

## **CHAPTER 3**

# **PEDIATRIC TREATMENT PROTOCOLS**

### **PEDIATRIC TREATMENT OVERVIEW**

Pediatric patients are not just "small people." They have unique needs and problems that will affect prehospital as well as hospital care. These differences are all the more important to remember, because infants and children make up a small part of our patient population and opportunities to practice assessment and management skills are infrequent. In addition, the pediatric emergency is rarely preceded by chronic disease. If intervention is swift and effective, the child can often be restored to full health. This makes the psychological burden and reward for us as providers all the greater.

The following principles should be remembered:

- A. Airways are smaller, softer, and easier to obstruct or collapse.
- B. Respiratory reserve is small. Minor insults such as improper positioning, vomitus, stomach filled with air, or airway narrowing can lead to major problems.
- C. Circulatory reserve is also small. The loss of one unit of blood is sufficient to account for severe shock or death in an infant. Conversely, 500 ml of unnecessary fluid can result in acute pulmonary edema.
- D. Vital signs and level of consciousness are difficult to assess. History, a high index of suspicion, and "soft signs" can be critical. Listen to the parents. They know when changes have occurred, even if they have difficulty expressing what has changed.
- E. Electrolyte solutions should always be used in pediatric IVs. D5W is *not* indicated for infants or children.
- F. The proper size of equipment is very important because of the child's poor cardiorespiratory reserve. A complete selection of laryngoscope blades, ET tubes, suction catheters and IV catheters is essential for optimal care.
- G. Pediatric equipment and drugs should be stored separately so they can be found easily when needed.
- H. Pediatric resuscitation skills must be practiced to be ready when needed. In addition, protocols should be kept simple and procedures with poor likelihood of success should be left to the hospital setting *if* simpler support and rapid transport will suffice to maintain the patient.

## INFANT AND CHILD RESUSCITATION

### Specific information needed

- A. History -- what happened, when was child found, recent illness.
- B. Past history -- diseases, medications.
- C. Surroundings -- evidence of abuse, neglect, poisoning.

### Specific objective findings

- A. Absence of consciousness.
- B. Terminal or no respirations.
- C. Absence of central pulse (carotid or femoral).
- D. Color, temperature.
- E. Signs of trauma.

### Treatment

- A. Open airway and attempt ventilation.
- B. If airway obstructed:
  1. Attempt to visualize airway with laryngoscope and remove any obvious foreign body.
  2. Reposition airway.
  3. Attempt to ventilate.
  4. If unsuccessful, administer up to 5 subdiaphragmatic abdominal thrusts (child) or up to 5 back blows and 5 chest thrusts (infant).
  5. Remove apparent foreign body, or
  6. Repeat steps 1-5 if needed.
  7. Consider needle cricothyrotomy if obstruction unrelieved.
- C. Check pulse once ventilations established. Begin chest compressions if no pulse.
- D. Check rhythm with monitor or quick-look paddles.

### **VENTRICULAR FIBRILLATION**

1. Defibrillate with 2 joules/kg, or equivalent biphasic, pediatric paddles.
2. If no response to initial shock repeat immediately with 2- 4 joules/kg or equivalent biphasic.
3. If no response, shock again with 4 joules/kg or equivalent biphasic.
4. If no response, intubate and hyperventilate at 30 breaths/min.
5. If no response, administer:  
Epinephrine (1:10,000), 0.1 ml/kg IV or (1:1,000) 0.1 ml/kg via ET, (ET dose is 10 times IV dose).

If no reponse, defibrillate at 4 j/kg or equivilent biphasic.  
Lidocaine 1 mg/kg IV or IO. Consider amiodarone or magnesium as an alternative.

6. Assess for hypovolemia. If possible -- start IV or IO, volume expander (RL or NS) administer 20 ml/kg.

### **BRADYCARDIA**

1. Oxygenate and hyperventilate. Intubate.
2. Compress chest if heart rate is < 80/minute in infant or < 60/minute in child.
3. IV or IO -- volume expander (RL or NS).
4. Treat for possible hypovolemia. Start IV or IO -- volume expander (RL or NS), administer 20 ml/kg rapidly.
5. Consider:
  - a. Epinephrine (1:10,000) 0.1 ml/kg IV or 0.1 ml/kg (1:1,000) via ET.
  - b. Atropine, 0.02 mg/kg IV or ET.
  - c. Consider pacing.

### **ASYSTOLE or PEA (Not VF/VT)**

1. Oxygenate and hyperventilate. Intubate.
2. IV -- volume expander (RL or NS).
3. Treat for possible hypovolemia. Start IV -- volume expander (RL or NS), administer 20 ml/kg rapidly.
4. Consider:
  - a. Epinephrine (1:10,000) 0.1 ml/kg IV or (1:1,000) 0.1 ml/kg ET. May repeat IV Epinephrine 0.1 - 0.2 ml/kg (1:10,000) in 3-5 minutes.
  - b. Calcium or Magnesium for specific indications.
  - c. Sodium bicarbonate for specific indications.
5. Consider treatable causes
6. Transport rapidly for further resuscitation with CPR in progress.

### **TACHYCARDIA**

1. Sinus Tachycardia – Treat underlying cause.
2. Supraventricular Tachycardia (Narrow complex)
  - a. Consider vagal maneuvers.
  - b. Adenosine 0.1 mg/kg IV (max 6 mg).
  - c. Adenosine 0.2 mg/kg IV (max 12 mg).
  - d. \*If patient conscious with signs of poor perfusion, consider sedation, cardiovert at 0.5-1.0 j/kg, or equivilent biphasic. May repeat once at 2.0 j/kg
  - e. If patient unconscious, cardiovert at 0.5-1.0 j/kg, or equivilent biphasic. May repeat once at 2.0 j/kg

- f. Consider treatable causes.
- 3. Ventricular Tachycardia (Wide Complex)
  - a. If conscious: Lidocaine 1 mg/kg IV. Consider amiodarone.
  - b. Consider procainamide 15 mg/kg IV over 30 minutes.
  - c. \*If patient conscious with signs of poor perfusion, consider sedation, cardiovert at 0.5-1.0 j/kg, or equilivent biphasic.
  - d. If patient unconscious, cardiovert at 0.5-1.0 j/kg, or equilivent biphasic. May repeat once at 2.0 j/kg
  - e. Consider treatable causes.

#### Specific precautions

- A. Pediatric arrests are most likely to be primary respiratory events. The rescuer's primary attention, therefore, must be directed to ensure both airway and good ventilations before any concerns for the cardiac rhythm. *Any* cardiac rhythm can spontaneously convert to NSR in a well-ventilated child.
- B. Infants and children have a much greater capacity than adults to recover from cardiorespiratory arrest. CPR should be started if there is any possibility of recovery. If the chances appear poor, basic CPR with rapid transport will still allow the relatives to receive the emotional and social support of the hospital environment. Conversely, children who are cold, rigid and mottled should be left at the scene after notification and arrival of responsible law enforcement personnel.
- C. SIDS (Sudden Infant Death Syndrome) will be one of the most frequent causes of cardiorespiratory arrest in infants between the ages of 1 month to 1 year. The parents or caretakers will have a great deal of guilt feelings. If these feelings are recognized and addressed it can help prevent some of the long-term effects of this devastating occurrence. Unfortunately, SIDS can be very hard to distinguish from child abuse and vice versa. Therefore it is most important not to be judgmental or suggest a diagnosis when there is not enough information to be accurate.
- D. Cardiorespiratory arrest in a trauma situation (as with an adult) is best treated with rapid transport with CPR enroute. IVs may be established and fluids administered during transport.
- E. The most successful infant resuscitations occur BEFORE a full cardiopulmonary arrest. Assess infants carefully and assist with airway, breathing, and circulatory problems BEFORE the arrest occurs to improve the overall care to the pediatric patient.
- F. The current recommendations from the American Heart Association for obstructed airway are for abdominal thrusts in children over the age of one year only. Infants less than one year

should be treated with both back blows and chest thrusts. The Pediatric Advanced Life Support (PALS) course is recommended for learning technique. However, paramedics or advanced EMTs should not feel restricted, but should use the laryngoscope early in an attempt to visualize the foreign body.

- G. Note the following differences in pediatric drug doses:
- Sodium bicarbonate is administered as half-strength solution (4.2%) for infants less than 10 kg. Use premixed pediatric ampules or dilute adult strength 1:1 with saline. Dose is 1 mEq/kg or 2 ml/kg of the 4.2% solution.
  - Epinephrine is given in the 1:10,000 strength IV or the 1:1,000 strength for ET administration.
  - Dextrose 25% (dilute 1:1 with saline or sterile water), 2-4 ml/kg of 25% solution.
- For IVs -- RL or NS is preferred.
- H. The Broselow Pediatric Resuscitation Tape is a simple and effective way to have multiple bits of data available to assist with infant and pediatric resuscitation. The tape is designed to place beside the youngster. Drugs and equipment are pre-measured and calculated such that by reading off the tape at the appropriate length of the patient, the approximate weight is given with equipment size listing and critical drug dosages. Its use is recommended.

## NEONATAL RESUSCITATION

### Specific information needed

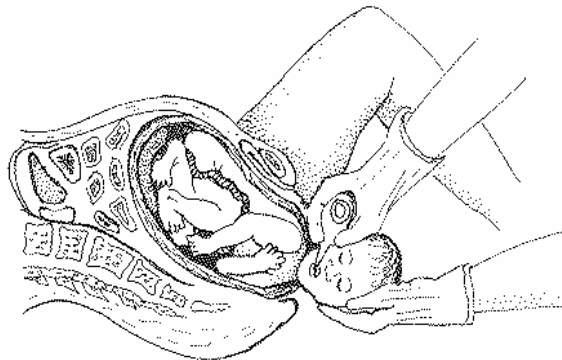
- A. History of mother -- age, due date, prenatal care, previous pregnancies and problems, medications, duration of labor, foul-smelling or stained amniotic fluid.
- B. History of infant -- if already delivered, when was delivery. How has infant behaved since delivery. What has been done for infant.

### Specific objective findings

- A. Vital signs, APGAR score at 1, 5 and 10 minutes.
- B. Temperature or warmth of skin. Color. Spontaneous movement.
- C. Meconium (brown/green/black stool fragments) in amniotic fluid or in newborn's airway.

### Treatment

- A. If baby is not delivered and head is not appearing at vaginal opening with contractions, transport rapidly and prepare to stop for delivery enroute if situation changes.
- B. If baby is not delivered, but head visible with contractions (crowning), delivery is imminent.
  1. Set up clean or sterile area for delivering baby:
    - a. Place sterile or clean drape between mother's legs.
    - b. Set sterile clamps, scissors, and suction on drape.
    - c. Put on sterile gloves.
    - d. Assign one attendant to mother, second to infant.
  2. As infant's head is delivering, put very gentle pressure against it with several fingers flat against head (not finger tips) to prevent an explosive delivery.
  3. As soon as head has delivered, use bulb suction to clear mouth (to back of mouth only, not throat) then nose (before delivery of infant's body if possible).



4. Suction immediately after delivery also, using bulb syringe to suction first the mouth, then the nose. Stimulate by drying with clean towel or blanket, administer O<sub>2</sub> near face.
  5. If apparent meconium and respiratory difficulty –
    - a. Suction on the perineum prior to delivery of shoulders.
    - b. If baby not vigorous, suction airway under direct laryngoscopic vision using catheter or ET tube to remove visible meconium from the airway or until heart rate drops to 60 bpm.
- C. After baby delivered, assess general appearance.
1. *If infant pink, with good cry and active movement (APGAR 8-10):*
    - a. Wrap in clean, dry blanket.
    - b. Keep infant level with perineum.
    - c. Clamp cord in two places 8-10 inches from infant.
    - d. Cut cord between clamps.
    - e. Bundle infant with mother, continue to monitor.
  2. *If infant color poor, weak cry, or limp (APGAR 7 or less):*
    - a. Hold O<sub>2</sub> tubing near infant's face.
    - b. Keep infant warm.
    - c. Continue to stimulate with suction and drying.
    - d. If infant's condition not improved within 30 seconds of delivery, assist ventilation with bag-valve-mask using 100% O<sub>2</sub> by positive pressure if respirations are inadequate, heart rate is < 100, or central cyanosis persists despite 100% oxygen. Assist at a rate of 40 to 60 breaths/min.
    - e. Suction trachea under direct vision if any meconium remains in airway. Intubate if respirations poor.
    - f. Clamp cord when infant level with perineum. CPR if heart rate < 60/minute and unresponsive to ventilations.
    - g. Administer 0.1-0.3 ml/kg epinephrine 1:10,000 IV, IO, or ET.
    - h. Transport as soon as possible with Porta Warmer or other infant warming system.

Specific precautions

- A. Neonatal resuscitation, unlike most other resuscitation situations, requires careful attention to temperature. For neonates the management priorities are:

- A Airway
- B Breathing
- C Circulation
- T Temperature

The newborn has very poor temperature control and circulatory and respiratory status are often entirely dependent on core temperature. If infant requires resuscitation, place in dry blanket on Porta-Warmer or other infant warming system. Wrap warmer and infant with silver swaddling if possible to aid in heat conservation.

- B. Avoid overstimulation of the back of the pharynx during suctioning. This may cause bradycardia in newborn. Do suction nares, as babies breathe only through nose for the first few months.
- C. If thick meconium is present in upper airway or an adequate airway cannot be obtained, use laryngoscope and suction through the endotracheal tube to clear airway under direct vision and avoid contamination of the lungs with meconium as much as possible. This should only be done under dire circumstances, since it is time-consuming and can cause heat loss and hypoxia -- minimize the time of suctioning.
- D. Airway management should be kept as simple as possible. Oxygen delivered by tube to the area of baby's face is usually all that is needed to aid in resuscitation. Bag-valve-mask respirations and endotracheal intubation should be considered only if initial oxygen provision fails to revive the neonate.
- E. Infants, particularly preemies, are very fragile. In most instances, basic stabilization by airway control, suctioning, temperature conservation and CPR enroute to the hospital is recommended. This is not the time to try IVs, drugs, or other ALS procedures in the field.

**PEDIATRIC RESPIRATORY DISTRESS**Specific information needed

- A. Present symptoms -- sudden or gradual onset.
- B. History of oral exposures -- toys, food, chemicals, etc.
- C. Associated symptoms -- cough, fever, upper respiratory symptoms, runny nose, sore throat, drooling, hoarseness.
- D. Past medical problems.
- E. Current medications.

Specific objective findings

- A. Mental status -- alert, agitated, confused, somnolent.
- B. Respiratory effort -- upper airway sounds, chest wall movement, use of accessory muscles, retractions (depressions between ribs on inspiration).
- C. Audible breathing noise -- wheezes, cough, crowing.
- D. Lungs by auscultation -- abnormal breath sounds.
- E. Other findings -- drooling, fever, skin color.

Treatment

- A. Put patient in position of comfort (usually upright).
- B. If respiratory arrest -- attempt to ventilate. Watch neck position carefully and adjust for maximum chest rise.
- C. If patient has airway obstruction from foreign body:
  - 1. Encourage coughing efforts with partial obstruction.
  - 2. If no air movement, visualize airway with laryngoscope and remove any obvious foreign body.
  - 3. Reposition the airway.
  - 4. Attempt to ventilate.
  - 5. If unsuccessful, administer up to 5 subdiaphragmatic abdominal thrusts for children or 5 back blows and 5 chest thrusts for infants.
  - 6. Reposition the airway and attempt to ventilate.
  - 7. If unsuccessful, consider percutaneous cricothyrotomy with 14 g. angiocath if qualified.
- D. Apply O<sub>2</sub>, high flow (10-15 L/min or volume sufficient to keep bag inflated) for significant respiratory distress. Titrate to pulse oximetry > 90% if possible.
- E. If patient is ventilating inadequately:
  - 1. Assist ventilations as needed with bag-valve-mask and high flow oxygen.
  - 2. Consider intubation if less invasive means are inadequate.

- F. Assist and consider treatment for the following problems if respiratory distress is severe and patient does not respond to proper positioning and administration of O<sub>2</sub>:
1. Croup
    - a. Administer racemic epinephrine 1:1000 0.3-0.5 ml (depending on age) with 2 ml saline via nebulizer.
    - b. Prepare to assist ventilations if child fatigues and is unable to maintain adequate ventilations.
  2. Epiglottitis
    - a. Allow patient to remain upright.
    - b. Assist with removal of secretions if needed.
    - c. For long transport with severe distress, administer racemic epinephrine by updraft nebulizer as above.
    - d. Prepare to assist ventilations.
  3. Asthma
    - a. Administer albuterol 1.5-3.0 ml 0.083% soln (1.5 ml under age 2, 3.0 ml over age 2) via nebulizer.
    - b. Administer epinephrine, 0.01 ml/kg of 1:1,000 SQ or IM if no improvement with albuterol.
- G. If diagnosis is unclear, transport patient rapidly with supplemental O<sub>2</sub>, and prepare to assist ventilations if child becomes fatigued or sustains respiratory arrest.

#### Specific precautions

- A. Children with croup, epiglottitis or laryngeal edema usually have respiratory arrest due to exhaustion or spasm. They may still be ventilated with pocket mask or bag-valve-mask (BVM) technique. Don't attempt intubation unless these techniques fail.
- B. Intubation of children in the field is infrequently performed, and therefore carries some risk. Do not attempt intubation if a simpler skill will manage the airway.
- C. Bag-valve-mask in small children carries the risk of excessive pressures and possible pneumothorax. It is easy to get overly excited and overventilate.
- D. In respiratory distress of sudden onset, think of foreign body aspiration. The mouth is a major sensory organ for children (as well as others) and admits a multitude of obstructive hazards.
- E. There may be a call to attend a child who has allegedly aspirated something that was in his or her mouth, but is now asymptomatic. This child may not need emergency intervention, but should be seen by a physician. Once the object has settled in the lung and is not irritating a major airway, it can rapidly become asymptomatic while still requiring removal to prevent further complications.

## PEDIATRIC SEIZURES

### Specific information needed

- A. History -- onset, duration of seizure, description of seizure activity, fever, recent illness.
- B. Past history -- immunizations, medications, previous seizures, diseases.

### Specific objective findings

- A. Vital signs.
- B. Level of consciousness.
- C. Fever, skin warmth, rash.
- D. Signs of trauma.

### Treatment

- A. Ensure airway, suction as needed.
- B. O<sub>2</sub>, moderate flow (4-6 L/min). Titrate to pulse oximetry > 90%.
- C. Remove excess clothing if patient feels febrile.
- D. Keep patient on side. Protect from injury during confusion or further seizure activity.
- E. If seizure persists or patient not alert:
  - 1. IV -- RL or NS. Start enroute at TKO.
  - 2. Test blood for glucose level.
  - 3. If glucose level < 60 mg/dl, administer 2-4 ml/kg 25% dextrose into secure vein.
  - 4. Administer diazepam *slowly* IV 0.2 mg/kg (Max of 10 mg) if seizure activity persists. Diazepam may need to be administered rectally if IV access not available. Be prepared to intubate if respiratory depression significant.
- F. Monitor vitals carefully enroute. Keep patient on side.

### Specific precautions

- A. If patient is obviously febrile, remove clothing DO NOT DELAY TRANSPORT FOR COOLING. Unbundling is often sufficient.
- B. Unlike the adult with a diagnosis of epilepsy, a child who has had a seizure, even though alert on arrival of the paramedics, usually requires medical attention. He is best transported by ambulance. Do not be falsely reassured by return of normalcy. This is *not* true of the patient who has a history of seizures and is under the care of a physician for those seizures. Those patients can often be managed at home. The question must be asked, however, why

emergency care was called for. Was this an unusual seizure? Or was this just an inexperienced (new) caretaker?

- C. Seizures in children may not be the usual grand mal type. A staring, peculiar eye movement, unresponsiveness, or arm twitching may be the only clue. The parents are usually very sensitive to the abnormality and potential seriousness of the situation. Do not downplay their concerns.
- D. Do not make the diagnosis of "febrile seizures" in the field. This diagnosis cannot be made until other causes are excluded. An important cause of seizures in childhood is meningitis (also associated with a fever). Other forms of encephalitis, head trauma, and epilepsy must also be excluded.
- E. If the diagnosis of meningitis is made in the patient at a later time, be sure to check with the receiving hospital concerning the need for prophylactic antibiotics for the prehospital providers. This is usually not necessary if there was no mucous membrane contact with the patient (e.g., mouth-to-mouth breathing).

**PEDIATRIC TABLES****Table 3.1****APGAR SCORE**

Observation	2	1	0
Appearance (color)	Pink	Pink body Blue limbs	Blue
Pulse (heart rate)	> 100	< 100	None
Grimace (reflex irritability)	Cough, sneeze	Grimace	Non-responsive
Activity (muscle tone)	Active	Flexion of extremities	Limp
Respirations	Good cry	Slow, irregular	None

Neurologic evaluation of the newborn is best accomplished by using the APGAR scoring system. This system, like the Glasgow Coma Scale for adults, shows a great deal of inter-observer reliability and also has some prognostic value. Healthy, normal infants usually score between 8 and 10, while infants scoring less than 7 require significant resuscitative efforts.

It is unlikely that most paramedics will deliver enough infants to easily score the newborns he or she encounters. The important point is to make the necessary observations. If these are made accurately, a numerical score can be derived later. Thus, it is important to note the COLOR of the infant, his HEART and RESPIRATORY RATE. Note his MUSCLE TONE when he is picked up. Finally, when suctioning, note the REFLEX IRRITABILITY when the catheter is placed into his nose and posterior pharynx. The APGAR score is usually noted at one minute and at five minutes after birth. If the baby is unstable the observations should be repeated every 5 minutes. DO NOT DELAY RESUSCITATION WHILE TRYING TO CALCULATE THE APGAR SCORE.

**Table 3.2****NORMAL VITAL SIGNS IN THE PEDIATRIC AGE GROUP**

AGE	PULSE beats/min	RESPIRATIONS rate/min	BLOOD PRESSURE systolic +/-20
Premature	150	30 -- 40	N/A
Newborn	140	30 -- 40	N/A
6 month	130	20 -- 36	80 palp
1 year	125	20 -- 30	90 palp
3 years	115	20 -- 30	95 palp
5 years	100	18 -- 24	95 palp
8-10 years	90	12 -- 20	100 palp

**Table 3.3****PEDIATRIC AIRWAY SIZES**

AGE	ORAL AIRWAY	ENDOTRACHEAL TUBE (uncuffed)	SUCTION CATHETER
Preemie	00	2.5-3.0	5 French
Newborn	0	3.0-3.5	6 F
6 months	0-1	3.5	8 F
18 months	1	4.0	8 F
3 years	2	4.5	10 F
5 years	2-3	5.0	10 F
8 years	3	6.0 Cuffed	10 F
Older	4	6.5-7.0 Cuffed	12 F

**Table 3.4**  
**PEDIATRIC TREATMENT REFERENCE**

Treatment	Solution	Administration
Adenosine	3 mg/ml	0.03 ml/kg
Albuterol	2.5 mg/3 ml	1.5 ml < 2 yrs 3.0 ml > 2 yrs
Atropine	0.1 mg/ml	0.2 ml/kg
Defibrillation		2 joule/kg
Dextrose 25%	250 mg/ml	2 ml/kg
Diazepam (0.2 mg/kg)	5 mg/ml	0.04 ml/kg
Epinephrine (0.01 mg/kg)	1:10,000 0.1 mg/ml	IV 0.1 ml/kg
	1:1,000 1 mg/ml	SQ or IM 0.01 ml/kg ET 0.1 ml/kg
IV fluids	NS or RL	20 ml/kg
Lidocaine (1mg/kg)	20 mg/ml	0.05ml/kg
Morphine (0.1 mg/kg)	10 mg/ml	0.01ml/kg
Naloxone	0.4 mg/ml	0.1 ml/kg
Sodium Bicarbonate	0.5 mEq/ml 4.2% for infants 10 kg or less	4 ml/kg
	1.0 mEq/ml 8.4% for infants over 10 kg	1 ml/kg