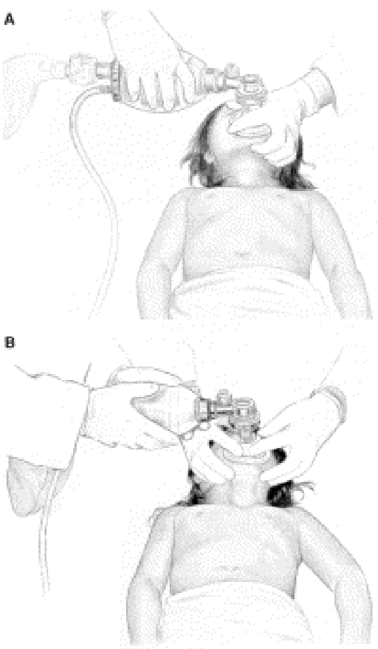


Figure 30. Bag-mask ventilation for child victim. A, 1 rescuer; B, 2 rescuers.

using the last 3 fingers (fingers 3, 4, and 5) of one hand. Position these 3 fingers under the angle of the mandible to lift the jaw up and forward. Do not put pressure on the soft tissues under the jaw, because this may compress the airway. When lifting the jaw, you also lift the tongue off the posterior pharynx, preventing the tongue from obstructing the pharynx. Place your thumb and forefinger in a "C" shape over the mask and exert downward pressure on the mask. This hand position uses the thumb and forefinger to squeeze the mask onto the face while the remaining fingers of the same hand lift the jaw, pulling the face toward the mask. This should create a tight seal between the mask and the victim's face. This technique of opening the airway and sealing the mask to the face is called the "E-C clamp" technique. Fingers 3, 4, and 5 form an E positioned under the jaw to provide a chin lift; the thumb and index finger form a C and hold the mask on the child's face. Once you successfully apply the mask with one hand, compress the ventilation bag with the other hand until the chest visibly rises.

Superior bag-mask ventilation can be achieved with 2 rescuers, and 2 rescuers may be required when the victim has significant airway obstruction or poor lung compliance. One rescuer uses both hands to open the airway and maintain a tight mask-to-face seal while the other rescuer compresses the ventilation bag (see "Part 3: Adult BLS," 2-rescuer technique for bag-mask ventilation). Both rescuers should observe the chest to ensure that it rises visibly with each breath.

Gastric Inflation. Increasing inspiratory time so the necessary tidal volume can be delivered at low peak inspiratory pressures can minimize gastric inflation in unresponsive or obtunded patients. Pace the ventilation rate and ensure adequate time for exhalation. To reduce gastric inflation, a second trained provider can apply cricoid pressure, but only with an unconscious victim. Cricoid pressure may also prevent regurgitation (and possible aspiration) of gastric contents. Do not use excessive pressure on the cricoid cartilage, because it may produce tracheal compression and obstruction or distortion of the upper airway anatomy. Gastric distention after prolonged bag-mask ventilation can limit effective ventilation. If gastric distention develops, healthcare providers should decompress the stomach with an orogastric or a nasogastric tube. If tracheal intubation is planned, you ideally defer gastric intubation until after tracheal intubation is accomplished. This will reduce the risk of vomiting and laryngospasm.

Ventilation Through a Tracheostomy or Stoma

Anyone responsible for the care of a child with a tracheostomy (including parents, school nurses, and home healthcare providers) should be taught to ensure that the airway is patent and to provide CPR by using the artificial airway. If CPR is required, perform rescue breathing and bag-mask ventilation through the tracheostomy. As with any form of rescue breathing, the key sign of effective ventilation is adequate chest expansion bilaterally. If the tracheostomy becomes obstructed and ventilation cannot be provided through it, remove and replace the tracheostomy tube. If a clean tube is not available, provide ventilation at the tracheostomy stoma until the site can be intubated with a tracheostomy or tracheal tube. If the child's upper airway is patent, it may be possible to provide bag-mask ventilation through the nose and mouth using a conventional bag and mask while occluding the superficial tracheal stoma site.

Oxygen

Healthcare providers should administer oxygen to all seriously ill or injured patients with respiratory insufficiency, shock, or trauma as soon as it is available. In these patients inadequate pulmonary gas exchange and/or inadequate cardiac output limits tissue oxygen delivery.

During cardiac arrest a number of factors contribute to severe progressive tissue hypoxia and the need for supplementary oxygen administration. At best, mouth-to-mouth ventilation provides 16% to 17% oxygen with a maximal alveolar oxygen tension of 80 mm Hg. Because even optimal external chest compressions provide only a fraction of the normal cardiac output, blood flow to the brain and body and tissue oxygen delivery are markedly diminished. In addition, CPR is associated with right-to-left pulmonary shunting due to ventilation-perfusion mismatch. Preexisting expiratory conditions may further compromise oxygenation. The combination of low blood flow and low oxygenation contributes to metabolic acidosis and organ failure. For these reasons, oxygen should be administered to children with demonstrated cardiopulmonary arrest or compromise, even if measured arterial oxygen tension is high. Whenever possible, administered oxygen should be humidified to prevent drying and thickening of pulmonary secretions; dried secretions may contribute to obstruction of natural or artificial airways.

Occasionally an infant may require *reduced* inspired oxygen concentration or manipulation of oxygenation and ventilation to control pulmonary blood flow (i.e., the neonate with single ventricle). A review of these unique situations is beyond the scope of this document.

Oxygen may be administered during bag-mask ventilation. In addition, if the victim is breathing spontaneously, oxygen may be delivered by nasal cannula, simple facemasks, and nonrebreathing masks (for further information, see "Part 10: Pediatric Advanced Life Support"). The concentration of oxygen delivered depends on the oxygen flow rate, the type of mask being used, and the patient's minute ventilation. As long as the flow of oxygen exceeds the maximal inspiratory flow rate, the prescribed concentration of oxygen will be delivered. If the inspiratory flow rate exceeds the oxygen flow rate, room air is entrained, reducing the oxygen concentration delivered to the patient.

Circulation

Assessment: No Pulse Check for Lay Rescuers

When you have opened the airway and provided 2 effective rescue breaths, determine whether the victim is in cardiac arrest and requires chest compressions. Cardiac arrest results in the absence of *signs of circulation*, including the absence of a pulse. The pulse check has been the "gold standard" usually relied on by professional rescuers to evaluate circulation. The carotid artery is palpated for the pulse check in adults and children; brachial artery palpation is recommended in infants. In the previous guidelines the pulse check was used to identify pulseless patients in cardiac arrest who required chest compression. If the rescuer failed to detect a pulse in 5 to 10 seconds in an unresponsive nonbreathing victim, cardiac arrest was presumed to be present and chest compressions were initiated.

Since 1992 several published studies have questioned the validity of the pulse check as a test for cardiac arrest, particularly when used by laypersons. Previous guidelines de-emphasized the pulse check for infant-child CPR for 2 reasons. First, 3 small studies suggested that parents had difficulty finding and counting the pulse even in healthy infants. Second, the reported complication rate from chest compressions in infants and children is low.

After publication of the 1992 ECC Guidelines, additional investigators evaluated the reliability of the pulse check with adult manikin simulation in unconscious adult patients undergoing cardiopulmonary bypass; unconscious mechanically ventilated adult patients, and conscious adult "test persons." These studies concluded that as a diagnostic test for cardiac arrest, the pulse check has serious limitations in accuracy, sensitivity, and specificity.

When lay rescuers check the pulse, they often spend a long time deciding whether or not a pulse is present; then they may fail 1 time out of 10 to recognize the absence of a pulse or cardiac arrest (poor sensitivity). When assessing unresponsive victims who do have a pulse, lay rescuers miss the pulse 4 times out of 10 (poor specificity). Details of the published studies include the following conclusions:

1. Rescuers take far too much time to check the pulse: most rescue groups, including laypersons, medical students, paramedics, and physicians, take much longer than the recommended period of 5 to 10 seconds to check for the carotid pulse in adult victims. In 1 study half of the rescuers required >24 seconds to decide whether a pulse was present. Only 15% of the participants correctly confirmed the presence of a pulse within 10 seconds, the maximum time allotted for the pulse check.
2. When used as a diagnostic test, the pulse check is extremely inaccurate. In the most comprehensive study documented, the accuracy of the pulse check was described as follows:

a. Sensitivity (ability to correctly identify victims who have no pulse and *are* in cardiac arrest) is only 90%. When subjects were pulseless, rescuers thought a pulse was present approximately 10% of the time. By mistakenly thinking a pulse *is* present when it is not, rescuers fail to provide chest compressions for 10 of every 100 victims of cardiac arrest. Without a resuscitation attempt, the consequence of such errors would be death for 10 of every 100 victims of cardiac arrest.

b. Specificity (ability to correctly recognize victims who *have* a pulse and *are not* in cardiac arrest) is only 60%. When the pulse was present, rescuers assessed the pulse as being absent approximately 40% of the time. By erroneously thinking a pulse is absent, rescuers provide chest compressions for approximately 4 of 10 victims who do not need them.
c. Overall accuracy was 65%, leaving an error rate of 35%.

Data is limited regarding the specificity and sensitivity of the pulse check in pediatric victims of cardiac arrest. Three studies have documented the inability of lay rescuers to find and count a pulse in healthy infants. Healthcare providers may also have difficulty reliably separating venous from arterial pulsation during CPR.

On a review of this and other data, the experts and delegates at the 1999 Evidence Evaluation Conference and the International Guidelines 2000 Conference concluded that the pulse check could not be recommended as a tool for lay rescuers to use in the CPR sequence to identify victims of cardiac arrest. If rescuers use the pulse check to identify victims of cardiac arrest, they will "miss" true cardiac arrest at least 10 of 100 times. In addition, rescuers will provide unnecessary chest compressions for many victims who are not in cardiac arrest and do not require such an intervention. This error is less serious but still undesirable. Clearly more worrisome is the potential failure to intervene for a substantial number of victims of cardiac arrest who require immediate intervention to survive.

Therefore, the lay rescuer should not rely on the pulse check to determine the need for chest compressions. Lay rescuers should not perform the pulse check and will not be taught the pulse check in CPR courses (Class IIa). Instead laypersons will be taught to look for *signs of circulation* (normal breathing, coughing, or movement) in response to rescue breaths. This recommendation applies to victims of any age. Healthcare providers should continue to use the pulse check as one of several signs of circulation. Other signs of circulation include breathing, coughing, or movement in response to rescue breaths. It is anticipated that this guideline change will result in more rapid and accurate identification of cardiac arrest. More importantly, it should reduce the number of missed opportunities to provide CPR (and early defibrillation using an AED for victims >8 years of age) for victims of cardiac arrest.

Assessment: Check for Signs of Circulation

The International Guidelines 2000 refer to assessment of signs of circulation. For the lay rescuer, this means the following: deliver initial rescue breaths and evaluate the victim for normal breathing, coughing, or movement in response to rescue breaths. The lay rescuer will look, listen, and feel for breathing while scanning the victim for other signs of movement. Lay rescuers will look for "normal" breathing to minimize confusion with agonal respirations.

In practice, lay rescuers should assess the victim for signs of circulation as follows:

1. Provide initial rescue breaths to the unresponsive, nonbreathing victim.
2. Look for signs of circulation:
   a. With your ear next to the victim's mouth, look, listen, and feel for normal breathing or coughing.
   b. Quickly scan the victim for any signs of movement.
3. If the victim is not breathing normally, coughing, or moving, immediately begin chest compressions.

Figure 31. Brachial pulse check in infant.

Healthcare professionals should assess signs of circulation by performing a pulse check while simultaneously evaluating the victim for breathing, coughing, or movement after delivering rescue breaths. Healthcare providers should look for breathing because they are trained to distinguish between agonal breathing and other forms of ventilation not associated with cardiac arrest. This assessment should take no more than 10 seconds. If you do not confidently detect a pulse or other signs of circulation or if the heart rate is <60 bpm with signs of poor perfusion, provide chest compressions. It is important to note that unresponsive, nonbreathing infants and children are very likely to have a slow heart rate or no heart rate at all. Therefore, do not delay the initiation of chest compressions to locate a pulse.

Healthcare providers should learn to palpate the brachial pulse in infants and the carotid pulse in children 1 to 8 years of age. The short, chubby neck of children <1 year of age makes rapid location of the carotid artery difficult. In addition, it is easy to compress the airway while attempting to palpate a carotid pulse in the infant's neck. For these reasons, the healthcare provider should attempt to palpate the brachial artery when performing the pulse check in infants. The brachial pulse is on the inside of the upper arm, between the infant's elbow and shoulder. Press the index and middle fingers gently on the inside of the upper arm for no more than 10 seconds, in an attempt to feel the pulse.

Healthcare providers should learn to locate and palpate the child's carotid artery on the side of the neck. It is the most accessible central artery in children and adults. The carotid artery lies on the side of the neck between the trachea and the strap (sternocleidomastoid) muscles. To feel the artery, locate the victim's thyroid cartilage (Adam's apple) with 2 or 3 fingers of one hand while maintaining head tilt with the other hand. Then slide the fingers into the groove on the side closer to the rescuer, between the trachea and the sternocleidomastoid muscles, and gently palpate the

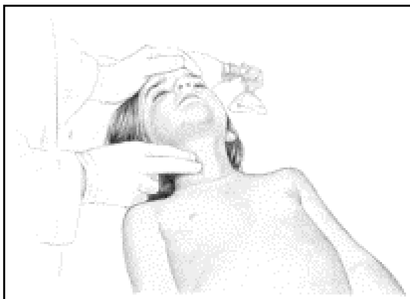


Figure 32. Carotid pulse check in child.

area over the artery for no more than 10 seconds.

If signs of circulation are present but spontaneous breathing is absent, provide rescue breathing at a rate of 20 breaths per minute (once every 3 seconds) until spontaneous breathing resumes.

After provision of approximately 20 breaths (slightly longer than 1 minute), the lone rescuer should activate EMS. If adequate breathing resumes and there is no suspicion of neck trauma, turn the child onto the side into a recovery position.

If signs of circulation are absent (or, for the healthcare provider, the heart rate is <60 bpm with signs of poor perfusion), begin chest compressions. This will include a series of compressions coordinated with ventilations. If there are no signs of circulation, the victim is >8 years of age, and an AED is available in the out-of-hospital setting, use the AED. A weight of 25 kg corresponds to a body length of approximately 50 inches (128 cm) using the Broselow color-coded tape. For information about use of AEDs for victims >8 years of age, see "Part 4: The Automated External Defibrillator."

Provide Chest Compressions

Chest compressions are serial, rhythmic compressions of the chest that cause blood to flow to the vital organs (heart, lungs, and brain) in an attempt to keep them viable until ALS can be provided. Chest compressions provide circulation as a result of changes in intrathoracic pressure and/or direct compression of the heart. Chest compressions for infants and children should be provided with ventilations.

Compress the lower half of sternum to a relative depth of approximately one third to one half the anterior/posterior diameter of the chest at a rate of at least 100 compressions per minute for the infant and approximately 100 compressions per minute for the child victim. Be sure to avoid compression of the xiphoid. This depth of compression differs slightly from that recommended for the newly born. The neonatal resuscitation guidelines call for compression to approximately one third the depth of the chest. The wider range of recommended compression depth and potentially deeper compressions in infants and children is not evidence based but consensus based. Chest compressions must be adequate to produce a palpable pulse during resuscitation. Lay rescuers will not attempt to feel a pulse, so they should be taught a compression technique that will most likely result in delivery of effective compressions.

Healthcare providers should evaluate the effectiveness of compressions during CPR. If effective compressions are provided, they should all produce palpable pulses in a central artery (i.e., the carotid, brachial, or femoral artery). Although pulses palpated during chest compression may actually represent venous pulsations rather than arterial pulses, pulse assessment by the healthcare provider during CPR remains the most practical quick assessment of chest compression efficacy.

Exhaled carbon dioxide detectors and displayed arterial pressure waveforms (if invasive arterial monitoring is in place) can assist the healthcare provider in evaluating the effectiveness of chest compressions. If chest compressions produce inadequate cardiac output and pulmonary blood flow, exhaled carbon dioxide will remain extremely low throughout resuscitation. If an arterial catheter is in place during resuscitation (i.e., during chest compressions provided to a patient in the ICU with an arterial monitor in place), chest compressions can be guided by the displayed arterial waveform.

To facilitate optimal chest compressions, the child should be supine on a hard, flat surface. CPR should be performed where the victim is found. If cardiac arrest occurs in a hospital bed, place firm support (a resuscitation board) beneath the patient's back. Optimal support is provided by a resuscitation board that extends from the shoulders to the waist and across the full width of the bed. The use of a wide board is particularly important when providing chest compressions to larger children. If the board is too small, it will be pushed deep into the mattress during compressions, dispersing the force of each compression. Spine boards, preferably with head wells, can be used in ambulances and mobile life support units. They provide a firm surface for CPR in the emergency vehicle or on a wheeled stretcher and may also be useful for extricating and immobilizing victims.

Infants with no signs of head or neck trauma may be successfully carried during resuscitation on the rescuer's forearm. The palm of one hand can support the infant's back while the fingers of the other hand compress the sternum. This maneuver effectively lowers the infant's head, allowing the head to tilt back slightly into a neutral position that maintains airway patency. If the infant is carried during CPR, the hard surface is created by the rescuer's forearm, which supports the length of the infant's torso, while the infant's head and neck are supported by the rescuer's hand. Take care to keep the infant's head no higher than the rest of the body. Use the other hand to perform chest compressions. You can lift the infant to provide ventilation.

Figure 33. One-rescuer infant CPR while carrying victim, with infant supported on rescuer's forearm.

Indications for Chest Compressions

Lay rescuers should provide chest compressions if the infant or child shows no signs of circulation (normal breathing, coughing, or movement) after delivery of rescue breaths. Healthcare providers should provide chest compressions if the infant or child shows no signs of circulation (breathing, coughing, movement, or pulse) or if the heart rate/pulse is <60 bpm with signs of poor perfusion after delivery of rescue breaths. Profound bradycardia in the presence of poor perfusion is an indication for chest compressions because cardiac output in infancy and childhood is largely dependent on heart rate, and an inadequate heart rate with poor perfusion indicates that cardiac arrest is imminent. No scientific data has identified an absolute heart rate at which chest compressions should be initiated; the recommendation to provide cardiac compression for a heart rate <60 bpm with signs of poor perfusion is based on ease of teaching and skills retention.

Chest Compression in the Infant (<1 Year of Age)

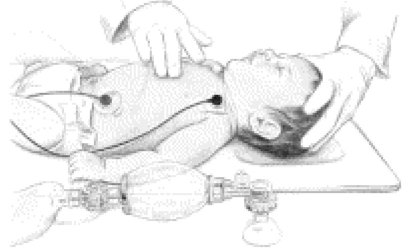


Figure 34. Two-finger chest compression technique in infant (one rescuer).

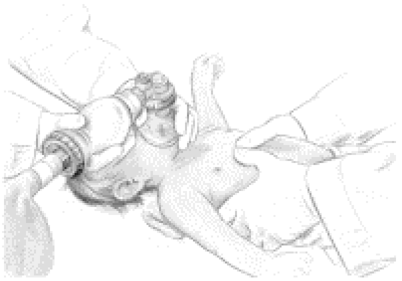


Figure 35. Two thumb-encircling hands chest compression technique in infant (two rescuers).

Two-finger technique (the preferred technique for laypersons and lone rescuers):

1. Place the 2 fingers of one hand over the lower half of the sternum, approximately 1 finger's width below the intermammary line, ensuring that you are not on or near the xiphoid process. The intermammary line is an imaginary line located between the nipples, over the breastbone. An alternative method of locating compression position is to run 1 finger along the lower costal margin to locate the bony end of the sternum and place 1 finger over the end of the sternum; this will mark the xiphoid process. Then place 2 fingers of your other hand above the finger (moving up the sternum toward the head). The 2 fingers will now be in the appropriate position for chest compressions, avoiding the xiphoid. You may place your other hand under the infant's chest to create a compression surface and slightly elevate the chest so that the neck is neither flexed nor hyper extended and the airway will be maintained in a neutral position.
2. Press down on the sternum to depress it approximately one third to one half the depth of the infant's chest. This will correspond to a depth of about 1/2 to 1 inch (1 1/2 to 2 1/2 cm), but these measurements are not precise. After each compression, completely release the pressure on the sternum and allow the sternum to return to its normal position without lifting your fingers off the chest wall.
3. Deliver compressions in a smooth fashion, with equal time in the compression and relaxation phases. A somewhat shorter time in the compression phase offers theoretical advantages for blood flow in a very young infant animal model of CPR and is reviewed in the neonatal guidelines. As a practical matter, with compression rates >100 per minute (nearly 2 compressions per second), it is unrealistic to think that rescuers will be able to judge or manipulate compression and relaxation phases. In addition, details about such manipulation would increase the complexity of CPR instruction. For these reasons, provide compressions in approximately equal compression and relaxation phases for infants and children.
4. Compress the sternum *at a rate of at least 100 times per minute* (this corresponds to a rate that is slightly less than 2 compressions per second during the groups of 5 compressions). The compression *rate* refers to the *speed* of compressions, not the actual number of compressions delivered per minute. Note that this compression rate will actually result in provision of <100 compressions each minute, because you will pause to provide 1 ventilation after every fifth

compression. The actual number of compressions delivered per minute will vary from rescuer to rescuer and will be influenced by the compression rate and the speed with which you can position the head, open the airway, and deliver ventilation.

5. After 5 compressions, open the airway with a head tilt-chin lift (or, if trauma is present, use the jaw thrust) and give 1 effective breath. Be sure that the chest rises with the breath. Coordinate compressions and ventilations to avoid simultaneous delivery and ensure adequate ventilation and chest expansion, especially when the airway is unprotected. You may use your other hand (the one not compressing the chest) to maintain the infant's head in a neutral position during the 5 chest compressions. This may help you provide ventilation without the need to reposition the head after each set of 5 compressions. Alternatively, to maintain a neutral head position, place your other hand behind the infant's chest (this will elevate the chest, ensuring that the head is in neutral position relative to the chest). If there *are* signs of head or neck trauma, you can place your other hand on the infant's forehead to maintain stability (do not tilt head).

Continue compressions and breaths in a ratio of 5:1 (for 1 or 2 rescuers). Note that this differs from the recommended ratio of 3:1 (compressions to ventilations) for the newly born or premature infant in the neonatal ICU. (See "Part 11: Neonatal Resuscitation.") This difference is based on ease of teaching and skills retention for specifically trained providers in the delivery room setting, with increased emphasis on effective and frequent ventilation for the newly born infant.

Two thumb-encircling hands technique (this is the preferred 2-rescuer technique for healthcare providers when physically feasible):

1. Place both thumbs side by side over the lower half of the infant's sternum, ensuring that the thumbs do not compress on or near the xiphoid process. Encircle the infant's chest and support the infant's back with the fingers of both hands. Place both thumbs on the lower half of the infant's sternum, approximately 1 finger's width below the intermammary line. The intermammary line is an imaginary line located between the nipples, over the breastbone.
2. With your hands encircling the chest, use both thumbs to depress the sternum approximately one third to one half the depth of the child's chest. This will correspond to a depth of approximately 1/2 to 1 inch, but these measurements are not precise. After each compression, completely release the pressure on the sternum and allow the sternum to return to its normal position without lifting your thumbs off the chest wall.
3. Deliver compressions in a smooth fashion, with equal time in the compression and relaxation phases. A somewhat shorter time in the compression than relaxation phase offers theoretical advantages for blood flow in a very young infant animal model of CPR and is discussed in the neonatal guidelines. As a practical matter, with compression rates of at least 100 per minute (nearly 2 compressions per second), it is unrealistic to think that rescuers will be able to judge or manipulate compression and relaxation phases. In addition, details regarding such manipulation would increase the complexity of CPR instruction. For these reasons, provide compressions in approximately equal compression and relaxation phases for infants and children.
4. Compress the sternum *at a rate of at least 100 times per minute* (this corresponds to a rate that is slightly less than 2 compressions per second during the groups of 5 compressions). The compression *rate* refers to the *speed* of compressions, not the actual number of compressions delivered per minute. Note that this compression rate will actually result in provision of <100 compressions per minute, because you will pause to allow a second rescuer to provide 1

ventilation after every fifth compression. The actual number of compressions delivered per minute will vary from rescuer to rescuer and will be influenced by the compression rate and the speed with which the second rescuer can position the head, open the airway, and deliver ventilation.

5. After 5 compressions, pause briefly for the second rescuer to open the airway with a head tilt-chin lift (or, if trauma is suspected, with a jaw thrust) and give 1 effective breath (the chest should rise with the breath). Compressions and ventilations should be coordinated to avoid simultaneous delivery and ensure adequate ventilation and chest expansion, especially when the airway is unprotected.

Continue compressions and breaths in a ratio of 5:1 (for 1 or 2 rescuers). Note that this differs from the recommended ratio of 3:1 (compressions to ventilations) for the newly born or premature infant in the neonatal ICU (see "Part 11: Neonatal Resuscitation"). This difference is based on ease of teaching and skills retention for specific trained providers in the delivery room setting, with increased emphasis on effective and frequent ventilation needed for resuscitation of the newly born.

The 2 thumb-encircling hands technique may generate higher peak systolic and coronary perfusion pressure than the 2-finger technique, and healthcare providers prefer this technique to the alternative. For this reason the 2 thumb-encircling hands chest compression technique is the preferred technique for 2 *healthcare providers* to use in newly born infants and infants of appropriate size (Class IIb). This technique is *not* taught to the lay rescuer and is not practical for the healthcare provider working alone, who must alternate compression and ventilation.

Chest Compression Technique in the Child (Approximately 1 to 8 Years of Age):

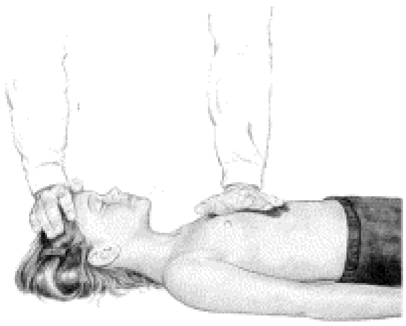


Figure 36. One-hand chest compression technique in child.

1. Place the heel of one hand over the lower half of the sternum, ensuring that you do not compress on or near the xiphoid process. Lift your fingers to avoid pressing on the child's ribs.
2. Position yourself vertically above the victim's chest and, with your arm straight, depress the sternum approximately one third to one half the depth of the child's chest. This corresponds to a compression depth of approximately 1 to 1 1/2 inches, but these measurements are not precise. After the compression, release the pressure on the sternum, allowing it to return to normal position, but do not remove your hand from the surface of the chest.
3. Compress the sternum *at a rate of approximately 100 times per minute* (this corresponds to a rate that is slightly less than 2 compressions per second during the groups of 5 compressions). The compression *rate* refers to the *speed* of compressions, not the actual number of compressions delivered per minute. Note that this compression rate will actually result in

provision of <100 compressions per minute because you will pause to provide 1 ventilation after every fifth compression. The actual number of compressions delivered per minute will vary from rescuer to rescuer and will be influenced by the compression rate and the speed with which you can position the head, open the airway, and deliver ventilations.

4. After 5 compressions, open the airway and give 1 effective rescue breath. Be sure the chest rises with the breath.
5. Return your hand immediately to the correct position on the sternum and give 5 chest compressions.
6. Continue compressions and breaths in a ratio of 5:1 (for 1 or 2 rescuers).

Note that many reasonable techniques are available to teach proper hand position for chest compression. The technique used should emphasize the importance of locating the lower half of the sternum, avoiding force on or near the xiphoid process and asymmetric force on the ribs. Emphasis should be placed on optimizing mechanics to depress the chest rhythmically approximately one third to one half the depth of the chest at a rate of approximately 100 times per minute and coordinating with rescue breaths to ensure delivery of adequate ventilation in between compressions without delay.

In large children and children >8 *years* of age, the adult 2-handed method of chest compression should be used to achieve an adequate depth of compression as follows (see "Part 3: Adult BLS"):

1. Place the heel of one hand on the lower half of the sternum. Place the heel of your other hand on top of the back of the first hand.
2. Interlock the fingers of both hands and lift the fingers to avoid pressure on the child's ribs.
3. Position yourself vertically above the victim's chest and, with your arm straight, press down on the sternum to depress it approximately 1 1/2 to 2 inches. Release the pressure completely after each compression, allowing the sternum to return to its normal position, but do not remove your hands from the surface of the chest.
4. Compress the sternum *at a rate of approximately 100 times per minute* (this corresponds to a rate of slightly <2 compressions per second during the groups of 15 compressions). The compression *rate* refers to the *speed* of compressions, not the actual number of compressions delivered per minute. Note that this compression rate will actually result in provision of <100 compressions each minute because you will pause to provide 2 ventilations after every group of 15 compressions. The actual number of compressions delivered per minute will vary from rescuer to rescuer and will be influenced by the compression rate and the speed with which you can position the head, open the airway, and deliver ventilation.
5. After 15 compressions, open the airway with the head tilt-chin lift (if trauma to the head and neck is suspected, use the jaw-thrust maneuver to open the airway) and give 2 effective breaths.
6. Return your hands immediately to the correct position on the sternum and give 15 chest compressions.
7. Continue compressions and breaths in a ratio of 15:2 for 1 or 2 rescuers until the airway is secure (see "Part 3: Adult BLS").

Until the airway is secured, the compression-ventilation ratio of 15:2 is recommended for 1 or 2 rescuers for adult victims and victims >8 years of age. Once the airway is secured, 2 rescuers should use a 5:1 ratio of compressions and ventilations.

Coordination of Compressions and Rescue Breathing
External chest compressions for infants and children should always be accompanied by rescue breathing. In the infant and child, a compression-ventilation ratio of 5:1 is maintained for both 1 and 2 rescuers. The 2-rescuer technique should be taught to healthcare providers. For infants in the special resuscitation circumstances of the delivery room and neonatal intensive care setting, even more emphasis is placed on ventilation during resuscitation, and a 3:1 compression-ventilation ratio is recommended (see "Part 11: Neonatal Resuscitation").

When 2 rescuers are providing CPR for an infant or child with an unsecured airway, the rescuer providing the compressions should pause after every fifth compression to allow the second rescuer to provide 1 effective ventilation. This pause is necessary until the airway is secure (intubated). Once the airway is secure (the trachea is intubated), the pause is no longer necessary. However, coordination of compressions and ventilation may facilitate adequate ventilation even after tracheal intubation and is emphasized in the newly born (see "Part 11: Neonatal Resuscitation"). Compressions may be initiated after chest inflation and may augment active exhalation during CPR. Although the technique of simultaneous compression and ventilation may augment coronary perfusion pressure in some settings, it may produce barotrauma and decrease ventilation and is not recommended. Priority is given to assuring adequate ventilation and avoidance of potentially harmful excessive barotrauma in children.

Reassess the victim after 20 cycles of compressions and ventilations (slightly longer than 1 minute) and every few minutes thereafter for any sign of resumption of spontaneous breathing or signs of circulation. The number 20 is easy to remember, so it is used to provide a guideline interval for reassessment rather than an indication of the absolute number of cycles delivered in exactly 1 minute. In the delivery room setting, more frequent assessments of heart rate-approximately every 30 seconds-are recommended for the newly born (see "Part 11: Neonatal Resuscitation").

In infants, coordination of rapid compressions and ventilations by a single rescuer in a 5:1 ratio may be difficult. To minimize delays, if no trauma is present, the rescuer can maintain airway patency during compressions by using the hand that is not performing compressions to maintain a head tilt. Effective chest expansion should be visible with each breath you provide. If the chest does not rise, use the hand performing chest compressions to perform a chin lift (or jaw thrust) to open the airway when rescue breaths are delivered. Then return the hand to the sternum compression position to resume compressions after the breath is delivered. If trauma is present, the hand that is not performing compressions should maintain head stability during chest compressions.

In children, head tilt alone is often inadequate to maintain airway patency. Often both hands are needed to perform the head tilt-chin lift maneuver (or jaw thrust) with each ventilation. The time needed to position the hands for each breath, locate landmarks, and reposition the hand to perform compressions may reduce the total number of compressions provided in a minute. Therefore, when moving the hand performing the compressions back to the sternum, visualize and return your hand to the approximate location used for the previous sequence of compressions.

Compression-Ventilation Ratio
Ideal compression-ventilation ratios for infants and children are unknown. From an educational standpoint, a single universal compression-ventilation ratio for victims of all ages and all

rescuers providing BLS and ALS interventions would be desirable. Studies of monitored rescuers have demonstrated that the 15:2 compression-ventilation ratio delivers more compressions per minute, and the 5:1 compression-ventilation ratio delivers more ventilations per minute.

There is consensus among resuscitation councils that pediatric guidelines should recommend a compression-ventilation ratio of 3:1 for newly born infants (see "Part 11: Neonatal Resuscitation") and 5:1 for infants and children up to 8 years of age. A 15:2 compression-ventilation ratio is now recommended for older children (>8 years of age) and adults for 1- or 2-rescuer CPR until the airway is secure. The rationale for maintaining age-specific differences in compression-ventilation ratios during resuscitation includes the following:

1. Respiratory problems are the most common cause of pediatric arrest, and most victims of pediatric cardiopulmonary arrest are hypoxic and hypercarbic. Therefore, effective ventilation should be emphasized.
2. Physiological respiratory rates in infants and children are faster than in adults.
3. Current providers are trained in and accustomed to these ratios. Any change from the current guidelines in a fundamental aspect of resuscitation steps should be supported by a high level of scientific evidence.

The actual number of delivered interventions (compressions and ventilations) per minute will vary from rescuer to rescuer and will depend on the compression rate, amount of time the rescuer spends opening the airway and providing ventilation, and rescuer fatigue. At present there is insufficient evidence to justify changing the current recommendations for compression-ventilation ratios in infants and children to a universal ratio (Class Indeterminate).

Emerging evidence in *adult* victims of cardiac arrest suggests that the provision of longer sequences of uninterrupted chest compressions (a compression-ventilation ratio >5:1) may be easier to teach and retain. In addition, animal data suggests that longer sequences of uninterrupted chest compressions may improve coronary perfusion. Finally, longer sequences of compressions may allow more efficient second-rescuer interventions in the out-of-hospital EMS setting. These observations have led to a Class IIb recommendation for a 15:2 compression-ventilation ratio for 1- and 2-rescuer CPR in older children (>8 years) and adults.

Compression-Only CPR

Clinical studies have established that outcomes are dismal when the pediatric victim of cardiac arrest remains in cardiac arrest until the arrival of EMS personnel. By comparison, excellent outcomes are typical when the child is successfully resuscitated before the arrival of EMS personnel. Some of these patients were apparently resuscitated with "partial CPR," consisting of chest compressions or rescue breathing only. In some published surveys, healthcare providers have expressed reluctance to perform mouth-to-mouth ventilation for unknown victims of cardiopulmonary arrest. This reluctance has also been expressed by some surveyed potential lay rescuers, although reluctance has not been expressed about resuscitation of infants and children.

The effectiveness of "compression-only" or "no ventilation" CPR has been studied in animal models of *acute VF* sudden cardiac arrest and in some clinical trials of *adult* out-of-hospital cardiac arrest. Some evidence in adult animal models and limited adult clinical trials suggests that positive-pressure ventilation may not be essential during the initial 6 to 12 minutes of an *acute VF* cardiac arrest. Spontaneous gasping and passive chest recoil may provide some ventilation during that time without the need for active rescue breathing. In addition, cardiac output during chest compression is only approximately 25% of normal, so the ventilation necessary to maintain optimal ventilation-perfusion relationships may be minimal. However, it does not appear that these observations can be applied to resuscitation of infants and children.

Well-controlled animal studies have established that simulated bystander CPR with chest compressions plus rescue breathing is superior to chest compressions alone or rescue breathing alone for asphyxial cardiac arrest and severe asphyxial hypoxic-ischemic shock (pulseless cardiac arrests). However, chest compression-only CPR and rescue breathing-only CPR have been shown to be effective early in animal models of pulseless arrest, and the application of either of these forms of "partial CPR" was found to be superior to no bystander CPR.

Preliminary evidence suggests that *both* chest compressions and active rescue breathing are necessary for optimal resuscitation of the asphyxial arrests most commonly encountered in children. For pediatric cardiac arrest, the lay rescuer should provide immediate chest compressions and rescue breathing. If the lay rescuer is unwilling or unable to provide rescue breathing or chest compressions, it is better to provide either chest compressions or rescue breathing than no bystander CPR (Class IIb).

APPENDIX C

Epidemiology, Recognition, and Management of Foreign Body Airway Obstruction in Adults

(Taken from: "Part 3: Adult Basic Life Support" *Circulation*. 102(8) (Supplement):I-22-I-59, August 22, 2000.)

Complete airway obstruction is an emergency that will result in death within minutes if not treated. The most common cause of upper-airway obstruction is obstruction by the tongue during loss of consciousness and cardiopulmonary arrest. An unresponsive victim can develop airway obstruction from intrinsic (tongue and epiglottis) and extrinsic (foreign body) causes. The tongue may fall backward into the pharynx, obstructing the upper airway. The epiglottis can block the entrance of the airway in unconscious victims. Blood from head and facial injuries or regurgitated stomach contents may also obstruct the upper airway, particularly if the victim is unconscious. Extrinsic causes may also produce airway obstruction, although the frequency is difficult to determine.

FBAO is a relatively uncommon but preventable cause of cardiac arrest. This form of death is much less common than death caused by other emergencies (1.2 deaths from choking per 100 000 population versus 1.7 per 100 000 for drowning, 16.5 per 100 000 for motor vehicle crashes, and 198 per 100 000 for coronary heart disease).

FBAO is *not* a common problem among submersion/near-drowning victims. Water does not act as a (solid) foreign body and does not obstruct the airway. Many submersion victims do not aspirate water at all, and any aspirated water will be absorbed in the upper airway and trachea. Near-drowning victims require immediate provision of CPR, particularly rescue breathing, to correct hypoxia. Therefore, efforts to relieve FBAO are not recommended for treatment of the victim of near-drowning. Such efforts may produce complications and will delay CPR, the most important treatment for the submersion victim.

Causes and Precautions

FBAO should be considered as a cause of deterioration in any victim, especially a younger victim, who suddenly stops breathing, becomes cyanotic, and falls unconscious for no apparent reason.

FBAO in adults usually occurs during eating, and meat is the most common cause of obstruction. A variety of other foods and foreign bodies, however, have caused choking in children and some adults. Common factors associated with choking on food include attempts to swallow large, poorly chewed pieces of food, elevated blood alcohol levels, and dentures. Elderly patients with dysphagia are also at risk for FBAO and should take care while drinking and eating. In restaurants, choking emergencies have been mistaken for a heart attack, giving rise to the term "café coronary."

The following precautions may help modify the risks and prevent FBAO:

1. Cut food into small pieces and chew slowly and thoroughly, especially if wearing dentures.
2. Avoid laughing and talking during chewing and swallowing.
3. Avoid excessive intake of alcohol.
4. Prevent children from walking, running, or playing when they have food in their mouths.

5. Keep foreign objects (i.e., marbles, beads, thumbtacks) away from infants and children.
6. Do not give foods that must be thoroughly chewed (i.e., peanuts, peanut butter, popcorn, hot dogs, etc) to young children.

Recognition of FBAO

Because recognition of airway obstruction is the key to successful outcome, it is important to distinguish this emergency from fainting, stroke, heart attack, seizure, drug overdose, or other conditions that may cause sudden respiratory failure but require different treatment.

Foreign bodies may cause either *partial* or *complete* airway obstruction. With partial airway obstruction, the victim may be capable of either "good air exchange" or "poor air exchange." With good air exchange, the victim is responsive and can cough forcefully, although frequently there is wheezing between coughs. As long as good air exchange continues, encourage the victim to continue spontaneous coughing and breathing efforts. At this point the rescuer should not interfere with the victim's own attempts to expel the foreign body but should stay with the victim and monitor these attempts. If partial airway obstruction persists, activate the EMS system.

The victim with FBAO may immediately demonstrate poor air exchange or may demonstrate initially good air exchange that progresses to poor air exchange. Signs of *poor* air exchange include a weak, ineffective cough, high-pitched noise while inhaling, increased respiratory difficulty, and possibly cyanosis. *Treat a victim with partial obstruction and poor air exchange as if he had a complete airway obstruction-you must act immediately.*

With *complete* airway obstruction the victim is unable to speak, breathe, or cough and may clutch the neck with the thumb and fingers. Movement of air is absent. The public should be encouraged to use the universal distress signal for choking emergencies. Ask the victim whether he or she is choking. If the victim nods, ask the victim if he or she can speak-if the victim is unable to speak, this indicates that a complete airway obstruction is present and you must act immediately.

Figure 37. Universal choking sign.

If complete airway obstruction is not relieved, the victim's blood oxygen saturation will fall rapidly because the obstructed airway prevents entry of air into the lungs. If you do not succeed in removing the obstruction, the victim will become unresponsive, and death will follow rapidly.

Relief of FBAO

Several techniques are used throughout the world to relieve FBAO, and it is difficult to compare the effectiveness of any one method with another. Most resuscitation councils recommend one or more of the following: the Heimlich abdominal thrusts, back blows, or chest thrusts. The level of evidence regarding any of these methods is weak, largely contained in case reports, cadaver studies, small studies involving animals, or mechanical models. Unfortunately, implementation of a randomized, prospective study to compare techniques for relief of FBAO in humans would be extremely difficult. Mechanical models of choking have been unsatisfactory. Cadaver studies can provide excellent models of unresponsive/unconscious victims, but they cannot replicate awake, responsive choking victims. Therefore, current recommendations are based on a low level of evidence (LOE 5 to 8), with an emphasis on the need to simplify information taught to the lay rescuer.

The Heimlich maneuver (also known as subdiaphragmatic abdominal thrusts or abdominal thrusts) is recommended for lay rescuer relief of FBAO in responsive adult (> 8 years of age) and child (1 to 8 years of age) victims in the United States, Canada, and many other countries. It is not recommended for relief of FBAO in infants. The Heimlich maneuver is also recommended by the AHA and several other resuscitation councils for use *by healthcare providers* for *unresponsive* adult and child (but not infant) victims.

Some resuscitation councils (i.e., the European Resuscitation Council) recommend that the rescuer provide up to 5 back blows/slaps as the initial maneuver, with the back slaps delivered between the shoulder blades with the heel of the rescuer's hand. If back slaps fail, up to 5 abdominal thrusts are then attempted, and groups of back slaps and abdominal thrusts are repeated. In countries such as Australia, back slaps and lateral chest thrusts are recommended for relief of FBAO in adults.

The Heimlich abdominal thrusts elevate the diaphragm and increase airway pressure, forcing air from the lungs. This may be sufficient to create an artificial cough and expel a foreign body from the airway. Successful relief of FBAO in responsive victims has been reported in the lay press and in medical case studies. Abdominal thrusts, however, may cause complications. For this reason, the Heimlich maneuver should never be performed unless it is necessary. Reported complications of the Heimlich maneuver include damage to internal organs, such as rupture or laceration of abdominal or thoracic viscera. In fact, victims who receive the Heimlich maneuver should be medically evaluated to rule out any life-threatening complications. To minimize the possibility of complications, do not place your hands on the xiphoid process of the sternum or on the lower margins of the rib cage. Your hands should be below this area but above the navel and in the midline. Some complications may develop even if the Heimlich maneuver is performed correctly. Regurgitation may occur as a result of abdominal thrusts and may be associated with aspiration.

Heimlich Maneuver with Responsive Victim Standing or Sitting

Stand behind the victim, wrap your arms around the victim's waist, and proceed as follows. Make a fist with one hand. Place the thumb side of your fist against the victim's abdomen, in the midline slightly above the navel and well below the tip of the xiphoid process. Grasp the fist with your other hand and press the fist into the victim's abdomen with a quick inward and upward thrust. Repeat the thrusts until the object is expelled from the airway or the victim becomes unresponsive. Each new thrust should be a separate and distinct movement administered with the intent of relieving the obstruction.

Figure 38. Subdiaphragmatic abdominal thrust (Heimlich maneuver), victim standing

The Heimlich maneuver is repeated until the object is expelled or the victim becomes unresponsive (loses consciousness). When the victim becomes unresponsive, the EMS system should be activated, and the lay rescuer will attempt CPR. The healthcare provider will proceed with the sequence of actions to relieve FBAO in the unconscious victim (see below).

The Self-Administered Heimlich Maneuver

To treat his or her own complete FBAO, the victim makes a fist with one hand, places the thumb side on the abdomen above the navel and below the xiphoid process, grasps the fist with the other hand, and then presses inward and upward toward the diaphragm with a quick motion. If this is unsuccessful, the victim should press the upper abdomen quickly over any firm surface, such as the back of a chair, side of a table, or porch railing. Several thrusts may be needed to clear the airway.

Chest Thrusts for Responsive Pregnant or Obese Victim

Chest thrusts may be used as an alternative to the Heimlich maneuver when the victim is in the late stages of pregnancy or is markedly obese. Stand behind the victim, with your arms directly under the victim's armpits, and encircle the victim's chest. Place the thumb side of one fist on the middle of the victim's breastbone, taking care to avoid the xiphoid process and the margins of the rib cage. Grab the fist with your other hand and perform backward thrusts until the foreign body is expelled or the victim becomes unresponsive.

If you cannot reach around the pregnant or extremely obese person, you can perform chest thrusts with the victim supine. Place the victim on his or her back and kneel close to the victim's side. The hand position and technique for the application of chest thrusts are the same as for chest compressions during CPR. In the adult, for example, the heel of the hand is on the lower half of the sternum. Deliver each thrust with the intent of relieving the obstruction.

Lay Rescuer Actions for Relief of FBAO in the Unresponsive Victim

Previous Guidelines recommendations for treatment of FBAO in the unresponsive victim were long, they took considerable time to teach, and they were often confusing for the student. When training programs attempt to teach large amounts of material, they fail to achieve core educational objectives (i.e., the psychomotor skills of CPR), and the result is poor skills retention and performance. Focused training on small amounts of information results in superior levels of student performance compared with traditional CPR courses. This compelling data indicates a need to simplify CPR training for laypersons.

Epidemiological data does not distinguish between FBAO fatalities in which the victim is *responsive* when first encountered and those in which the victim is *unresponsive* when first encountered by rescuers. The total number of all deaths caused by choking is small, however, so the likelihood that a rescuer will encounter an unconscious victim of FBAO is small. Cardiac arrest caused by VF is far more common than cardiac arrest caused by complete FBAO.

Expert panelists at the 1999 Evidence Evaluation Conference and at the International Guidelines 2000 Conference agreed that lay rescuer BLS courses should focus on teaching a small number of essential skills. These essential skills were identified as relief of FBAO in the responsive/conscious victim and the skills of CPR. Teaching the complex skills of relief of FBAO in the *unresponsive/unconscious* victim to *lay rescuers* is no longer recommended (Class IIb). If the adult choking victim becomes unresponsive/unconscious during attempts to relieve FBAO, the lone lay rescuer should activate the EMS system (or send someone to do it) and begin CPR. In fact, chest compressions may be effective for relief of FBAO in the unresponsive victim. A recent study using cadaver subjects (an acceptable model of the unresponsive/unconscious victim of FBAO) has shown that chest compressions may create a peak airway pressure that is equal to or superior to that created by abdominal thrusts. If the lay rescuer appears to encounter an unsuspected airway obstruction in the unresponsive victim during the sequence of CPR after attempting and reattempting ventilation, the rescuer should continue the sequence of CPR, with chest compressions and cycles of compressions and ventilations.

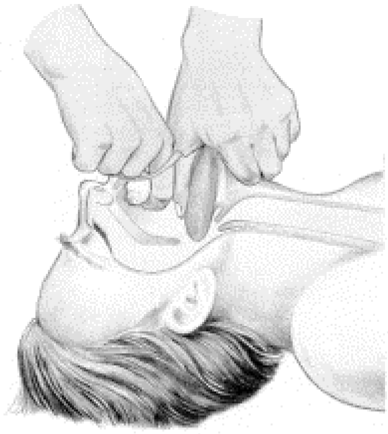


Figure 39. Finger sweep

The lay rescuer should attempt CPR with a single addition-each time the airway is opened, look for the obstructing object in the back of the throat. *If you see an object*, remove it. This recommendation is designed to simplify layperson CPR training and ensure the acquisition of the core skills of rescue breathing and compression while still providing treatment for the victim with FBAO.

Finger Sweep and Tongue-Jaw Lift

The finger sweep should be used by healthcare providers only in the *unresponsive/ unconscious* victim with complete FBAO. This sweep should not be performed if the victim is responsive or is having seizures.

With the victim face up, open the victim's mouth by grasping both the tongue and lower jaw between the thumb and fingers and lifting the mandible (tongue-jaw lift). This action draws the tongue away from the back of the throat and from a foreign body that may be lodged there. This maneuver alone may be sufficient to relieve an obstruction. Insert the index finger of your other hand down along the inside of the cheek and deeply into the victim's throat, to the base of the tongue. Then use a hooking action to dislodge the foreign body and maneuver it into the mouth so that it can be removed. It is sometimes necessary to use the index finger to push the foreign body against the opposite side of the throat to dislodge and remove it. Be careful to avoid forcing the object deeper into the airway.

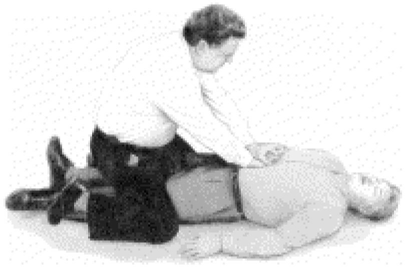


Figure 40. Healthcare provider provision of subdiaphragmatic abdominal thrust (Heimlich maneuver) in unresponsive/ unconscious victim.

Healthcare Provider Sequence for Relief of FBAO in the Unresponsive Victim
Victims of FBAO may initially be responsive when encountered by the rescuer and then become unresponsive. In this circumstance the rescuer will know that FBAO is the cause of the victim's symptoms. Victims of FBAO may be unresponsive when initially encountered by the rescuer. In this circumstance the rescuer will probably not know that the victim has FBAO until repeated attempts at rescue breathing are unsuccessful.

Healthcare Provider Relief of FBAO in a Responsive Victim Who Becomes Unresponsive
If you observe the victim's collapse and you *know* it is caused by FBAO, the following sequence of actions is recommended:

1. Activate the emergency response system at the proper time in the CPR sequence. If a second rescuer is available, send the second rescuer to activate the EMS system while you remain with the victim. Be sure the victim is supine.
2. Perform a tongue-jaw lift, followed by a finger sweep to remove the object.
3. Open the airway and try to ventilate; if you are unable to make the victim's chest rise, reposition the head and try to ventilate again.
4. If you cannot deliver effective breaths (the chest does not rise) even after attempts to reposition the airway consider FBAO. Straddle the victim's thighs and perform the Heimlich maneuver (up to 5 times).
5. Repeat the sequence of tongue-jaw lift, finger sweep, attempt (and reattempt) to ventilate, and Heimlich maneuver (steps 2 through 4) until the obstruction is cleared and the chest rises with ventilation or advanced procedures are available (i.e., Kelly clamp, Magill forceps, cricothyrotomy) to establish a patent airway.
6. If the FBAO is removed and the airway is cleared, check breathing. If the victim is not breathing, provide slow rescue breaths. Then check for signs of circulation (pulse check and evidence of breathing, coughing, or movement). If there are no signs of circulation, begin chest compressions.

To deliver abdominal thrusts to the unresponsive/unconscious victim, kneel astride the victim's thighs and place the heel of one hand against the victim's abdomen, in the midline slightly above the navel and well below the tip of the xiphoid. Place your second hand directly on top of the first. Press both hands into the abdomen with quick upward thrusts (Figure 40). If you are in the correct position, you will be positioned over the midabdomen, unlikely to direct the thrust to the right or left. You can use your body weight to perform the maneuver.

Two types of conventional forceps are acceptable for removal of a foreign body, the Kelly clamp and the Magill forceps. Forceps should be used only if the foreign body is seen. Either a laryngoscope or tongue blade and flashlight can be used to permit direct visualization. The use of such devices by untrained or inexperienced persons is unacceptable. Cricothyrotomy should be performed only by healthcare providers trained and authorized to perform this surgical procedure.

Healthcare Provider Relief of FBAO in Victims Found Unresponsive

If the victim is found to be unresponsive and the cause is unknown, the following sequence of actions is recommended:

1. Activate the emergency response system at the appropriate time in the CPR sequence. If a second rescuer is available, send that rescuer to activate the EMS system while you remain with the victim.
2. Open the airway and attempt to provide rescue breaths. If you are unable to make the chest rise, reposition the victim's head (reopen the airway) and try to ventilate again.
3. If the victim cannot be ventilated even after attempts to reposition the airway, straddle the victim's knees (see Figure 40) and perform the Heimlich maneuver (up to 5 times).
4. After 5 abdominal thrusts, open the victim's airway using a tongue-jaw lift and perform a finger sweep to remove the object.
5. Repeat the sequence of attempts (and reattempts) to ventilate, Heimlich maneuver, and tongue-jaw lift and finger sweep (steps 2 through 4) until the obstruction is cleared or advanced procedures are available to establish a patent airway (i.e., Kelly clamps, Magill forceps, or cricothyrotomy).
6. If the FBAO is removed and the airway is cleared, check breathing. If the victim is not breathing, provide 2 rescue breaths. Then check for signs of circulation (pulse check and evidence of breathing, coughing, or movement). If there are no signs of circulation, begin chest compressions.

APPENDIX D

Relief of Foreign-Body Airway Obstruction in Infants and Children

(Taken from: “Part 9: Pediatric Basic Life Support” *Circulation*. 102(8) (Supplement):I-253-I-290, August 22, 2000.)

BLS providers should be able to recognize and relieve complete FBAO. Three maneuvers to remove foreign bodies are suggested: back blows, chest thrusts, and abdominal thrusts. There are some differences between resuscitation councils as to the sequence of actions used to relieve FBAO, but the published data does not support the effectiveness of one sequence over another. There is consensus that lack of protection of the upper abdominal organs by the rib cage renders infants and young children at risk for iatrogenic trauma from abdominal thrusts. Therefore, the use of abdominal thrusts is not recommended for relief of FBAO in infants (Class III).

Epidemiology and Recognition of FBAO

Most reported cases of FBAO in adults are caused by impacted food and occur while the victim is eating. Most reported episodes of choking in infants and children occur during eating or play, when parents or childcare providers are present. The choking event is therefore commonly witnessed, and the rescuer usually intervenes when the victim is conscious.

Signs of FBAO in infants and children include the *sudden* onset of respiratory distress associated with coughing, gagging, or stridor (a high-pitched, noisy sound or wheezing). These signs and symptoms of airway obstruction may also be caused by infections such as epiglottitis and croup, which result in airway edema. However, signs of FBAO typically develop very abruptly, with no other signs of illness or infection. Infectious airway obstruction is often accompanied by fever, with other signs of congestion, hoarseness, drooling, lethargy, or limpness. If the child has an infectious cause of airway obstruction, the Heimlich maneuver and back blows and chest thrusts will not relieve the airway obstruction. The child must be taken immediately to an emergency facility.

Priorities for Teaching Relief of Complete FBAO

When FBAO produces signs of *complete* airway obstruction, act quickly to relieve the obstruction. If partial obstruction is present and the child is coughing forcefully, do not interfere with the child's spontaneous coughing and breathing efforts. Attempt to relieve the obstruction only if the cough is or becomes ineffective (loss of sound), respiratory difficulty increases and is accompanied by stridor, or the victim becomes unresponsive. Activate the EMS system as quickly as possible if the child is having difficulty breathing. If > 1 rescuer is present, the second rescuer activates the EMS system while the first rescuer attends to the child.

If a *responsive infant* demonstrates signs of complete FBAO, deliver a combination of back blows and chest thrusts until the object is expelled or the victim becomes unresponsive. Although the data in this age group is limited, Heimlich thrusts are not recommended because abdominal thrusts may damage the relatively large and unprotected liver.

If a responsive child (1 to 8 years of age) demonstrates signs of complete FBAO, provide a series of Heimlich subdiaphragmatic abdominal thrusts. These thrusts increase intrathoracic pressure, creating artificial "coughs" that force air and the foreign body out of the airway.

Epidemiological data does not distinguish between FBAO fatalities in which the victims are responsive when first encountered from those in which the victims are unresponsive when initially encountered. Anecdotal evidence, however, suggests that the lay rescuer is more likely to encounter a victim of FBAO who is conscious initially.

The likelihood that a cardiac arrest or unresponsiveness will be caused by an unsuspected FBAO is thought to be low. However, the impact of averting a cardiac arrest in a responsive victim with complete airway obstruction would be significant.

The 1992 guidelines for treatment of FBAO in the unconscious/unresponsive victim were time consuming to teach and perform and were often confusing to students. Training programs that attempt to teach large amounts of material to lay rescuers may fail to achieve core educational objectives (i.e., the psychomotor skills of CPR), resulting in poor skills retention and performance. Focused skills training results in superior levels of student performance compared with traditional CPR courses. This data indicates a need to simplify CPR training for laypersons, including skills in relief of FBAO.

Expert panelists at the Second AHA International Evidence Evaluation Conference held in 1999 and at the International Guidelines 2000 Conference on CPR and ECC agreed that lay rescuer BLS courses should focus on teaching a small number of essential skills. These essential skills were identified as relief of FBAO in the responsive/conscious victim and the skills of CPR. Teaching of the complex skills set of relief of FBAO in the *unresponsive/ unconscious* victim to *lay rescuers* is no longer recommended (Class IIb).

If the infant or child choking victim becomes unresponsive/unconscious during attempts to relieve FBAO, provide CPR for approximately 1 minute and then activate the EMS system. Several studies indicate that chest compressions identical to those performed during CPR may generate sufficient pressure to remove a foreign body. If the lay rescuer appears to encounter an airway obstruction in the unresponsive victim during the sequence of CPR after attempting and reattempting ventilation, the rescuer should look for and remove the object if seen in the airway when the mouth is opened for rescue breathing. Then the rescuer continues CPR, including chest compressions and cycles of compressions and ventilation.

Healthcare providers should continue to perform abdominal thrusts for responsive adults and children with complete FBAO and alternating back blows and chest thrusts for responsive infants with complete FBAO. Healthcare providers should also be taught the sequences of action appropriate for relief of FBAO in *unresponsive* infants, children, and adults. These sequences of actions for healthcare providers are unchanged from the 1992 guidelines.

Relief of FBAO in the Responsive Infant: Back Blows and Chest Thrusts
The following sequence is used to clear a foreign-body obstruction from the airway of an infant. Back blows are delivered while the infant is supported in the prone position, straddling the rescuer's forearm, with the head lower than the trunk. After 5 back blows, if the object has not been expelled, give up to 5 chest thrusts. These chest thrusts consist of chest compressions over the lower half of the sternum, 1 finger's breath below the intermammary line. This landmark is the same location used to provide chest compressions during CPR. Chest thrusts are delivered while the infant is supine, held on the rescuer's forearm, with the infant's head lower than the body.

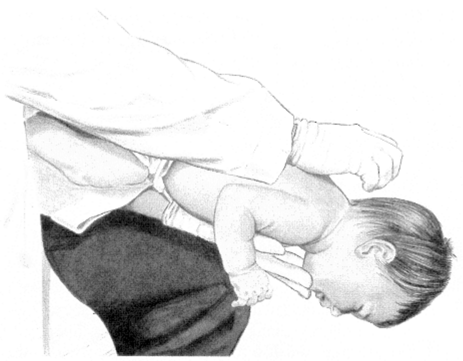


Figure 41. Infant back blows to relieve complete FBAO.

Perform the following steps to relieve airway obstruction (the rescuer is usually seated or kneeling with the infant on the rescuer's lap):

1. Hold the infant prone with the head slightly lower than the chest, resting on your forearm. Support the infant's head by firmly supporting the jaw. Take care to avoid compressing the soft tissues of the infant's throat. Rest your forearm on the your thigh to support the infant.
2. Deliver up to 5 back blows forcefully in the middle of the back between the infant's shoulder blades, using the heel of the hand. Each blow should be delivered with sufficient force to attempt to dislodge the foreign body.
3. After delivering up to 5 back blows, place your free hand on the infant's back, supporting the occiput of the infant's head with the palm of your hand. The infant will be effectively cradled between your 2 forearms, with the palm of one hand supporting the face and jaw, while the palm of the other hand supports the occiput.
4. Turn the infant as a unit while carefully supporting the head and neck. Hold the infant in the supine position, with your forearm resting on your thigh. Keep the infant's head lower than the trunk.
5. Provide up to 5 quick downward chest thrusts in the same location as chest compressions- lower third of the sternum, approximately 1 finger's breadth below the intermammary line. Chest thrusts are delivered at a rate of approximately 1 per second, each with the intention of creating enough of an "artificial cough" to dislodge the foreign body.
6. If the airway remains obstructed, repeat the sequence of up to 5 back blows and up to 5 chest thrusts until the object is removed or the victim becomes unresponsive.

Relief of FBAO in the Responsive Child: Abdominal Thrusts (Heimlich Maneuver)

Note: Three maneuvers are suggested to relieve FBAO in the child: back blows, chest thrusts, and abdominal thrusts. Back blows and chest thrusts may be alternative interventions for FBAO in children, and international training programs should train providers on the basis of ease of teaching and retention in their community.

Abdominal Thrusts with Victim Standing or Sitting

The rescuer should perform the following steps to relieve complete airway obstruction:

1. Stand or kneel behind the victim, arms directly under the victim's axillae, encircling the victim's torso.
2. Place the flat, thumb side of 1 fist against the victim's abdomen in the midline slightly above the navel and well below the tip of the xiphoid process.
3. Grasp the fist with the other hand and exert a series of up to 5 quick inward and upward thrusts. Do not touch the xiphoid process or the lower margins of the rib cage, because force applied to these structures may damage internal organs.

Figure 42. Abdominal thrusts performed for a responsive child with FBAO.

4. Each thrust should be a separate, distinct movement, delivered with the intent to relieve the obstruction. Continue the series of up to 5 thrusts until the foreign body is expelled or the victim becomes unresponsive.

Relief of FBAO in the Unresponsive Infant or Child

Lay Rescuer Actions

If the infant or child becomes unresponsive, attempt CPR with a single addition-each time the airway is opened, look for the obstructing object in the back of the throat. *If you see an object*, remove it. This recommendation is designed to simplify layperson CPR training and ensure the acquisition of the core skills of rescue breathing and compression while still providing treatment to the FBAO victim.

Healthcare Provider Actions

Blind finger sweeps should not be performed in infants and children because the foreign body may be pushed back into the airway, causing further obstruction or injury to the supraglottic area. When abdominal thrusts or chest thrusts are provided to the unresponsive/unconscious, non-breathing victim, open the victim's mouth by grasping both the tongue and lower jaw between the thumb and finger and lifting (tongue-jaw lift). This action draws the tongue away from the back of the throat and may itself partially relieve the obstruction. If the foreign body is seen, carefully remove it.

If the *infant* victim becomes unresponsive, perform the following sequence:

1. Open the victim's airway using a tongue-jaw lift and look for an object in the pharynx. If an object is visible, remove it with a finger sweep. Do not perform a blind finger sweep.
2. Open the airway with a head tilt-chin lift and attempt to provide rescue breaths. If the breaths are not effective, reposition the head and reattempt ventilation.
3. If the breaths are still not effective, perform the sequence of up to 5 back blows and up to 5 chest thrusts.

4. Repeat steps 1 through 3 until the object is dislodged and the airway is patent or for approximately 1 minute. If the infant remains unresponsive after approximately 1 minute, activate the EMS system.
5. If breaths are effective, check for signs of circulation and continue CPR as needed, or place the infant in a recovery position if the infant demonstrates adequate breathing and signs of circulation.

If the *child* victim becomes unresponsive, place the victim in the supine position and perform the following sequence:

1. Open the victim's airway using a tongue-jaw lift and look for an object in the pharynx. If an object is visible, remove it with a finger sweep. However, do not perform a blind finger sweep.
2. Open the airway with a head tilt-chin lift, and attempt to provide rescue breaths. If breaths are not effective, reposition the head and reattempt ventilation.
3. If the breaths are still not effective, kneel beside the victim or straddle the victim's hips and prepare to perform the Heimlich maneuver abdominal thrusts as follows:

a. Place the heel of one hand on the child's abdomen in the midline slightly above the navel and well below the rib cage and xiphoid process. Place the other hand on top of the first.
b. Press both hands onto the abdomen with a quick inward and upward thrust. Direct each thrust upward in the midline and not to either side of the abdomen. If necessary, perform a series of up to 5 thrusts. Each thrust should be a separate and distinct movement of sufficient force to attempt to dislodge the airway obstruction.

Figure 43. Abdominal thrusts performed for supine, unresponsive child.

4. Repeat steps 1 through 3 until the object is retrieved or rescuer breaths are effective.
5. Once effective breaths are delivered, assess for signs of circulation and provide additional CPR as needed or place the child in a recovery position if the child demonstrates adequate breathing and signs of circulation.