

## PEDIATRIC TRAUMA SELF-STUDY MODULE



### OVERVIEW

The following self-study module was developed from sections of the Alaska Pediatric Prehospital Emergency Course. The course is based on the original course developed by the Washington State Emergency Medical Services for Children Grant Project, using expertise from EMTs, paramedics, pediatricians, and EMS medical advisors.

This self-study module is part of a continuing project by the Alaska EMSC Program to improve the flexibility of the delivery of this important educational material to EMTs and paramedics throughout Alaska. Information from the original course has been revised and updated as needed to reflect the new American Heart Association 2000 PALS guidelines.

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I would like to acknowledge:

American Heart Association. Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care, *Circulation*, 2000; 102 (supplement).

Dieckmann R, Brownstein D, Gausche-Hill M, eds. American Academy of Pediatrics, Pediatric Education for Prehospital Professionals. Sudbury, MA: Jones and Bartlett; 2000

Emergency Medical Services for Children Program, EMSC Slide Set, EMSC 1997 for photograph contributions.

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## **SELF STUDY MODULE CONTINUING MEDICAL EDUCATION INFORMATION:**

### **Instructions:**

There are two posttests included at the end of the module; one for the basic EMT only and an additional one for advanced level providers. The basic EMT should complete only the first basic test. Advanced level EMTs and Paramedics should complete BOTH tests.

The tests were developed in conjunction with the material presented in the self-study module “Core Objectives and Core Reading Material” and the accompanying “Related Pediatric Procedures.” Please read each question carefully, and select and indicate the one best response.

### **To Receive CME Credit:**

Please forward your completed tests to the regional EMS office serving your area:

Interior Region EMS Council, Inc.  
3522 Industrial Ave.  
Fairbanks, AK 99701

Maniilaq Association EMS  
P. O. Box 256  
Kotzebue, AK 99752

Southern Region EMS Council, Inc.  
6130 Tuttle Place  
Anchorage, AK 99507

Norton Sound Health Corporation  
EMS Office  
P. O. Box 966  
Nome, AK 99762

Southeast Region EMS Council, Inc.  
P.O. Box 259  
Sitka, AK 99835

Yukon Kuskokwim Health Corporation  
EMS Office  
P. O. Box 528  
Bethel, AK 99559

Gary Judd, EMS Coordinator  
North Slope Borough Fire Department  
P. O. Box 69  
Barrow, AK 99723

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## CORE OBJECTIVES

Upon completion of this reading material, the EMT or Paramedic will:

1. List the most common type of trauma in children.
2. Identify the correct sequence of priorities to be used in assessing and managing the multiply injured patient.
3. Discuss the priorities for the trauma patient and state the critical differences in the pediatric patient that exist in:
  - a. Airway management
  - b. Recognition of shock
  - c. Fluid management
  - d. Dosage of medications
  - e. Psychological support
4. State the initial assessment priorities of the pediatric trauma patient.
5. List the assessment and management priorities for the near-drowning victim.
6. Identify when ALS backup or alternative modes of transport are needed.

## CORE READING MATERIAL

**IMPORTANT NOTE:** All advanced level material in this section is presented in *italics*. Basic level providers will not be tested on this material.

### I. Etiology/Epidemiology

- A. In Alaska, injuries are the leading cause of childhood death.
1. Intentional and unintentional injuries are the leading cause of death, potential years of life lost, morbidity, and disability among all children in Alaska.
  2. According to the latest statistics from the CDC, Alaska ranks fourth in the nation for the rate of deaths due to injury among children to age 19. While we previously ranked first and have made much progress; more needs to be done.
  3. Alaska's death rates among children rank in the highest in the United States among suffocation deaths, and drowning deaths.
  4. Injury deaths among Alaska children ages 0-19, 1994-1998:

Motor vehicle traffic	25.1%
Suicide	21.2%:
Homicide	11.7%
Drowning	11.7%
Fire	6%
- B. Risk factors for injury among Alaska children:
1. Two out of three injuries occur in males.
  2. Higher incidence in children who live in poverty, in single parent households, and in infants born to teenage mothers.
  3. Frequently alcohol and drug related in teenagers.
- C. Types of injuries nationwide:
1. Pediatrics: 80-90% blunt trauma, 10-20% penetrating trauma.
  2. Adults: 50% penetrating, 50% blunt.
  3. Anatomic distribution of injuries:

Head	63%
Extremities	29%
Abdomen	14%
Chest	9%
  4. Head injury – a major factor in mortality and morbidity. One in ten children hospitalized with a head injury will suffer moderate to severe neurologic impairment.
  5. Mechanism of injury is a critical observation in field triage of trauma. Early notification of base hospital is imperative if mechanism is suggestive of serious injury, even if child “looks OK” (e.g., ejection from motor vehicle, vehicular intrusion, fall from significant height).

## II. Initial Assessment and Management

- A. Principles of evaluation and stabilization for trauma are the same for patients of any age. Pediatric trauma care differs from that of adults because:
1. Children sustain different types of injuries.
  2. Smaller total blood volume (70-80 cc/kg).
  3. Pulse, respiratory rate, blood pressure and drug dosages vary with age.
  4. Most care providers have less experience in dealing with children.
- B. The goals of prehospital management of the critically injured child include rapid assessment and treatment of life-threatening conditions and immediate transport to a hospital. Early notification of the hospital is important so that maximal resources are available upon arrival.
- C. During the initial assessment, life-threatening conditions are identified and simultaneous management is begun. Resuscitation of vital functions proceeds concurrently with the initial assessment.

- A – Airway management with C-spine stabilization
- B – Breathing (oxygenation and ventilation)
- C – Circulation with control of ongoing hemorrhage
- D – Disability (level of consciousness)
- E – Expose and examine



- D. Airway management with spinal immobilization:
1. The first priority in caring for the injured child is to establish a patent airway while simultaneously taking steps to protect the cervical spine.
  2. Assume a cervical spine injury in any trauma patient with the following:
    - a. An altered level of consciousness.
    - b. Obvious injuries of the head or neck.
    - c. A mechanism of injury involving head or spine.
    - d. Complaint of weakness or numbness.

3. Airway evaluation:

Patent – no intervention needed.

Intervention needed –

BLS – (positioning, suction, oral/nasopharyngeal airway, foreign body removal via Heimlich/back blows).

ALS – (*endotracheal intubation, cricothyrotomy, magill forceps*).

4. Establishing an airway:

a. Maintain gentle in-line stabilization and a neutral position of the head and neck while establishing a patent airway. Avoid the use of traction.

b. Use modified jaw thrust maneuver only.

c. Remove any foreign matter from the mouth.

d. If an adequate natural airway cannot be maintained, an oral or nasopharyngeal airway may be placed.

1) An oral airway will produce gagging/vomiting in a conscious child.

2) Nasal airways may be better tolerated in the awake child with intact gag reflex. Caution should be used in their placement to avoid trauma to nasal passages.

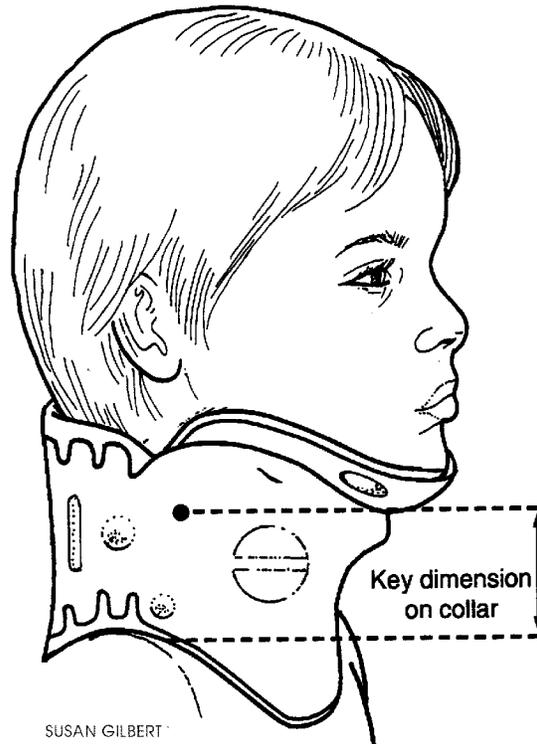
e. *Endotracheal intubation should be considered if a stable airway cannot be maintained with non-invasive maneuvers.*

5. Techniques of Spinal Immobilization



a. The cervical spine is immobilized using a rigid cervical collar and two-inch tape across the forehead to secure the head to a backboard.

**Figure 12: Properly Positioned Collar**



- b. Do not attempt to use a collar if you do not have the appropriate size available. Adequate immobilization can be achieved using towel/blanket rolls and two - inch tape.
  - c. The child's body must be secured to a backboard. Blanket rolls may be necessary to ensure adequate immobilization using an adult backboard and straps.
  - d. A frightened or preverbal child cannot cooperate – anticipate this in your efforts to restrain the child.
6. Before applying the cervical collar check for neck vein distension, carotid pulses, tracheal deviation, and subcutaneous emphysema.

**E. Breathing and Ventilation**

1. Look, listen, and feel for air movement.
2. If the child does not start breathing after opening the airway, assisted ventilation should be initiated – mouth to mask, or bag-valve-mask. Proper mask fit is imperative to obtain an adequate seal and adequate air entry.
3. *If adequate tidal volume cannot be delivered via bag-valve-mask, or prolonged assisted ventilation is anticipated, endotracheal intubation may be necessary.*

4. *An orogastric or nasogastric tube should be inserted if the child is being ventilated with positive pressure. Positive pressure ventilation in children leads to gastric distension with impairment of diaphragmatic excursion and decreased ability to ventilate, as well as increased risk of vomiting and aspiration. In a small child and those suspected of having a basilar skull fracture, the tube should be inserted orally.*
5. If the child is spontaneously breathing, the adequacy of ventilation must be assessed.
  - a. Look:
    - 1) Expose the chest.
    - 2) Determine if there is symmetrical chest rise and estimate rate of respirations.
    - 3) Inspect for signs of respiratory distress: substernal, intercostal or suprasternal retractions; expiratory grunt; nasal flaring.
    - 4) Note bruises, open wounds which may reflect underlying contusion or hemo/pneumothorax. Immediately treat sucking chest wounds, impaled objects, or tension pneumothorax the same as for adults.
    - 5) Listen: Over midaxillary line bilaterally for equal breath sounds.
  - b. Feel: Palpate trachea and neck noting tenderness, subcutaneous emphysema or deviation of the trachea.
  - c. Re-evaluate airway.
6. Supplemental oxygen should be administered to all trauma patients.

#### F. Circulation

1. The possibility of shock must be considered in all trauma patients.
  - a. Shock is present when circulation is inadequate to meet tissue metabolic needs.
  - b. In trauma, shock is most often caused by blood loss, but may be caused by spinal cord injury, cardiac tamponade, or tension pneumothorax. Since the majority of pediatric trauma is blunt, blood loss may not be obvious.
2. Shock is characterized by:
  - a. tachycardia
  - b. cool clammy skin
  - c. delayed capillary refill (>2 seconds)
  - d. anxiety, agitation, or decreased level of consciousness
  - e. increased respiratory rate
  - f. decreased blood pressure
3. Hypotension is a late indication of shock in children

Blood pressure will be maintained at “normal” values via compensatory mechanisms such as increased heart rate and vasoconstriction despite acute loss of 20-30% of blood volume. Never wait for hypotension to initiate shock treatment.

In the initial assessment of a multiple trauma patient, consider attempting to take a blood pressure once in children less than 3 years of age. If time is critical, omit this step altogether in this young age group.

4. In children, total blood volume = 80 ml/kg of body weight.

Small volumes of blood loss are significant in a child. For example, a 10kg one year old with a total blood volume of 800 ml will be in shock with a loss of only 160 ml of blood (20% of total blood volume).

5. Field treatment of shock

- a. As in adults, the therapy of shock in children consists of control of ongoing hemorrhage, raising the lower extremities, preventing heat loss, *and volume resuscitation with crystalloid.*
- b. *Volume resuscitation – 20 cc/kg bolus of ringer’s lactate or normal saline. Repeat as necessary based on clinical response (heart rate, capillary refill time, extremity warmth, level of consciousness).*
- c. *Vascular access – advantage of field IV placement must be weighed against prolonged scene time. Consider intraosseous infusion if peripheral venous line cannot be rapidly established.*



- d. Pneumatic anti shock garments

- 1) The use of pneumatic antishock garments in children is controversial. Good evidence for their efficacy in treating pediatric shock is lacking.
- 2) Inflation of the abdominal compartment will lead to compromise of respiratory status; **avoid its use in children under ten.**
- 3) May be useful to splint lower extremity or pelvic fractures.
- 4) Pediatric garment fits children and adolescents. Garments are not available for infants and toddler; anti shock garments are not recommended in these age groups.

## G. Disability

1. The level of consciousness can be quickly determined by following the acronym:
  - A – alert
  - V – responds to verbal stimulus
  - P – responds to painful stimulus
  - U – unresponsive
2. Note pupil equality, size, and response to light.
3. Decrease in level of consciousness in suspected head injuries should be treated with assisted ventilations.
4. A brain injured child who is posturing or has dilated or asymmetric pupils should be ventilated at a respiratory rate of 5 breaths/min more than the normal rate for age. When the pupils constrict or posturing stops, resume the normal rate.

## H. Expose

While it is important that all life-threatening injuries be discovered in the primary assessment, hypothermia may compound the initial insult. Measures to avoid excessive heat loss should be taken at the scene and in the rig, especially in infants and toddlers. For infants, a cap made out of kerlix can be made to cover the infant's head to decrease heat loss. Most of an infant's heat is lost through the head.

- I. Remember: Airway maintenance, cardiopulmonary resuscitation, and other life-saving measures should be initiated when the problem is identified, rather than after completion of the initial assessment.

## III. Rapid Head to Toe Trauma Assessment



### A. Neck

1. Patients with facial/head trauma due to blunt injury should be assumed to have a C-spine fracture.
2. Inspect for tracheal deviation. Palpate for subcutaneous emphysema.

## B. Head

1. Injuries to the head include:
  - a. Skull fracture.
  - b. Concussion – Temporary loss of consciousness with no significant anatomical brain injury.
  - c. Contusion – Bruise of the brain resulting from small vessel bleeding within the brain tissue. Often leads to prolonged loss of consciousness.
  - d. Epidural hematoma – Mass lesion resulting from tear of middle meningeal artery in parieto-temporal region of skull. May cause acute deterioration and cerebral herniation in the field. In pediatric patients, may result from venous bleed and have less acute course. Prognosis excellent if properly treated acutely.
  - e. Subdural hematoma – Mass lesion resulting from tear of cerebral veins. Often associated with severe underlying brain injury and poor long-term prognosis.
  - f. Parenchymal hematoma – Mass lesion within brain tissue itself. Associated with severe primary brain injury and poor prognosis.
2. Field Assessment



- a. Inspect for signs of penetrating or blunt trauma – abrasions, lacerations, skull deformities, scalp hematoma.
  - 1) Clear drainage from nose or ears, bloody discharge from ears suggest closed head injury with basilar skull fracture.
  - 2) Battle's sign, raccoon's eyes are late signs of basilar skull fracture.
- b. Palpate skull for bony step-offs or irregularities suggesting underlying fracture.
- c. Serial neuro exams:
  - 1) Examine pupils for size, equality, reaction to light.
  - 2) Assess level of consciousness –  
Alert? Responsive to voice? Responsive to pain? Unresponsive

- 3) Observe motor activity for unilateral weakness, paralysis suggesting intracranial mass lesion.
- 4) Glasgow Coma Scale may be used for children over ~3 years of age. A modified coma scale exists for infants.
- d. Assess for signs of elevated intracranial pressure (ICP)
  - 1) In trauma, elevated ICP results from increase in volume of intracranial contents due to one of three mechanisms.
    - a) Increase in volume of brain tissue itself due to cerebral edema.
    - b) Presence of mass lesion – i.e. hematoma.
    - c) Increase in intravascular blood volume – vasodilatation results from hypercarbia associated with hypoventilation.
  - 2) Effect of elevated ICP varies based on magnitude of the increase in contents, rapidity with which change occurs, and relative rigidity of the skull.
  - 3) As intracranial pressure rises, death will occur when:
    - a) Distortion/compression of brainstem results in acute cardiorespiratory arrest.
    - b) Intracranial pressure rises to equal or exceed systemic arterial pressure leading to cessation of cerebral blood flow and brain death.
  - 4) Early signs of elevated ICP include:
    - a) Altered level of consciousness – agitation, lethargy, disorientation
    - b) Vomiting
    - c) Headache
  - 5) Late signs and symptoms include:
    - a) Pupillary dilatation, especially one “blown” pupil.
    - b) Bulging anterior fontanel in infants – anterior fontanel usually disappears by 12-18 months of age.
    - c) Posturing (flexor or extensor).
    - d) Central neurogenic hyperventilation, irregular respirations, or apnea.
    - e) Classic Cushing Triad of hypertension, bradycardia, and hypoventilation may not occur.
    - f) Bradycardia signals imminent cardiac arrest due to critical brainstem distortion secondary to ICP or to hypoxemia due to respiratory failure.
- e. The isolated closed head injury does not account for shock – look for site of occult hemorrhage if shock is present.

### 3. Field management

- a. Control external bleeding – children can lose sufficient blood from scalp lacerations to cause shock.
- b. Do not remove penetrating objects unless they interfere with essential resuscitation or extrication.

- c. Treat suspected elevation of intracranial pressure.
- 1) Elevate head to 30 degrees.
    - a) Ensure C-spine immobilization and neutral head position – lateral turning may lead to jugular compression and further elevation of ICP.
    - b) Head elevation contraindicated in presence of shock.
  - 2) Supplemental oxygen and assisted ventilation as needed.
  - 3) Procedures likely to produce surges of intracranial pressure such as *laryngoscopy, intubation*, or aggressive suctioning should be employed only when clearly indicated.  
*Administration of 2mg/kg lidocaine prior to laryngoscopy will decrease ICP response.*
  - 4) *Shock must be treated with aggressive fluid resuscitation. If cardiovascular status is stable, limit fluids to avoid cerebral edema.*
  - 5) *Drug therapy should be dictated by physician advisor.*

C. Chest



1. Assessment
  - a. Due to the elasticity of the pediatric chest wall, a significant amount of trauma can occur to the intrathoracic organs in the absence of obvious external chest injury.
  - b. Visually inspect the chest, both anterior and posterior. Minor deformities, small areas of paradoxical movement, contusions, and abrasions can all be indicative of severe injury.
  - c. Palpate the entire chest wall.
  - d. Auscultate breath and heart sounds.
2. Life-threatening injuries to the chest include:
  - a. Open pneumothorax, flail chest, and pericardial tamponade (rare in children).
    - 1) Open pneumothorax treated with vaseline gauze, taped on three sides only; assisted ventilation as needed. Be alert for development of tension pneumothorax.
    - 2) Flail segment treated with positive pressure ventilation as needed.
  - b. Tension pneumothorax – common in children due to mobility of mediastinal structures, shift of the trachea, heart, and esophagus into hemothorax of the unaffected lung.
    - 1) Poorly tolerated – consider in the face of continued signs of shock despite resuscitative measures.
    - 2) Treatment – *insertion of a 12-16 gauge angiocath/intracath into the second intercostal space at the midclavicular line of the affected hemothorax*; supplemental oxygen, assisted ventilation as needed.
  - c. Large hemothorax – difficult to diagnose, tracheal deviation is minimal, absent breath sounds, and profound shock.

Treatment – treat shock, supplemental oxygen, assisted ventilation, transport.

#### D. Abdomen

1. Assessment
  - a. When abdominal trauma is suspected, the specific diagnosis is not as important as the fact that abdominal injury exists.
  - b. Most pediatric trauma is blunt trauma and may produce little evidence of severe underlying abdominal injury. The most common organ injured is the liver which is more anterior and less well protected in children than adults.
  - c. Be alert to mechanism of injury – serious injury should be suspected in all acceleration-deceleration accidents.
  - d. The abdomen should be thoroughly examined for signs of penetrating trauma, or signs of blunt trauma such as tenderness, bruising, or distention.

- e. Remember though, that the normal abdominal exam for adults is altered in children.
  - 1) Young children may normally have a distended abdomen. It is important to obtain a baseline measure of the girth and reassess for changes.
  - 2) Even a frightened child may respond to palpation with guarding and crying. However, remember that a child with an abdominal injury who normally needs to use the diaphragm and abdominal muscles to breathe, will exhibit shallow respirations and will avoid vigorous crying because it hurts to cry.
  - 3) Also remember that many children also have referred abdominal pain to either shoulder just as adults do in abdominal injury. This means, for example, that an unexplained complaint of R shoulder pain with no evidence or mechanism for injury may actually be referred from a liver injury.
- 2. Field management of abdominal injuries includes treatment of shock, application of sterile saline dressings to eviscerations or penetrating wounds, and NG tube (*nasogastric intubation*).

#### E. Extremities



- 1. Assessment
  - a. Because bone growth is still occurring in children, skeletal injuries, particularly to long bones, may produce serious disability if not managed properly. Long bone fractures and pelvic fractures may also be associated with blood loss that is proportionately greater in the child than in the adult.
  - b. Extremities and joints should be palpated and inspected for deformity, tenderness, swelling, bruising, and crepitus.

- c. All peripheral pulses should be assessed to rule out vascular injury or compartment syndrome.
- 2. Field management
  - a. Dislocated joints and fractures should be splinted in the position found unless they are severely angulated. If pulses are absent, straighten severe angulations to an anatomic position using gentle traction unless resistance is met.
  - b. A sterile dressing should be applied to open fractures.
  - c. Consider the use of antishock garments for fractures of lower extremities and/or pelvis.

F. Neurologic exam

- 1. The neurologic exam includes repeated evaluation of the patient's level of consciousness and pupils, as well as evaluation of motor and sensory function.
- 2. A numerical evaluation such as the Glasgow coma scale may be useful in evaluating, documenting and communicating serial exams. The score is derived by totaling the scores for best response in three areas: eye opening, verbal response, and motor movement. The Glasgow scale may be difficult to assign in preverbal infants and toddlers.
- 3. An accurate description of what is seen and heard will allow hospital personnel to assign a coma score based upon the prehospital report form.

## GLASGOW COMA SCALE

### BEST EYE RESPONSE

Adult & Child	Infant (12 Months)	Points
Spontaneous	Spontaneous	4
To Command	To Voice	3
To Pain	To Pain	2
None	None	1
	TOTAL	

### BEST VERBAL RESPONSE

Adult & Child	Infant (12 Months)	Points
Oriented	Coos and Babbles	5
Confused	Irritable Cry	4
<i>Inappropriate</i>	<i>Cries to Pain</i>	3
<i>Incomprehensible</i>	<i>Moans to Pain</i>	2
<i>None</i>	<i>None</i>	1
	TOTAL	

### BEST MOTOR RESPONSE

Adult & Child	Infant (12 Months)	Points
Obeys Command	Spontaneous Movement	6
Localizes Pain	Withdraws (Touch)	5
Withdraws	Withdraws (Pain)	4
<i>Flexion to Pain</i>	<i>Flexion to Pain</i>	3
<i>Extension to Pain</i>	<i>Extension to Pain</i>	2
<i>None</i>	<i>None</i>	1
	TOTAL	

G. History: A brief history should be obtained when possible. Obtaining the history should never delay transport. The history should include:

- A - Allergies
- M - Medications
- P - Past Illness
- L - Last Meal
- E - Events Preceding Injury

H. Re-evaluate the ABC's

#### IV. Burn Injuries

##### A. Incidence of burns

1. 1300 children die from burns in the U.S. yearly.
2. Burns are the third leading cause of death in childhood.
3. 60,000 pediatric patients with burn injuries are admitted to hospitals each year in the U.S., resulting in significant disabilities.
4. In 1998, 20 patients under the age of 15 were admitted to an Alaskan hospital due to flame and hot substance burn injuries. Of these, 75% of the patients had hot substance, rather than flame injuries, while only 48% of the adult burn injuries were due to hot substances.



Scald Burns

## **B. Assessment and field management of burns**

### **Calculation of total body surface area burned**

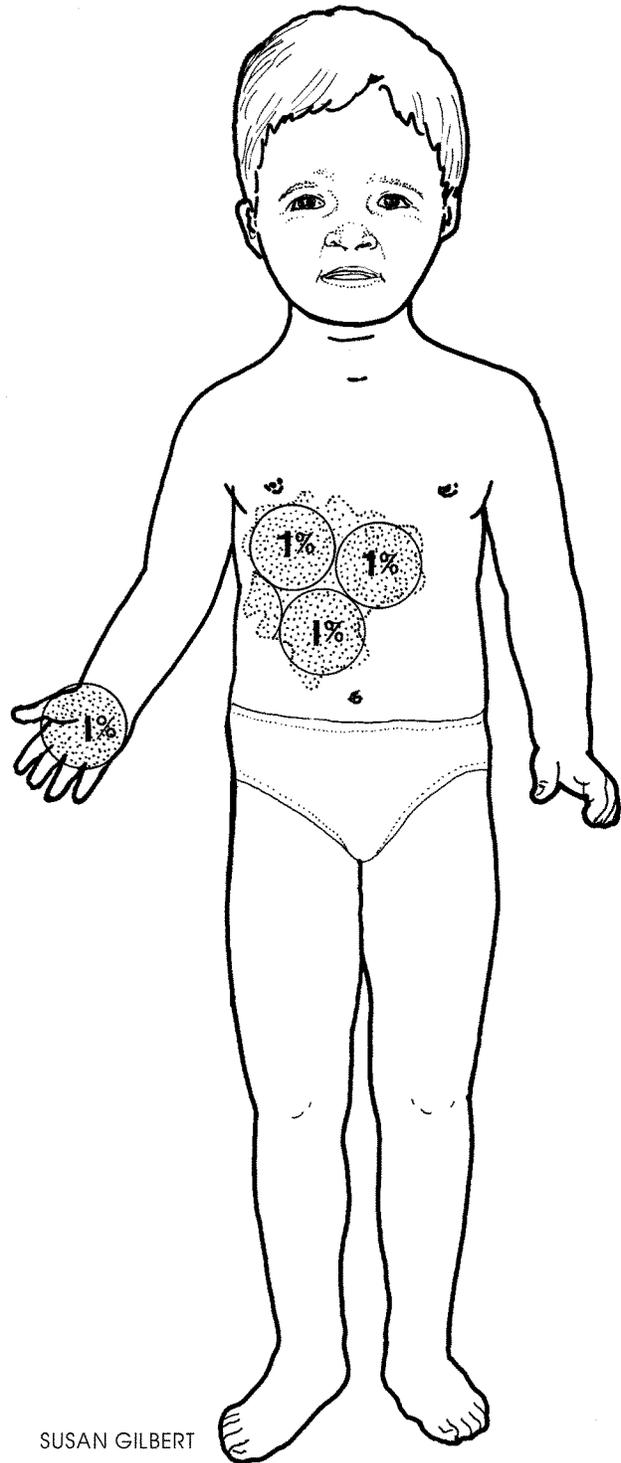
“Rule of Nines” applies to adults. Because children have relatively large heads and smaller lower extremities than do adults, it must be modified to determine the body surface area burned on a child or infant.

For smaller injuries or scattered burns, it is helpful to remember that the palm of the patient’s hand = 1% of the body surface area.

A detailed assessment of the total body surface area burned is not necessary in the field. Describe anatomically, i.e.  $\frac{1}{2}$  of L arm, all of back,  $\frac{3}{4}$  of R leg, etc.

Assessment of depth is impossible in the field and unnecessary since the initial management is the same for any burn that is deeper than first degree.

Note circumstances of burns – e.g. chemical, closed space-inhalation injury, home remedies applied.



SUSAN GILBERT

**Figure 20: Rule of Palms**  
Child's palm equals approximately  
1% of total body surface area

2. Field management:
  - a. Remove from source of injury, protecting self.
  - b. Attend to ABC's – C-spine if other injury also involved.
  - c. Cover patient with clean sheet.
  - d. Keep patient warm. The patient will lose 70 times more heat through the burn wound than through normal skin. Children, with their large surface to volume ratio, are especially vulnerable to heat loss and hypothermia.
  - e. *IV access if:*
    - 1) *burn >15% of body surface.*
    - 2) *long transport time (>30 minutes).*
    - 3) *IV may be placed through burned skin; secure with kerlix.*
  - f. Elevate burned extremities.
  - g. Remove jewelry from burned extremities.
  - h. May cool with clean dressing soaked in tepid water if within 15 minutes of injury and total body surface area involved is <10%.
  - i. Do not:
    - 1) Break blisters.
    - 2) Apply greasy substances.
    - 3) Apply ice or cold solutions.

### C. Inhalation injuries

1. Suspect an inhalation injury when:
  - a. A flame burn occurs in a closed space.
  - b. There are facial burns.
  - c. The nasal hairs are singed.
  - d. Soot in sputum – this may indicate significant smoke inhalation.
  - e. Oral, nasal, or pharyngeal burns.
  - f. Presence of stridor.
  - g. Child unconscious in smoky area.
2. Direct heat injury to the upper airway may lead rapidly to edema and airway obstruction. Presence of stridor indicates critical airway compromise.
3. The lungs themselves do not sustain heat injury. Lower airway compromise is due to inhalation of toxic products.
4. Carbon monoxide poisoning may be the cause of unconsciousness.
5. Management of inhalation injuries:
  - a. Elevate head of stretcher.
  - b. *Secure airway – upper airway swelling may make endotracheal intubation difficult or impossible. May require smaller than anticipated tube size.*
  - c. Supply oxygen in high concentration – high flow, 100% oxygen will speed removal of carbon monoxide from hemoglobin.
  - d. Follow burn protocol.
  - e. Notify base station and transport.

#### D. Electrical Injuries

1. Low voltage – household current of 110 v or 220 v. Cardiac arrest can occur with household current if low resistance conditions exist due to wet hands and feet (such as in a bathroom). CPR may be necessary.
  - a. Remove from source.
  - b. ABC's.
  - c. Patients with any burns or any history of loss of consciousness (even briefly) should be transported to hospital for evaluation.
  - d. Most common electrical burn in children results from toddler chewing on electrical cord, resulting in oral burns.



2. High voltage – rare in young children; may be seen in adolescents and older children.

#### V. Near-Drowning

- A. In Alaska submersion injuries are the fourth leading cause of death in children 0-19 years of age. The majority of incidents in Alaska occur in open waters.
  1. Most submersion injuries in adolescents are associated with the use of alcohol or drugs.
  2. Most submersion injuries in small children are caused by inadequate adult supervision.

B. Definitions:

1. Drowning: Submersion accident with death within 24 hours.
2. Near-drowning: Recovery of vital signs following a submersion accident, with survival for at least 24 hours.
3. Secondary drowning: Death due to pulmonary failure, hours to days following the submersion accident.

C. Physiology of Near-Drowning:

1. Hypoxemia, metabolic acidosis, and respiratory acidosis represent the common pathway to organ failure and death.
  - a. The central nervous system is the organ system most sensitive to these derangements.
  - b. Even when the cardiovascular system is successfully resuscitated, neurologic devastation may define the child's ultimate outcome.
2. Hypothermia is a frequent complication of submersion in water, especially in Alaska.
  - a. Cold water is relatively protective of the CNS, but only if immersion hypothermia occurs before the compromise of oxygenation.
  - b. Severe hypothermia may lead to depression of metabolic function and cardiovascular collapse. Ventricular arrhythmias, and asystole may be seen.
  - c. The ultimate outcome of a hypothermic child cannot be determined in the field, regardless of his/her clinical appearance.
3. Pulmonary complications include aspiration, pulmonary edema, atelectasis and pneumothorax.
  - a. Aspiration of even small amounts of fresh or salt water leads to marked decrease in pulmonary compliance and hypoxemia.
  - b. Vomiting and aspiration of stomach contents may occur during resuscitation and may be avoided by placement of an NG tube.

D. Assessment of the Near-Drowning Victim

1. Initial assessment should be directed toward the ABC's and cardiopulmonary resuscitation.
2. The near-drowning victim's appearance in the field may range from "normal" to clinically "dead", depending on the length of submersion, the effects of water temperature, the dive reflex (shunting of blood to the brain and heart), and the degree of CNS and cardiovascular hypoxic injury.
3. Occult spine or head injuries may be present. C-spine protection should be undertaken in unconscious children, as well as older children who may have been diving.

4. Near-drowning may be due to intentional trauma. If child abuse is suspected, the physicians at the receiving hospital should be alerted and appropriate referral made.

E. Field Management of the Near-Drowning Victim

1. Near drowning is a “pre-hospital” disease. The ultimate outcome of serious immersion accidents is largely dependent on the effectiveness of initial resuscitation efforts.
2. Outcome is difficult to predict, and resuscitative efforts should only be terminated or withheld with physician-approved protocols.
  - a. Airway should be opened and the spine should be immobilized.
  - b. Breathing: Good ventilatory support is the treatment of hypoxemia and acidosis.
    - 1) All patients should receive 100 % oxygen.
    - 2) Bag-valve-mask ventilation or *endotracheal intubation* may be required. High inflating pressures may be needed to adequately ventilate. Watch for chest rise.
    - 3) *Consider nasogastric tube if assisted ventilation is necessary (may improve compliance, decrease risk of aspirating stomach contents).*
  - c. Circulation:
    - 1) If pulse is weak or blood pressure is low, treat for shock.
    - 2) In hypothermic patients, time should be taken to ascertain the presence or absence of pulse and respirations. If present, even if slow, gentle handling, airway management, and expeditious transport are the only therapies indicated.
    - 3) *Establishment of a peripheral IV may be difficult. Consider intraosseous infusion in the unstable patient where rapid venous access cannot be achieved.*
    - 4) *Attach a heart monitor:*
      - a) *Supraventricular tachycardia is often seen as a response to hypoxemia. Ensure adequate oxygenation and ventilation.*
      - b) *The pharmacologic therapy of arrhythmias in patients with profound hypothermia (<90 degrees F, 32 degrees C) is not likely to be successful. Poor circulation and hypometabolism make the administration of multiple rounds of drugs potentially dangerous. Although bicarbonate may be given empirically (1meq/kg) in the patient with prolonged arrest, the treatment of choice for acidosis in the field is hyperventilation.*

- d. Hypothermic patients should be dried, covered, and kept in a warm environment during transport.
  - 1) Do not terminate support in a hypothermic child. Decisions about viability should be made by experts in a hospital setting.  
Restoration of vital functions may occur with re-warming despite prolonged CPR, although children who remain apneic and asystolic on arrival at the ER are unlikely to recover neurologically.
  - 2) Treat the hypothermic patient in accordance with the Alaska Cold Water Near Drowning and Hypothermia Guidelines.
- e. Temperatures below 88 degrees F or 32 degrees C should have treatment centered on maintenance of vital functions and prevention of further heat loss. Attempts at external re-warming in these patients should be kept to a minimum.
- f. All near drowning victims should be transported, with early notification of the receiving hospital. Even patients who look well at the scene and have a history of brief submersion times may develop late pulmonary complications.

## **CASE STUDIES RELATED TO THE PEDIATRIC TRAUMA MODULE:**

### **CASE ONE**

A 10-year old boy has been involved in a swimming accident at a spot that is popular with local children. The boy was reported to have jumped or dove from a rock outcropping into the river. He did not surface immediately and was pulled from the water a few minutes later about 25 yards downstream. His respiratory rate is 8 breaths/minute and he has noisy respirations. Heart rate is 120 beats/minute. His extremities are cold and he does not respond to his name. He is not moving spontaneously. He opens his eyes to painful stimuli and pushes the examiners hand away. There is an abrasion on his forehead.

What should your initial approach to this patient be??

Answer:

This is a diving incident and your initial assessment indicates that the child has suffered a head injury with probable C-spine injury. Careful attention needs to be paid to proper C-spine stabilization. Because his respirations are noisy and only 8 breaths/minute, he may need suctioning to clear his airway and positive pressure ventilation with a BVM with 100% oxygen followed by intubation as needed. His heart rate is 120 beats/minute, but because he is cold, capillary refill time will be unreliable. I would want to know the quality of his pulses. I am concerned about early signs of shock. He needs an IV but at this time it is unclear whether he needs volume replacement. I will obtain a BP and monitor for signs of shock. I will assess his Glasgow coma score and do frequent neuro checks. His wet clothes need to be stripped off and I need to keep him warm. Because of his short submersion time I probably will not have severe hypothermia, but I need to monitor his core temperature. He needs rapid load and go transport.

### **CASE TWO**

Sally is a three-year old child who has fallen about 10 feet from a deck on her house. She has landed in some soft muddy ground. Her vital signs are within normal limits for her age. Skin is warm and pink. She is crying and will not interact with you. She is very agitated and uncooperative. You find no other obvious injuries. You have immobilized her on a full size backboard, but she has twice pulled her legs out from under the leg straps of the backboard.

What should your approach to this patient be??

Answer:

This 3-year old requires a soft soothing voice and calm approach. While her injuries are likely to be minimal, the mechanism of injury requires immobilization. Your job is to engage the child and reduce her anxiety to gain her cooperation. Use distraction techniques, a favorite toy, have her caregiver talk to her, tell a story or sing to her softly. Also check the positioning of the straps and adequacy of your padding. Adequate blanket rolls and padding helps to improve the security of your

straps on young children when immobilized on a back board. If there is any space underneath the straps that is not filled with padding, a child will be able to pull out of the straps.

### **CASE THREE**

Bobby is a 4-year old child who is injured in a motor vehicle crash. There were two other fatalities in this vehicle. He was sitting in the rear seat and was wearing a seat belt. His vital signs are heart rate 190 beats/minute, respirations 36 breaths/minute, and blood pressure 90/48. Capillary refill time is 3 seconds. His skin is cool and pale. He has a grossly deformed and painful right femur. There are abrasions across his abdomen. No other obvious injuries are noted. He opens his eyes and moans to your verbal commands. You estimate his weight to be 18 kg.

What should your approach to this patient be??

Answer:

This child has significant apparent life threatening injuries. The mechanism is very significant with fatalities in the same vehicle. First attention should be paid to C-spine control with maintenance of a patent airway. 100% oxygen via non-rebreather is indicated if spontaneous respiratory effort is adequate. Be prepared to initiate positive pressure ventilation and intubate if respiratory status deteriorates. He has early signs of compensated shock and will require an IV and repeat fluid boluses of 20cc per kg until his circulatory status is stabilized with a capillary refill time of <2 seconds, adequate distal pulses, and color improvement and decreased heart rate. He requires full spinal immobilization and load and go, rapid transport.

His Glasgow Coma score should be noted and frequent neuro checks done. His abdominal girth should be measured and reassess for further distention. His femur requires stabilization and may need a pediatric traction splint if no contraindications exist.

## RELATED PEDIATRIC PROCEDURES:

### **Basic Material: Distraction Techniques for a Child Secured to a Backboard or Immobilization Device**

Infants and young children may be frightened, anxious and have difficulty coping with necessary immobilization. Struggling against the straps may aggravate an injury. Comfort measures and distraction techniques become extremely important methods for the EMT/paramedic to use, especially during longer transports. The caregiver's participation in providing distraction techniques should be encouraged. The techniques should also be age and developmentally appropriate.

Examples of distraction techniques for younger children and infants include:

#### Infants:

1. Pacifiers and stroking the skin.
2. Keep the caregiver in infant's line of vision.
3. Play soothing music.
4. Speak quietly in soothing, rhythmic tones.
5. Use soap bubbles, glitter wands, or puppets to engage attention.

#### Young children:

1. Stroking child's head or arm and talking softly.
2. Playing soothing music or children's stories or songs.
3. Using soap bubbles, glitter wands, puppets to engage attention.
4. Ask caregiver to read or tell child a story.
5. Ask child to sing a song or count aloud slowly.



**Basic Material:**  
**Removing a Child from a Child Safety Seat While Maintaining Spinal Immobilization and Securing to a Backboard**

1. Stabilize the head and cervical spine manually.
2. Remove or cut the shoulder harness of the car seat and move the safety bar out of the way.
3. Select an appropriate size C-collar for the child. Collars labeled pediatric or infant still need to be measured carefully for proper fit. If a correct size collar is unavailable, towel rolls may be used, but be careful to achieve the proper neutral position of the head and neck.
4. Place the car seat at the foot of the backboard. Tip the seat back and lay it down onto the backboard.



5. Have one rescuer slide his hands along each side of the child's head. The head and neck are thus supported by the rescuer's hands and arms. The second rescuer takes control of the child's body.
6. The person at the head controls the sliding of the child out of the car seat onto the backboard.
7. Proceed with immobilizing the child. Secure the child's body to the backboard. The leader maintains manual stabilization of the C-spine until the body and then the head are secured to the board.



8. Some pediatric boards are now available which have a step off at the head of the board to allow for proper positioning of the head into a sniffing position. Medics should be careful not to fill this space on the board with a towel or blanket for padding as it will defeat the purpose of the board.



9. Place three straps across the child's body. One strap is placed across the chest, one across the hips, and one above the knees.

10. In infants and small children, towels or blanket rolls are placed alongside the body to secure the child and fill up the spaces between the edge of the backboard and the body. This restricts movement and prevents the child from moving freely beneath the strap.
11. Apply a lateral head support device to either side of the head to prevent lateral and anterior movement. Towels and blanket rolls can also be used.
12. Place a piece of tape across the forehead. Do not apply tape across the chin and the edge of the C-collar.
13. Inform the parents or caregivers that they need to replace car seats that have been involved in a crash. Auto insurance may cover the cost of replacing the car seat.

### **Advanced Material: Peripheral IV Insertion:**

#### **General Principles:**

1. Placement of IVs in infants and young children can be the most time-consuming part of a pediatric resuscitation. Benefits of IV placement must be verified against risks of prolonged scene time and delay to definitive care.
2. Duration of IV attempts should never exceed transport time.
3. In critically ill or injured patients (e.g., cardiac arrest, shock), intraosseous infusion should be considered if peripheral access is not achieved in two minutes and transport time is long.
4. In general, good airway management to ensure oxygenation and ventilation will have a far greater impact on outcome than IV therapy.



#### **Techniques of IV insertion:**

1. Preferred sites for IV placement vary with age.
  - a. Dorsum of the hands or feet: veins easily visualized; easily restrained.
  - b. Scalp veins: easily visualized in young infants; easily secured.
  - c. Antecubital fossa: good site for “big” line; veins easily palpable (but not visualized) in even youngest infants; difficult to secure.
  - d. Saphenous vein at ankle: accepts “large” IV, easily palpated.

- e. External jugular vein: relatively large; may be difficult to cannulate; placement may interfere with airway management; difficult to secure.
2. Choice of needles/catheters will vary with age.
- a. Butterfly: used in children for blood draws; difficult to secure and not appropriate for prehospital IV therapy.
  - b. Over-the-needle catheters: sizes range from 24 gauge, up.

<u>Child Size</u>	<u>Angiocaths</u>	<u>Butterfly</u>
Preemie (1-2.5 kg)	22-24	25
Neonate (2.5-4.0 kg)	22-24	23-25
6 Months (6.0-8.0 kg)	22-24	23-25
1 Year (10-12 kg)	20-22	23
2-3 Years (13-15 kg)	18-20	21-23
4-5 Years (16-18 kg)	18-20	21-23
6-7 Years (19-23 kg)	18-20	21
8-10 Years (24-30 kg)	16-20	18-21

3. Pediatric IV tips:

- a. Restrain the patient--frightened children can't cooperate.
- b. Small veins on the dorsum of the hands and feet may be seen, but not felt. Placement will be guided by visualization rather than palpation. If time permits, veins may be "raised" by applying warm pack.
- c. Hyperextending the elbow (for antecubital IV placement) or holding the hand firmly with the wrist flexed (for hand veins) will stretch the vein, make it more easy to palpate, and decrease risk of "rolling."
- d. Placing a finger proximal to the insertion site will allow you to feel the vein throughout the procedure and stretch the skin and vein slightly to minimize rolling.
- e. Nick the skin entrance site first with an 18-20 gauge needle, then advance catheter through skin hold. This decreases chances of going through vein with forcible entry of the flexible catheter through the skin.
- f. Don't expect a big flash back with the small catheters: When you get any blood return, advance the needle a few millimeters into the vein, then slide catheter over needle.
- g. A large rubber band around the head will serve as a tourniquet for scalp vein IV placement.
- h. When placing a scalp vein IV, advance the needle toward the heart, as this is the direction of blood flow.

- i. When IV is in place, secure it carefully. Again, a frightened child can't cooperate and your efforts can be undone in a hurry!

### **Advanced Material: Intraosseous (IO) Infusion:**

#### **Indications:**

1. Drug and fluid resuscitation of an infant or child who is unconscious and unresponsive, and in need of immediate life saving intervention for shock or cardiopulmonary arrest.
2. Catecholamines, blood products, calcium, lidocaine, atropine, valium, dilantin, phenobarbital, and sodium bicarbonate have been successfully infused by the intraosseous route.
3. IO has been an alternative to venipuncture in children usually younger than 6 years of age when peripheral venous access cannot be quickly achieved within a couple of minutes.
4. American Heart Association 2000 guidelines changes recommend immediate intraosseous access for victims of cardiac arrest, not waiting for peripheral IV attempts, in those situations and that overall use of intraosseous techniques should NOW be considered for children of all ages.



#### **Procedure:**

1. Infant or child is placed in the supine position.
2. Identify and locate the bony landmarks.
  - a. The site of choice is in the proximal tibia 1-2 finger breadths (1-3 cm) below the tibial tuberosity on the anteromedial surface.
  - b. Alternate sites are:
    - 1) the distal femur 2 finger breadths (2-3 cm) above the external condyles in the midline;
    - 2) the distal tibia 1-2 finger breadths (1-3 cm) above the medial malleolus at the ankle.
3. Prep the site with betadine.
4. Direct and insert the needle with the stylet in place perpendicular to the bone or angled away from the joint, avoiding the epiphyseal plate.

5. Insert with pressure and a boring or screwing motion until penetration into the marrow, which is marked by a sudden lack of resistance.
6. Remove the stylet.
7. Attach a 5 ml syringe. Needle is appropriately placed if the following are present:
  - a. Aspiration with syringe yields blood with marrow particulate matter.
  - b. Attempt at infusion of saline in syringe is not met with resistance or infiltration at the site.
  - c. Needle stands without support.
8. Attach IV tubing, with or without stopcock.
  - a. Flow rates to gravity may be unacceptably slow.
  - b. Consider placing an IV solution in pressure bag inflated to 300 torr or “pushing” the fluid bolus with a syringe attached to the hub of the IO needle.
9. Stabilize needle on both sides with sterile gauze and secure with tape (avoid tension on needle).
10. Medications administered by IO must be followed by a sterile saline flush of at least 5 ml to ensure that the drug is infused into the central circulation.

**Contraindications:**

1. Placement of an intraosseous line in a fractured bone;
2. Placement of an intraosseous line distal to a fractured bone, i.e., tibial placement with a femur fracture;
3. Infection or burns at the intended site are relative contraindications and base station physician should advise.
4. Previous attempts at intraosseous insertion in the same bone.

**Complications:**

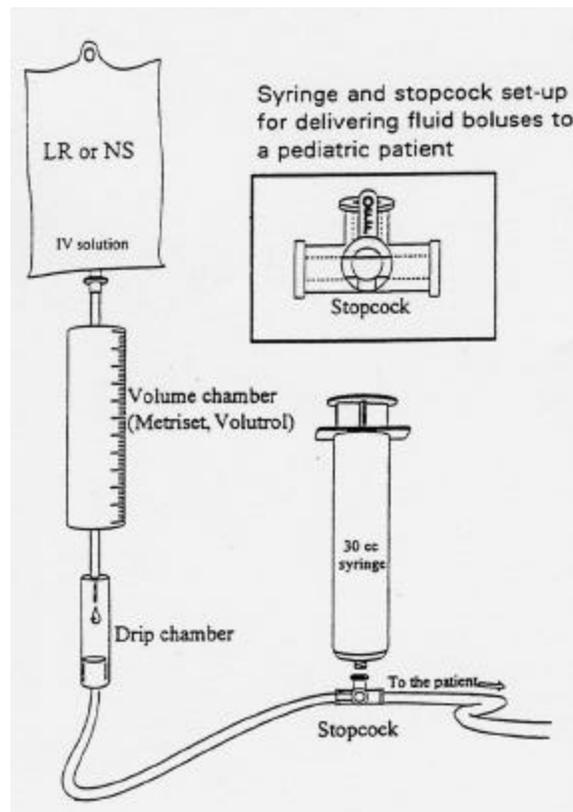
1. The infusion rate may not be adequate for resuscitation of ongoing hemorrhage or severe shock. It is a good alternative route when venous access is difficult or while it is being attempted.
2. Extravasation of fluid is the most common problem secondary to improper initial placement or dislodgement of needle.
3. Other complications reported in the literature are rare, including fat embolism and osteomyelitis.

**Advanced Material: Procedure for Rapid IV Fluid Administration**

For children weighing 25 kg or more, who are receiving at least a 20ml/kg bolus (500 ml), and who have an IV catheter size of 20 gauge or larger, apply a rapid infuser pressure bag to the IV solution and use with a regular drip set or large bore blood tubing.

For children less than 25 kg, the volume of the bolus is too small for the pressure bag. Also the catheter size of less than 20 gauge will impede gravity flow. Therefore, the stopcock technique should be used for administering fluid boluses:

1. Attach a 3-way stopcock, or a 4-way stopcock with an extension tubing, between the T-connector at the catheter (patient) and the IV tubing to the IV bag. The stopcock should be of the type that has a small lever which can be turned or rotated between three separate ports closing off any one of the ports as needed.
2. Attach a large syringe (30-60cc) to one of the ports on the stopcock. Turn off the stopcock TO the port leading to the child (catheter end). The arrow is toward the child.
3. When the stopcock is turned off to the child, it should be open between the IV bag and the attached syringe. It should allow you to easily withdraw the plunger of the syringe and fill it with IV solution from the IV bag.
4. When the amount of solution you need is withdrawn from the IV bag, turn off the stopcock TO the IV bag. The arrow is toward the IV bag. The stopcock will be open from the syringe to the patient, allowing you to push the fluid bolus from the syringe to the patient. Repeat the procedure until the amount of IV solution you need for a bolus is administered.
5. **Caution:** If the stopcock you are using does not allow you to easily pull your IV solution from the bag into the attached syringe and then push it into the patient from the syringe without having to detach the syringe; then you probably do not have the correct stopcock.



**ADDITIONAL PEDIATRIC REFERENCE INFORMATION INCLUDING INTERNET RESOURCES:**

American Heart Association, Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation*, 2000; 102 (supplement).

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Luten, RC. *Pediatric Advanced Life Support: PALS Plus* (videotape). St. Louis, MO: American Safety Video Publishers, a division of Mosby; 1992. (35 minutes).

McSwain N, ed. Initial care and resuscitation of the injured child. In: *PHTLS, Basic and Advanced Pre-Hospital Trauma Life Support*. 3<sup>rd</sup> ed. St. Louis: Mosby lifeline; 1994: 310-331.

Romig L. Assessment of the traumatized child. *Emergency* Sept. 1993:35-38.

Simon J, Goldberg A. Pediatric trauma. In: *Prehospital Pediatric Life Support*. St. Louis: C.V. Mosby; 1989: 70-81.

**Internet Sites:**

American Academy of Pediatrics, [www.aap.org](http://www.aap.org)

American Academy of Pediatrics, Pediatric Education for Prehospital Professionals, [www.PEPPsite.com](http://www.PEPPsite.com)

Center for Pediatric Emergency Medicine, [www.cpem.org](http://www.cpem.org)

Emergency Medical Services for Children Program, [www.ems-c.org](http://www.ems-c.org)

## BASIC EMT POSTTEST -Pediatric Trauma Module

1. When a child experiences multiple trauma, the most common site of injury is to the:
  - a. Head
  - b. Abdomen
  - c. Extremity
  - d. Chest
  
2. The best BLS maneuver for opening the airway of a pediatric trauma victim is:
  - a. Insertion of an airway
  - b. Administration of oxygen
  - c. A jaw thrust
  - d. Hyperextension of the neck
  - e. Head tilt-chin lift
  
3. A late sign of hypovolemic shock in a pediatric trauma patient is:
  - a. Cool, clammy skin
  - b. Tachycardia
  - c. Hypotension
  - d. Capillary refill time of 2 seconds
  
4. The first priority for treating any pediatric near-drowning patient is:
  - a. Re-warm to prevent hypothermia and further heat loss.
  - b. Treat and transport only those patients who are symptomatic.
  - c. Open the airway and provide 100% oxygen
  - d. Suction water from the lungs.
  
5. Which statement is **TRUE** regarding the use of MAST pants in children:
  - a. MAST pants are designed to fit infants and toddlers.
  - b. Use of the abdominal compartment improves respiratory function in young children.
  - c. MAST pants should not be used to splint pelvic fractures.
  - d. The abdominal compartment of the MAST should not be inflated in a pediatric trauma patient under age 10.

6. You arrive at the scene of a rear-end collision in which a 5-year old child was not restrained. The child is unconscious but has no obvious injuries or respiratory distress. Which of the following suspected injuries would you initially manage?
- Pelvic injury
  - Cervical spine injury
  - Thoracic injury
  - Internal hemorrhage
7. You arrive at the scene of a motor vehicle accident (occurred 15 minutes earlier) involving a father and son. The father is critically injured, but his 5-year old son, who was wearing a seat belt, is alert, conscious, pale, and complaining of a “small amount” of pain in his right upper abdominal area. Capillary refill is delayed. Your concern for the child is:
- Minimal, since children are resilient and can tolerate much of the force of impact.
  - That he not know how serious his father’s injuries are.
  - Moderate, because restrained children often have few serious injuries.
  - Urgent, since children compensate for hypovolemia for a short time before circulatory collapse occurs.
8. It is often difficult to evaluate the neurological status in an infant under 15-months of age. Indicators of level of consciousness for this age group include all of the following except:
- Crying or babbling spontaneously
  - Obeying commands
  - Turning to mother’s voice
  - Watching every move you make
9. Which of the following is **NOT** true regarding the compensation mechanism of children?
- Children have poor ability to compensate.
  - Children rapidly deteriorate once past compensation.
  - Children have a great ability to compensate.
  - Children are difficult to resuscitate once compensation is lost.
10. The least reliable indicator of decreased cardiovascular status and shock is?
- Hypotension
  - Heart rate
  - Capillary refill
  - Level of consciousness

11. The initial assessment approach to the child with multiple trauma is:
- a. Airway, with cervical spine control, breathing circulation
  - b. Airway, breathing, circulation, cervical spine control
  - c. Airway, breathing, circulation
  - d. Airway, breathing, cervical spine control, circulation
12. Which of the following children from a bus accident would raise the **highest** suspicion for significant abdominal trauma:
- a. A 4-year old who laughs when you palpate his abdomen.
  - b. A frightened, agitated 5-year old who cries loudly when you palpate his abdomen.
  - c. A quiet 3-year old with shallow breathing, who tries hard not to make any sound and only whimpers softly when you palpate his abdomen
  - d. An alert, ambulatory 18-month old toddler with a distended abdomen.

## ADVANCED EMT/PARAMEDIC POSTTEST Pediatric Trauma Module

The following information should be used to answer questions 1-5.

A 7-year old boy was struck by a car while riding his bicycle. He is lying face down, unconscious with abrasions on the right temple area, and apparent disruption of alignment of the left femur. His vital signs are heart rate = 140, respiratory rate = 12, blood pressure = 100/64, capillary refill = 3 seconds. On observation of the chest, there are abrasions and no detectable movement on the right side.

1. After log rolling the child to supine position and maintaining C-spine alignment, he stops breathing. Your initial response is to:
  - a. Administer oxygen
  - b. Perform a jaw thrust
  - c. Intubate
  - d. Suction the oral cavity
  
2. The child begins breathing spontaneously with a respiratory rate of 16. On observation of the chest, there are abrasions and no detectable movement on the right side. The most common consequence of thoracic injury in a pediatric patient is:
  - a. Pulmonary contusion
  - b. Tension pneumothorax
  - c. Rib fracture
  - d. Hemothorax
  - e. Cardiac tamponade
  
3. The assessment parameter which you should not depend upon for early detection of a tension pneumothorax is:
  - a. Respiratory rate and quality
  - b. Heart rate
  - c. Capillary refill
  - d. Level of consciousness
  - e. Tracheal deviation
  
4. Because the child is in early shock, fluid resuscitation is initiated. The child is estimated to weigh 55 lbs by the mother. The initial fluid bolus of Lactated Ringers should be:
  - a. 1100 cc
  - b. 500cc
  - c. 750 cc
  - d. 250 cc

5. The preferred initial site to establish an IV line for fluid resuscitation in this child is the:
- Antecubital fossa
  - Femoral vein
  - External jugular vein
  - Saphenous vein
6. Intraosseous infusion is approved for which age of children??
- Any age child
  - Less than 3 years
  - 12 months to 4 years
  - 6 years and younger
7. Why is a volume chamber, stopcock and syringe used in the infusion of fluids for pediatric patients?
- To prevent excess pressure on tiny veins and infiltration
  - To prevent air emboli
  - To administer fluid rapidly in an accurate amount
  - To have IV routes available if medications are required
8. The cardiac arrhythmia most often seen in children with fever, pain, and early hypovolemia is?
- Tachycardia
  - Bradycardia
  - PVC's
  - Children have healthy hearts and do not respond with any arrhythmia
9. Which of the following is considered the **most** significant pre-arrest condition in a pediatric patient?
- Decreased level of consciousness
  - Tachycardia
  - Bradycardia
  - Hypotension
10. In hypothermia, poor circulation and hypo-metabolism make the administration of multiple rounds of drugs for arrhythmias potentially dangerous. Below what temperature should multiple rounds of drugs be avoided?
- 60 degrees F
  - 70 degrees F
  - 80 degrees F
  - 90 degrees F