

MODULE VI

OB, INFANTS & CHILDREN

LEARNING OBJECTIVES

Upon completion of this course, you will be able to:

1. Assess and provide care to the obstetric patient.
2. Assist with the delivery of an infant.
3. Assess and provide care to the newborn.
4. Assess and provide care to the mother immediately following delivery of a newborn:
 - Identify pre-delivery emergencies.
 - State the steps to assist in the delivery.
 - Discuss the steps in the delivery of the placenta.
 - List the steps in the emergency medical care of the mother post delivery.
 - Summarize neonatal resuscitation procedures.
 - Describe the procedures for abnormal deliveries.
5. Assess and provide care to an ill or injured infant or child with:
 - Respiratory distress.
 - Shock (hypoperfusion).
 - Cardiac arrest.
 - Seizures.
 - Trauma.

Infants, children, and expectant mothers often cause anxiety for the prehospital care provider. This may be caused by lack of experience in dealing with these special populations or by a fear of failure. Understanding the special factors involved (eg, body size, developmental considerations, normal ranges for vital signs) is important in their emergency medical care.

Your crew stopped for an ice cream on the way back to the station on a hot summer evening. Suddenly a woman screams "He's coming! Oh, no! He's coming now!"

As you look toward her a reddish-yellow puddle on the floor catches your eye. Captain Smith radios for an ambulance and rescue unit.

SCENARIO

"Miss, I am an EMT. Can I help you?" you ask. And then you heard the words you have dreaded since finishing EMT school.

"Catch my baby! He's coming out—right now!"

And sure enough you see the baby is crowning.

NORMAL DELIVERY

Predelivery Considerations

When it comes to childbirth, transport of the expectant mother is your priority. However, when delivery is imminent, you should be prepared to deliver on scene. In order to assess how imminent delivery is, you need to perform a predelivery assessment, including these triage questions:

- Are you pregnant?
- How long have you been pregnant?
- Are there any contractions or pain?
- Are you having any bleeding or discharge?
- Is crowning occurring with contractions (do you feel the baby's head coming out)?
- What is the frequency and duration of contractions?
- Do you feel as if you are having a bowel movement, with increasing pressure in the vaginal area?
- Do you feel the need to push?

Precautions

If you determine that delivery is imminent, you must take precautions for a safe and clean delivery. Body substance isolation (BSI) precautions should be followed according to your local protocol. You should have an obstetrics or childbirth kit in the ambulance. These kits vary by manufacturer, but at minimum you should have:

- 2 antiseptic OB towels
- 1 bulb syringe
- 1 sterile scalpel or pair of umbilical scissors

- 1 disposable plastic apron
- 1 pair of sterile exam gloves
- 1 plastic-lined under-pad
- 3 disposable towels
- 1 sterile OB pad
- 4 sterile 4 x 4s

To ensure a safe delivery, remember the following don'ts:

- Don't allow the mother to use the bathroom.
- Don't hold the mother's legs together in an attempt to delay delivery.
- Don't encourage the mother to push.
- Don't examine the vaginal area without someone else present (except for actual delivery of the newborn).

Everyone has limitations, and you need to know yours before you commit to a delivery. Once you are committed, if delivery has not occurred within 10 minutes initiate transport to the closest medical facility. Understand that delivery may occur during transport.

Delivery Procedures

Childbirth is a natural process and the job of prehospital providers is to assist that process. Once you have observed proper BSI, you need to position the mother appropriately. Two positions are commonly used to facilitate childbirth. The SIMS position—in which the mother lies on her side with her back toward the attendant and her knees drawn toward her chest—is generally not used by prehospital providers due to space limitations and possible discomfort to the patient.

Positioning the mother supine, with her knees drawn up and legs apart, works better when space is limited. Remember to leave room for delivery of the newborn onto the bed or other safe surface. If desired, the mother's buttocks can be elevated with blankets or a pillow.

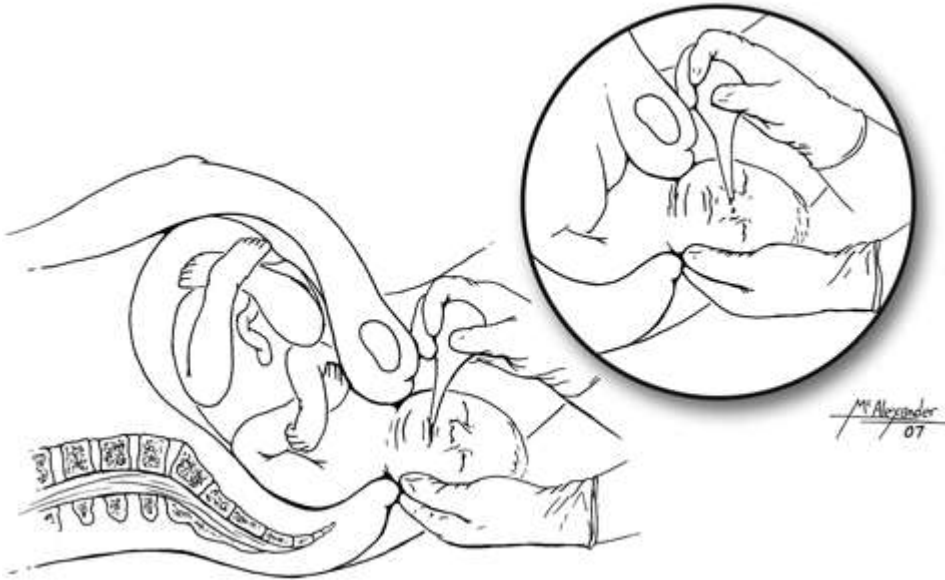
Once the mother is in position, maintain a sterile field around the vaginal opening. As the head begins to deliver (crowns), gently exert pressure against the bony part of the baby's skull to prevent an explosive delivery. Avoid pressing on the fontanelle (soft spot).

If the amniotic sac is not broken, a clamp can be used to puncture the sac. Push the sac away from the infant's head and mouth as they appear. As the head continues to deliver, observe for the umbilical cord around the infant's neck. You can either unwrap it or slip the cord over the infant's shoulder. As a last resort, to avoid asphyxiation to the fetus, clamp and cut the cord. Once the head is delivered, it needs to be supported.

Medical Director Comment

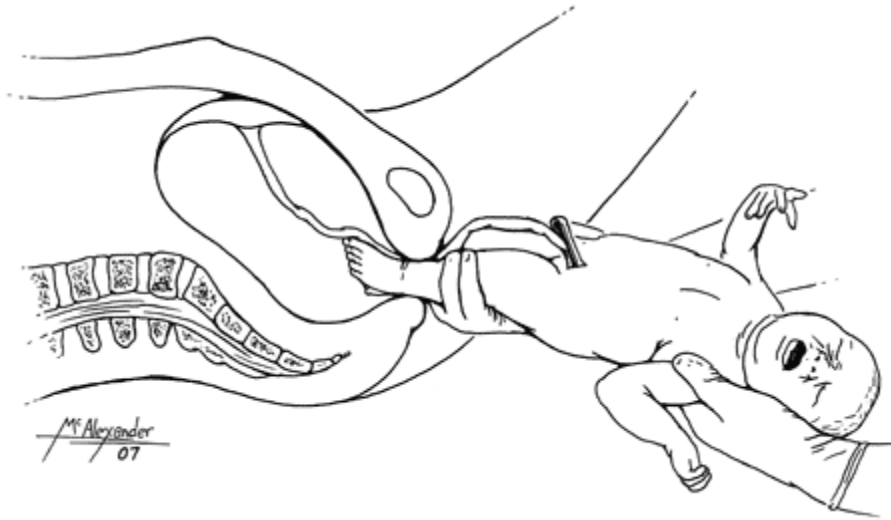
In the past, it was common to suction the infant's airway after delivery of the head—but before delivery of the shoulders—to try to reduce aspiration, especially when meconium

was seen. However a large recent study showed no benefit; therefore, the new American Heart Association (AHA) guidelines no longer advise routine suctioning of the nose or mouth before the shoulders are delivered.



Once delivered, the baby's head is supported. The AHA no longer recommends routine suctioning, but it is still done in special circumstances (eg, when meconium is present). (Illustration by Jason M. McAlexander, MFA. Copyright © 2007 by Wild Iris Medical Education.)

The torso is next to deliver. Occasionally, some assistance is needed. The infant's shoulders may need to be guided past the symphysis pubis (bone). Using one hand to support the head and neck and the other to support the torso, apply gentle pressure toward the posterior (downward toward the floor); this should be all that's needed to pass the symphysis pubis. Maintain two hands on the infant at all times and be sure to grasp the feet as they deliver. The baby will be very slippery. If you grasp the lower leg firmly with one hand, just proximal to the ankle, it is less likely that the baby could slip out of your hands.



As the newborn exits the birth canal, grasp the lower leg firmly near the ankle to avoid dropping the slippery body. (Illustration by Jason M. McAlexander, MFA. Copyright © 2007 by Wild Iris Medical Education.)

Medical Director Comment

Keep the infant level with the vaginal opening until the umbilical cord has been clamped and cut. Suction the mouth and nose. Wipe any blood and mucus from the mouth and nose with sterile gauze. Wrap the infant in a warm blanket and place it on its side with the head lower than the trunk. Position is important to avoid transfusion from fetus to placenta or placenta to fetus. Either condition will cause severe compromise and require more-invasive neonatal resuscitation.

Once the infant has been delivered, assign one crew member to monitor and care for the infant.

The EMT tending the mother notes when pulsation of the umbilical cord ceases, and clamps or ties the cord about 4 finger widths from the infant. A second clamp or tie should be placed 3 to 4 finger widths from the first. The cord is then cut between the clamps.

The placenta will deliver on its own within 10 to 15 minutes. Transport should not be delayed for delivery of the placenta. Do not pull on the umbilical cord to get the placenta out. This will put the mother at risk for postpartum hemorrhage. Once the placenta is delivered, wrap it in a towel and place it in a plastic bag. The placenta must be transported safely to the hospital along with mother and newborn.

Prepare mother and child for transport. Place a sterile pad over the vaginal opening, and lower the mother's legs, gently holding them together. Mother, child, and placenta are then delivered to the hospital.

Do not forget to record the time of birth!

Vaginal Bleeding Following Delivery

Bleeding of as much as 500 ml is normal after delivery and is usually well tolerated by the mother. Being aware of this will help prevent undue psychological stress on the mother or the emergency crew.

Excessive postpartum hemorrhaging—of more than 500 ml—calls for aggressive, rapid intervention. First, massage the uterus. Place one hand, fingers fully extended, on the mother's lower abdomen and the other above the symphysis pubis, massage or knead the lower abdominal area. The uterus should become firm. If bleeding continues, check the massage technique and transport immediately. High-flow oxygen should be administered en route, with frequent reassessment of interventions and vital signs.

Regardless of estimated blood loss, if the mother shows signs of shock or hypoperfusion you should transport immediately. Treat the mother as if severe shock is present. Begin uterine massage en route. This is a life-threatening emergency.

Initial Care of the Newborn

Care for the newborn begins with positioning, warming, and stimulation. Wrap the newborn in a blanket and be sure the baby is properly positioned. Begin by wiping and drying the newborn while it is protected by the blanket. Cover the head to prevent heat loss. Suction the mouth and nose as needed. When you have finished wiping and drying the newborn, replace the original blanket with one that is clean and warm.

The APGAR score is commonly used to evaluate the newborn's condition at delivery. The initial APGAR score is done at 1 minute and then 5 minutes following delivery. The newborn should then be reassessed every 5 minutes until care is transferred to the hospital. The APGAR uses **A**ppearance, **P**ulse, **G**rimace, **A**ctivity, and **R**espiratory effort to determine physiological condition. Ten is the best possible score. The following chart explains APGAR scoring.

Sign	0	1	2
Appearance	Blue, pale	Body pink, ext. blue	All pink
Pulse rate	0	<100	>100
Grimace	No response	Grimaces	Cries
Activity	Limp	Some flexion of extremities	Active motion
Respiratory	Absent	Slow and irregular	Strong cry

If at delivery the infant is not breathing, or is breathing irregularly, stimulate it by flicking the soles of the feet or rubbing the back. Stimulation should produce regular ventilations and increase perfusion. When stimulation does not work, more aggressive resuscitation measures are needed.

Resuscitation of the Newborn

The first steps are to position, suction, warm, dry, and stimulate the newborn. These are all part of the normal delivery process and should be accomplished in 30 seconds. Next you assess skin color, heart rate, and breathing effort. If there are signs of poor perfusion and the heart rate is less than 100 beats per minute, begin oxygen administration by nonrebreather mask. Always be cautious with high-flow oxygen; if the pressure is too high, hyperoxia can result.

If the newborn is not breathing, proceed immediately to assisted ventilations by bag valve mask. Administer breaths at 40 to 60 breaths per minute for 30 seconds. Check the heart rate again. The newborn's heart rate can be checked two ways: (1) Palpate the pulse below the umbilicus. Count the beats for 10 seconds and multiply by 6. (2) If the pulse is not palpable, auscultate with your stethoscope over the apical area for heart sounds. If the heart rate is below 60 beats per minute, you need to initiate chest compressions at a rate of 100 per minute. Use the two hands encircling technique if possible (AHA, 2006).



If the newborn's heart rate is less than 60 bpm, initiate compressions at 100 bpm using the two-hand-encircling technique shown here. (Illustration by Jason M. McAlexander, MFA. Copyright © 2007 by Wild Iris Medical Education.)

If compressions and ventilations do not work, advanced life support (ALS) is required. Continue with ventilations and compressions until care can be transferred to an ALS provider or the newborn demonstrates adequate ventilations and perfusion. Remember that effective ventilations include a good seal and normal inhalation/exhalation times. Ventilating too fast and too forcefully will compromise the heart and circulatory system (AHA, 2006).

ABNORMAL DELIVERIES

It is a windy October day. Kids are decorating for Halloween, only two days away. An 8-year-old boy runs up to your ambulance.

"Help me! It is my mom. She's having her baby."

"Where is she now?" you ask. He points toward a car, where a crowd is gathering.

SCENARIO You move the ambulance next to the car. The scene appears safe. You have only time for one question.

"Ma'am, when are you due?"

"The baby is early, my doctor warned me this could happen."

The next thing you know a lifeless newborn is in your hands.

Prolapsed Cord

Prolapsed cord is the condition where the umbilical cord presents through the birth canal before delivery of the head. This is a serious emergency that endangers the life of the fetus.

Prolapsed cord is a rare presentation that generally occurs in early labor when the amniotic sac ruptures. The main concern is to prevent compression of the umbilical cord by a limb or the head. Compression of the cord will cause a decrease in oxygen and nutrients to the fetus. If prolapsed cord is not recognized early, the end result is fetal death.

The responder should have performed a normal scene size-up, initial assessment, history, and physical examination. An initial set of vital signs is obtained and monitored every 5 minutes.

Because a prolapsed cord causes *fetal* distress, there may be no abnormality in the mother's vital signs, and you may not recognize the condition until you evaluate the mother's vaginal opening and actually see the thick, bluish umbilical cord. If you see the cord, help the mother into knee-chest position (on her knees, facing down, with pelvis elevated) or keep her supine but elevate the pelvis with pillows and try to lower her head.

These positions are meant to take the weight of the fetus off the umbilical cord. Most important, make sure the mother does not try to push, which will cause further cord compression and endanger her baby.

There are very few times when prehospital providers insert their fingers into the vaginal opening. This is one of them. Carefully insert your sterile-gloved fingers into the vaginal opening. Apply a gentle pressure on the head of the fetus to keep it off the cord. To protect the exposed cord, wrap it in a moist sterile towel, preferably one soaked in saline.

You must maintain this position, holding the fetus away from the umbilical cord, until the patient is handed off. Check the cord frequently for pulsations. If pulsations are not felt, apply more pressure or reposition the mother. Provide high-flow oxygen for the mother and transport rapidly to the closest hospital with surgical capabilities.

Breech Presentation

Breech presentation occurs when the fetus is positioned in the uterus so that the buttocks or lower extremities will be the first to deliver. This presentation places the fetus at risk for trauma. It also makes prolapse of the umbilical cord more likely. Transport should begin as soon as breech presentation is recognized.

Treatment is similar to that for prolapsed cord. The mother is placed on high-flow oxygen and in the supine position, with her pelvis elevated by pillows above the level of her head. For a consideration of knee-chest, see medical director comment that follows.

Medical Director Comment

It is dangerous to transport a patient in the knee-chest position because the patient is at risk of tumbling off the gurney when the ambulance turns corners; this should be reserved for the more emergent condition of prolapsed cord, which poses far greater risk to the fetus. The guidelines state "head-down position with pelvis elevated" and I think this implies supine with pelvis elevated by Trendelenberg and/or pillows under pelvis. This is safest for both mother and baby.

Nothing should be inserted into the vaginal opening unless there is a prolapsed cord. Immediate, rapid transport to a facility with surgical capabilities is the best treatment. Encouraging the mother not to push is extremely important as you attempt to delay delivery.

Limb Presentation

Limb presentation occurs when a limb of the fetus protrudes through the vaginal opening. This is a presentation that requires surgical intervention. Cover the protruding limb with a sterile towel. Position the mother supine with her head lower and her pelvis elevated by pillows. Place the mother on high-flow oxygen and begin transport immediately. Do not attempt to push the limb back into the vaginal opening. Choose the closest appropriate facility that has surgical capabilities.

Multiple Births

Multiple births are not usually a surprise to the expectant mother; however, mothers who have had poor or no prenatal care may not know they are having more than one baby. If the abdomen remains enlarged after delivery of the first fetus, or the first fetus is remarkably small for a full-term baby, you need to check for another fetus. It will be very difficult to hear a fetal heartbeat using a stethoscope on the mother's abdomen; palpation for a second baby is much easier, especially in a noisy setting.

The procedure for delivering multiple fetuses is the same as that for a single fetus, except that you will need additional assistance, equipment, and ambulances. Multiple fetuses are more likely to be born prematurely and to have low birthweight. Be prepared to address resuscitation issues with premature newborns.

Meconium

Meconium is a greenish substance that represents the newborn's first bowel movement. Amniotic fluid that is greenish or brownish-yellow rather than clear indicates the presence of meconium and may signal fetal distress during labor. It is important to prevent the fetus from aspirating meconium. Once the newborn has been delivered, take care not to stimulate breathing until the mouth and nose are thoroughly suctioned. If you suspect aspiration of meconium, request ALS assistance. The infant may need tracheal suctioning if distress develops.

This is a serious respiratory emergency for the newborn. Aspiration of meconium can result in the collapse of alveoli, or atelectasis. You need to ensure appropriate oxygenation and ventilation. Do not delay transport of the newborn in these cases. Rapid transport to a facility with neonatal resuscitation is recommended, particularly if ALS providers are not on scene. Consider rendezvousing en route with ALS providers.

Premature Delivery

Premature delivery is any delivery at 36 weeks of gestation, or earlier. It is possible for a fetus to survive on its own anytime after 24 weeks' gestation. There are two considerations with preterm delivery. The first is hypothermia, and you must take all steps to lessen hypothermia as a matter of practice. The other is the need for aggressive resuscitation. Always request ALS assistance when the delivery is premature.

Mothers in their teens or those over 35 years of age are at risk for preterm delivery. Other preterm women at risk include those with infections, those with an illicit drug history, and those who have excessive amniotic fluid.

MEDICAL PROBLEMS IN INFANTS AND CHILDREN

Partial Airway Obstruction

Children tend to put foreign objects into their mouths; unfortunately, this can cause a partial or complete airway obstruction. A **partial obstruction** is when the child is conscious and alert, and able to cough, cry, or speak. Stridor or crowing noises are typical airway sounds heard when there is partial obstruction of the upper airway. Retractions are seen upon inspection of the chest. Retractions are named based on their location on the chest:

- Intercostal retractions are seen between the ribs.
- Sub- or supra-clavicular retractions are seen around the clavicles.
- Sub- or supra-sternal retractions are seen around the sternum.



Child experiencing shortness of breath. Note retractions in the neck and chest. (Illustration by Jason M. McAlexander, MFA. Copyright © 2007 by Wild Iris Medical Education.)

A decrease in capillary refill time following partial obstruction is a sign of decreased peripheral perfusion and a deterioration in the child's condition.

Emergency treatment and assessment are limited in the child with a partially obstructed airway. Agitation in the child may cause the obstruction to worsen. Place children in a

position of comfort. Never lay them down. If children are more comfortable on a parent's lap, allow them to remain there until the obstruction is cleared.

Offer the child oxygen, through either blow-by or mask. Be careful not agitate children by forcing oxygen on them. Limit your examination to noninvasive techniques and visualization. Observing from a distance is acceptable. Transport to the closest appropriate facility should begin as soon as possible.

Complete Airway Obstruction

A partial obstruction can quickly deteriorate into a **complete obstruction**. Altered level of consciousness, cyanosis, and inability to cough are signs of impending respiratory failure due to complete airway obstruction. Unconsciousness and lack of ventilations are the last signs seen in a complete airway obstruction.

You must attempt to clear the airway when children are semi-conscious or unable to clear the airway on their own. For children from 12 months of age up to adolescence, perform the Heimlich maneuver until the obstruction is expelled or the child becomes unconscious. Before giving ventilations, examine the mouth for the obstruction. If you can visualize it, try to remove it but do not perform blind finger sweeps; the risk of pushing the object farther down the airway is greater in children. If you are unable to remove the obstruction after an attempt to visualize it, perform CPR on an unconscious child.

You need to clear the airway for infants under 12 months who are semi-conscious or unable to clear on their own. Alternate between 5 back blows and 5 chest thrusts until the object is expelled or the infant becomes unconscious. When the infant is unconscious, proceed as with an older child, being sure to avoid blind finger sweeps.

For infants and children, ventilations are performed with a bag valve mask (BVM). A good seal is needed to maintain effective ventilation and oxygenation. Be cautious when providing artificial ventilations. If ventilations are too forceful or the rate is too high, barotrauma and cardiac compromise can result.

Respiratory Emergencies

Respiratory difficulty is one of the common reasons for activation of the 911 system. **Stridor** is a high-pitched sound heard on inspiration and is a key sign for partial or complete airway obstruction. It is also a sign for upper-airway obstruction due to disease.

Upper-Airway Diseases

There are several other upper-airway diseases. Croup and epiglottitis are the two most common. They tend to mimic an upper-airway obstruction by a foreign object.

Croup is a viral infection that causes inflammation of the trachea, resulting in subglottic edema. The child will present with a 2- to 4-day history of cold symptoms and a low-grade fever. A barking (seal-like) cough is the universal sign for croup and more severe cases also involve stridor.

Epiglottitis is a bacterial infection of the epiglottis. Excessive drooling is the universal sign for epiglottitis. In addition to drooling, the child will have a sudden onset of dysphagia or difficulty swallowing, stridor, and high-grade fever. The child may also be in the tripod position upon arrival.



Child assuming the tripod position as a reaction to impaired breathing. (Illustration by Jason M. McAlexander, MFA. Copyright © 2007 by Wild Iris Medical Education.)

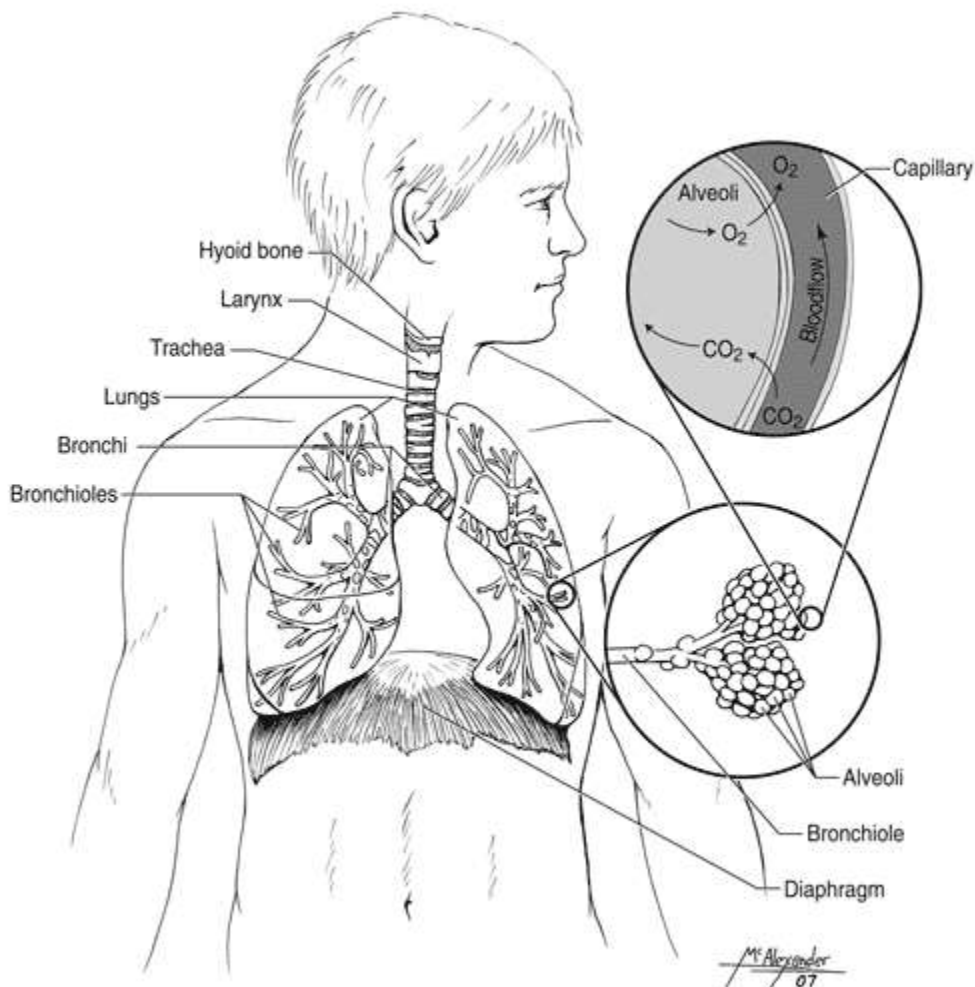
In the prehospital setting, croup and epiglottitis are treated in the same way. The child needs humidified oxygen through either blow-by or nonrebreather mask. Humidity will help to reduce the swelling in the airway. Agitating the child must be avoided because agitation will increase the work of breathing. Visualization of the mouth and throat are also to be avoided. The child's position is important for reducing work of breathing. An upright, seated position is preferred. If the child prefers to sit on a parent's lap, permit them to do so if it is in accordance with your local protocols.

Bag valve mask ventilations are indicated in cases of impending respiratory failure. Rapid transport is indicated because of the possibility of complete airway obstruction. For every millimeter of edema in the airway, children lose 50% of their airway.

Lower-Airway Diseases

Many children suffer from diseases affecting the lower airways. While stridor is an indication of upper-airway obstruction, **wheezing** is the sound of lower-airway obstruction. It is usually heard during exhalation due to increased breathing effort. On initial assessment, the child with lower-airway disease will have rapid, labored ventilations and visual retractions.

Asthma is the most common lower-airway disease affecting children. Asthma in children under 2 years of age may be called reactive airway disease (RAD). Asthma is a chronic disease state with triggered episodes. An episode is an inflammatory response in which bronchoconstriction, mucosal edema, and profuse secretions occur in the lower airways.



Lower airway showing gas exchange. (Illustration by Jason M. McAlexander, MFA. Copyright © 2007 by Wild Iris Medical Education.)

Children with known asthma will likely be on bronchodilators, self-administered by MDI or nebulizer. Most episodes are self-treated at home without EMS assistance. The cases in which the 911 system is activated require a good initial assessment and early recognition of possible impending respiratory failure.

A child having an asthma episode will present with changed levels of breathing effort, breathing rate, wheezing, and pulse rate. By comparing the presenting signs and symptoms to the patient history or asthma risk assessment you will be able to gage the severity of the episode.

Prehospital treatment for asthma is dependent on the severity of the episode. Oxygen should be administered regardless of pulse oximetry. If children are unable to self-administer their MDI, assist them in accordance with local protocols. Assistance by ALS is requested for treatment with nebulized bronchodilators and advanced airway management when respiratory failure is imminent or assisted ventilations are needed. Do not force ventilations or provide rapid ventilations. These children are at high risk for barotrauma or pneumothorax due to obstructed lower airways. They should be transported to the closest appropriate facility in accordance with local protocol.

Respiratory syncytial virus (RSV) infection in the bronchioles is a major cause of **bronchiolitis**, which usually affects children from 6 months to 2 years of age. It presents similar to croup, with a 2- to 4-day history of cold symptoms. As the disease progresses, there is an increase in breathing effort, wheezing, and visual retractions. Again, avoid agitation, which will increase the effort of breathing.

Prehospital treatment begins with humidified oxygen through either blow-by or nonrebreather mask. Request ALS assistance for treatment with nebulized bronchodilators. When providing ventilations for these children, be aware of maintaining tidal volume appropriate to their small size. Transport to the closest appropriate facility in accordance with local protocol.

Respiratory Distress

Children's bodies can compensate for many medical problems that may show earlier signs in an adult; therefore, prehospital providers need to recognize the subtle signs of increased breathing effort. Once you recognize them, proceed with aggressive treatment. Nasal flaring, retractions, and accessory muscle use are all signs that may be overlooked on initial assessment. Retractions can appear above or below the clavicle, in the intercostal spaces, and above or below the sternum.

Stridor, wheezing, and grunting are all airway sounds commonly heard in children with respiratory difficulty. **Stridor** is a high-pitched sound heard on inspiration due to partial upper-airway obstruction. **Wheezing** is a whistling sound heard on exhalation due to increased mucus production in the bronchi or to bronchospasm. **Grunting** is a low-pitched sound heard at the end of exhalation due to fluid in the lower airways and alveoli.

When early signs of increased breathing effort have gone untreated, an increase in accessory muscle use and ventilation rate sometimes indicates that distress is progressing. A child with a ventilation rate greater than 60 breaths per minute is considered to have respiratory distress—even, if there are no associated symptoms. As early distress progresses, look for a decrease in peripheral perfusion, poor muscle tone, and altered mental status. Cyanosis, either peripheral or central, is also seen in early respiratory distress. These are all signs of impending failure or arrest.

Respiratory arrest, or failure, occurs when the child can no longer compensate. A ventilation rate less than 10 breaths per minute is considered respiratory failure. Weak or absent peripheral pulses coupled with a decreased heart rate are signs of respiratory failure. Unconsciousness and limp muscle tone signify respiratory arrest and failure.

Failure can be prevented with early recognition and aggressive intervention. Prehospital treatment of respiratory distress begins with high-flow oxygen through blow-by or nonrebreather mask. If distress progresses and ventilatory assistance is required, use a BVM at a rate of 1 breath every 3 seconds and no more than 20 ventilations a minute. Over-aggressive ventilations and too-rapid ventilations will cause further compromise in the sick child. Provide ventilatory support to all children who persist with altered mental status, poor muscle tone, respiratory failure, and cyanosis despite oxygen administration. Remember, recognize fast and treat early!

Cardiac Arrest

Cardiac arrest in children and infants is usually secondary to an injury or illness. Sudden cardiac arrest is possible, although there are only a few known causes. Congenital heart problems, blunt trauma to the chest, and toxins are the most common.

For infants and children in nontraumatic cardiac arrest, prehospital providers should check for movement or response after stimulation. If there is not a response, the airway is opened by head tilt–chin lift. The provider should look for chest rise and listen and feel for air movement over no longer than 10 seconds. If there is not breathing, give 2 breaths. If at any time breaths do not enter, the airway needs to be repositioned.

After the 2 breaths are given, perform a pulse check. Palpate for a brachial pulse on infants or a carotid pulse on children. The pulse check should not exceed 10 seconds. If no pulse is felt, initiate chest compressions without delay. Cycles of 30 compressions and 2 breaths are performed if one provider is present. Cycles of 15 compressions and 2 breaths are performed if two providers are present. The two hands encircling technique is preferred for compressions on an infant.

Cardiopulmonary resuscitation should continue on an **infant** until ALS providers take over or the infant begins to move. If the infant has a pulse and is not breathing, 1 ventilation is given every 3 seconds. Providers should not exceed 20 ventilations per minute.

Cardiopulmonary resuscitation should continue on a **child** until ALS providers take over, or an AED is attached, or the child begins to move. If the child has a pulse but is not breathing, 1 ventilation is given every 3 to 5 seconds. Providers should not exceed 20 ventilations per minute.

An AED, when available, should be used on children older than 12 months. Pediatric defibrillation patches are preferred, but if there are only adult patches available, use them. Just be sure that the patches do not touch each other and do not cut them to fit the child. When you have witnessed the cardiac arrest, apply the AED as soon as possible and perform defibrillation immediately when shock is advised.

For all other cardiac arrest situations, CPR is performed for 5 cycles or 2 minutes. The rhythm is analyzed and defibrillation is administered without delay when shock is advised. Continue CPR until the AED is charged; the goal is to minimize the amount of time that CPR is not being performed. After defibrillation, immediately resume CPR for 5 cycles or 2 minutes followed by rhythm and pulse checks. Continue to provide 5 cycles or 2 minutes of CPR and defibrillations (when advised) until ALS providers take over or the child begins to move. Remember to resume CPR immediately after the defibrillation.

Seizures

Seizures are another common reason for activation of the 911 system. Understanding why seizures happen is challenging; learning the common causes of seizures is easy. Common causes for seizures in children are:

- Head injury.
- Fever.
- Ingestion.
- Infections.
- Hypoxia.
- Hypoglycemia.

Seizures present in three ways: generalized, partial, and status.

Generalized seizures involve both sides of the brain and have an associated loss of consciousness. The most common is the **grand mal seizure**. The child exhibits rhythmic movements of the extremities. A **petit mal seizure** has no rhythmic movements. The child is unresponsive to the environment or unaware of the surroundings regardless of stimulation.

Partial seizures involve just one side of the brain. They can be either simple or complex. The child will have rhythmic movements of one extremity or one side of the body. There is no associated loss of consciousness. A partial seizure may progress to a complex seizure. The defining sign is a loss of consciousness.

Status seizures, or status epilepticus, had previously been defined as generalized seizures lasting more than 30 minutes or two or more seizures without regaining consciousness. Most recently the definition has been changed to any continuous seizure lasting longer than 5 minutes or intermittent seizures over more than 15 minutes.

Prehospital providers should obtain a good history on children who have had a possible seizure. There are many possible causes for pediatric seizures. If the child has a history of seizures, you need to ask about prior seizures: their pattern, their duration, and the time elapsed since the last seizure. Document any anti-seizure medications along with their prescribed dosages. Ask the parent or care provider when was the last time the child took the medication.

Prehospital treatment begins with ensuring a patent airway during and after the seizure. Position the child on the side if there is no possibility of spinal injury. A suction device with appropriate catheters may be needed to clear secretions, blood, or foreign bodies that can obstruct the airway. Give oxygen through either blow-by or nonrebreather mask during and after the seizure. If the child has signs of inadequate breathing, provide ventilatory support with a BVM.

Transport can be delayed until the seizure stops, unless the child is in status seizure. The cause of the seizure may be more life-threatening than the seizure itself. Look for and treat the cause. Check the blood sugar to rule out hypoglycemia. Use pulse oximeters to rule out hypoxia. Check the temperature to rule out fever. Request ALS assistance. The child may need pharmacologic intervention to stop the seizure. Also, advanced providers may be needed to treat the cause.

During the postictal (post seizure) period, inadequate breathing and altered mental status are common. You need to continue supporting ventilation or to initiate support. Once the child is completely conscious, alert, and oriented, provide supplemental support measures.

Shock

Shock is hypoperfusion to the tissues and organs. In children, shock is rarely a primary cardiac event. The common causes of shock in children are diarrhea, dehydration, multi-system trauma, vomiting, blood loss, sepsis, and abdominal injuries. These causes need to be recognized and treated early. Children compensate better than adults and they can deteriorate quickly without warning.

Signs of shock can be subtle in children. Look for an increase in pulse and respirations as the first signs of shock. Infants may be fussy for a few days before exhibiting more apparent signs. As shock progresses, pale, cool, clammy skin, and delayed peripheral capillary refill are the signs to look for. A decrease in urine output is significant but it is hard to measure in the prehospital setting. Ask the parent or caregiver about the number of wet diapers since the onset of symptoms. Change in mental status, absent or weak

peripheral pulses, and delayed central capillary refill are late signs of shock. The absence of tears may be noted if the child is crying. The child is no longer compensating.

Prehospital treatment of shock begins with recognition. Request ALS assistance early. Give oxygen through blow-by or nonrebreather mask. If the child has inadequate ventilations, support them with a BVM and an airway. Control external bleeding. Place the child supine with legs elevated.

When children are in shock, it is hard for their bodies to regulate temperature. Take steps to lessen hypothermia regardless of ambient temperature. Begin transport immediately upon recognition of shock. Perform detailed physical examinations en route to the closest appropriate facility or according to local protocols.

TRAUMA IN CHILDREN

On the way back to the station, you pull up to a red light. There is a crowd of people gathered on the corner. Your partner looks through the crowd and yells "A child has been hit by a car!"

SCENARIO You pull over, and both of you approach the child. He is a 5-year-old wearing a red helmet. There is deformity of his left thigh. You direct your partner to get immobilization supplies and request ALS assistance. You complete your rapid trauma assessment, only to hear over the radio that the nearest ALS unit is 20 minutes away.

Patterns of Injury

Injuries are the most common cause of death in infants and children. These deaths are usually preventable. Protective strategies can prevent certain injuries. Car seat checkpoints, helmet campaigns, and drowning prevention programs are available in most communities. It is up to you to get involved. Ensuring proper care is the most proactive roll!

Blunt trauma is more common than penetrating trauma in children. The child's pathophysiology and anatomy are more resilient and pliable than adults, so injuries tend to go unnoticed until it is too late. Prehospital providers need to recognize subtle signs and suspect injury based on mechanism.

Children also have different injury patterns than adults. The patterns vary by mechanism of injury. The most common mechanism is motor vehicle accidents (MVAs). There are four subcategories of MVA: unrestrained passenger, restrained passenger, deployed airbag, and auto v. pedestrian.

In the **unrestrained** child passenger, suspect head, neck, scalp, and facial injuries. Multi-system trauma is common. In the **restrained** child passenger, suspect chest and

abdominal injuries from the seatbelt. Lower-spine injuries are common even though the child is restrained.

Airbags are there to prevent injury but for a child they do more harm than good. If **airbags** deploy, suspect head, chest, and facial injuries. Upper-extremity injuries are also common.

When a child is **struck by a vehicle**, they do one thing different from an adult; the child will turn toward the vehicle. Children are open to more serious injuries. At low speeds, suspect extremity fractures. At moderate and high speeds, suspect head, facial, neck, chest, and abdominal injuries. Lower-extremity fractures and multi-system trauma are common.

Falls from height or diving into shallow water are other common mechanisms of injury. Neck and head injuries are the most likely. Low heights may produce lower-extremity fractures. Medium to high heights may produce both upper- and lower-extremity fractures. Multi-system trauma should be suspected on falls from great heights.

Bicycles are related to two mechanisms. A child may be struck while riding a bicycle or may fall from the bicycle. If a child was struck while riding a bicycle suspect spinal, chest, lower-extremity, and abdominal injuries. Falls from a bicycle may produce abdominal and upper-extremity injuries. Any time a child is not wearing a helmet, suspect a head injury. (Remind children to wear a helmet whenever they are riding a bicycle.)

Burns are another common injury. There are two mechanisms: scalds and direct contact. Children suffer from scalds through tipping boiling fluids onto themselves or through being immersed in a tub of hot water. Immersion scalds are a common sign of abuse.

Children sustain contact burns either by touching something hot or by having something hot abusively inflicted upon them. Cigarettes, curling irons, and steam irons are common items used to inflict burns. Not all burns are the result of abuse. Obtain a good history of events prior to and after the burn. Suspected abuse must be reported in accordance with local protocol and state law.

Sports injuries are common among school-aged children. Most commonly these involved the head, neck, or extremities.

Child abuse has multiple patterns, and not everything that looks like abuse is abuse. However, it should be suspected. Burns are the most common pattern. Raccoon eyes, fresh abrasions from restraint, human bites, welts or abrasions from whipping with a belt or cord, and other bizarre injuries are all possible signs of abuse. If a child has multiple bruises in different stages of healing, this may be a sign of ongoing abuse.



Child showing evidence of abuse, including fresh and healing cigarette burns and raccoon eyes. (Illustration by Jason M. McAlexander, MFA. Copyright © 2007 by Wild Iris Medical Education.)



It is important to examine the child's entire body. The broken arm could be a sign of abuse. The marks on the neck and shoulder appear to be from fingers and the marks on the back and leg could be from a beating with a belt, cord, or other device. (Illustration by Jason M. McAlexander, MFA. Copyright © 2007 by Wild Iris Medical Education.)

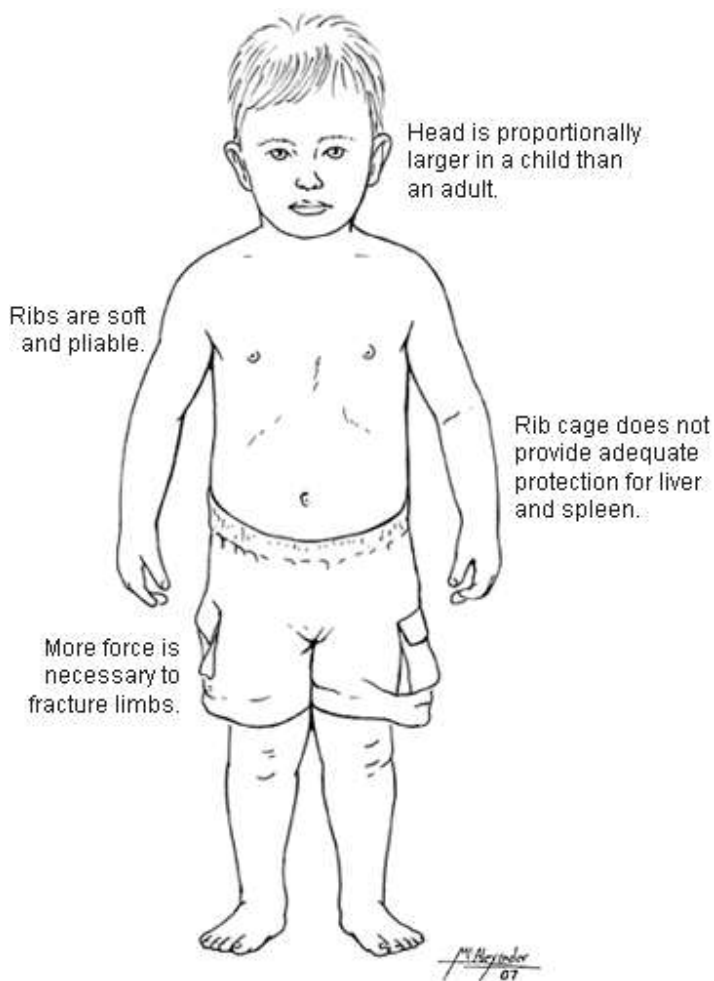
In addition to injury patterns, prehospital providers should look into the events leading to the injury. Red flags include:

- Inappropriate response from parents or care provider
- Prolonged interval between onset and medical attention
- Story doesn't meet the developmental level of the child
- Discrepancy between the history and degree of injury

Abuse should be suspected if any of the listed factors are present during the assessment. Remember that abuse must be reported in accordance with local protocol and state law.

Specific Body Systems

The child's body differs from an adult's in several ways. You must understand these differences to ensure appropriate treatment and prevent unseen complications. For example, take steps to lessen or prevent hypothermia regardless of ambient temperatures. In a traumatic event, the child may not be able to maintain normal temperature.



Note the differences between the child and adult body.
(Illustration by Jason M. McAlexander, MFA. Copyright © 2007 by Wild Iris Medical Education.)

The head is proportionally larger in a child than an adult. Head injuries in children commonly lead to respiratory arrest. Arrest may occur during transport. Signs of a head injury could be masked by compensation or other distracting injuries. Hypoxia is likely due to airway obstruction by the tongue. Opening and maintaining a patent airway is essential to prevent obstruction.

The jaw-thrust is the preferred technique to open and maintain an airway in the child who has suffered trauma. Providing a patent airway is a priority over cervical spine stabilization because the child will die without an airway. If the airway cannot be opened or maintained with a jaw-thrust, a modified head tilt–chin lift should be done.

The chest is a common place for hidden injuries. The ribs are soft and pliable. Energy from blunt trauma is transferred to the organs within the rib cage. There may be no outward signs of injury. Serious injury is suspected when there has been blunt trauma to the chest.

The abdomen is the most common place for injury, which may be hidden. The liver and spleen are protected by the rib cage in an adult, but the child's rib cage does not provide adequate protection for those organs. Intra-abdominal injury is suspected in a child with deteriorating vital signs and no external signs of trauma.

Assess for a distended abdomen, which may signal air trapped in the stomach; this can be caused by over-aggressive ventilations. Trapped air may actually interfere with artificial ventilations due to increased intrathoracic pressure. The ventilation provider may complain that it is hard to ventilate or there is poor compliance. An increase in intrathoracic pressure will also cause poor cardiac output and hypoperfusion.

Children's extremities are not that different from those of an adult, although it takes more force to fracture them. Fractures are managed in the same way as for adults. Check circulation, motor function, and sensation distal to the injury before and after application of a bandage or splint.