PEDIATRIC MODULE

(an addition to the Wisconsin EMT-Intermediate Technician Curriculum)

April 2004

NOTE: Content in italics is optional and may be included at the discretion of the training center.

6-2 At the completion of this unit, the EMT Intermediate Technician student will be able to integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for the pediatric patient.

COGNITIVE OBJECTIVES: At the completion of this unit, the EMT I.V. Technician student will be able to:	**DECLARATIVE CONTENT**:
6-2.9 Identify key anatomical and physiological characteristics of infants and children and their implications. (C-2) 6-2.10 Outline differences in adult and childhood anatomy and physiology. (C-3)	I. Anatomy and physiology review A. Head 1. Proportionally larger size 2. Larger occipital region 3. Fontanelles open in infancy 4. Face is small in comparison to size of head 5. EMT IV Technician implications a. Higher proportion of blunt trauma involves the

head
b. Different airway positioning techniques
(1) Place thin layer of padding under back of seriously injured child < 3 years of age to obtain neutral position
(2) Place folded sheet under occiput of medically ill child > 3 years of age to obtain sniffing position
c. Examine fontanelle in infants
(1) Bulging fontanelle suggests increased intracranial pressure
(2) Sunken fontanelle suggests dehydration

B. Airway
1. Narrower at all levels
2. Infants are obligate nasal breathers
3. Jaw is proportionally smaller in young children
4. Tracheal cartilage softer
5. Trachea smaller in both length and diameter
6. EMT IV Technician implications
a. Keep nares clear in infants < 6 months of age
b. Narrower upper airways are more easily obstructed
(1) Flexion or hyperextension
(2) Particulate matter
(3) Soft tissue swelling (injury, inflammation

C. Chest and lungs
1. Ribs are positioned horizontally
2. Ribs are more pliable and offer less protection to organs
3. Chest muscles immature and fatigue easily
4. EMT IV Technician implications
a. Infants and children are diaphragmatic breathers
b. Infants and children are prone to gastric distention
c. Rib fractures are less frequent but not uncommon in child abuse and trauma
d. Greater energy transmitted to underlying organs following trauma, therefore, significant internal injury can be present without external signs

D. Abdomen
1. Immature abdominal muscles offer less protection
2. Abdominal organs are closer together
3. Liver and spleen proportionally larger and more vascular
4. EMT IV Technician implications
a. Liver and spleen more frequently injured
b. Multiple organ injuries more common

E. Extremities
1. Bones are softer and more porous until adolescence
2. Injuries to growth plate may disrupt bone growth
3. EMT IV Technician implications
a. Immobilize any “sprain” or “strain” as it is likely a fracture
b. Avoid piercing growth plate during intraosseous needle insertion

F. Cardiovascular system
1. Can maintain blood pressure with a greater proportional loss of circulating volume than an adult
2. Absolute blood volume is smaller than in an adult
3. EMT IV Technician implications
a. Smaller absolute volume of fluid/blood loss needed to cause shock
b. Hypotension is a late sign of shock

6-2.11 Describe techniques for successful assessment of infants and children. (C-1)	II. Assessment A. General considerations 1. Many components of the initial patient evaluation can be done by observing the patient 2. Utilize the parent/guardian to assist in making the infant or child more comfortable as appropriate 3. Interacting with parents and family a. Normal responses to acute illness and injury b. Parent/guardian and child interaction c. Intervention techniques
6-2.12 Describe the physical examination of a pediatric patient. (C-1)	B. Physical exam 1. Scene survey a. Observe the scene for hazards or potential hazards b. Observe the scene for mechanism of injury/illness. e. g. (1) Ingestion - pills, medicine bottles, household chemicals, etc. (2) Child abuse - injury and history do not coincide, bruises not where they should be for mechanism of injury, etc. (3) Position patient found c. Observe the parent/guardian/caregiver interaction with the child (1) Do they act appropriately (2) Is parent/guardian/caregiver concerned (3) Is parent/guardian/caregiver angry (4) Is parent/guardian/caregiver indifferent 2. Initial assessment a. General impression (1) General impression of environment (2) General impression of parent/guardian and child interaction (3) General impression of the Pediatric Assessment Triangle (a) A structure for assessing the pediatric patient (b) Focuses on the most valuable information for pediatric patients (c) Used to ascertain if any life-threatening condition exists (d) Components (i) Appearance a) Mental status b) Muscle tone (ii) Work of breathing a) Respiratory rate b) Respiratory effort (iii) Circulation

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	a) Skin signs b) Skin color (4) Initial triage decisions (a) Urgent - proceed with rapid ABC assessment, treatment and transport (b) Non urgent - proceed with focused history, detailed physical exam after initial assessment b. Vital functions (1) Determine level of consciousness (a) AVPU scale (i) **A**lert (ii) Responds to **V**erbal stimuli (iii) Responds to **P**ainful stimuli (iv) **U**nresponsive (b) Modified Glasgow Coma Scale Ed. Note: See appended table (c) Signs of inadequate oxygenation (2) Airway - determine patency (3) Breathing (a) Adequate chest rise and fall (b) Use of accessory muscles (c) Nasal flaring (d) Tachypnea (e) Bradypnea (f) Irregular breathing pattern (g) Head bobbing (h) Grunting (i) Absent breath sounds (j) Abnormal sounds (4) Circulation (a) Pulse (i) Central (ii) Peripheral (iii) Quality of pulse (b) Blood pressure Note: Measuring blood pressure is less useful in evaluating circulation in children < 3 years of age than in older individuals (c) Skin color and temperature (d) Active hemorrhage
6-2.13 Identify "normal" age group related vital signs. (C-1) 6-2.14 Discuss the appropriate equipment utilized to obtain pediatric vital signs. (C-1)	(5) Vital signs (a) Equipment needed (b) Technique (c) Normal ranges (Ed. Note: see appended table) (i) Infant (ii) Toddler (iii) Preschool (iv) School aged (v) Adolescent

6-2.16 List the content of the focused history of the pediatric patient. (C-1)	3. Focused history a. Approach (1) For infant, toddler, and preschool age patient, obtain from parent/guardian (2) For school age and adolescent patient, most information may be obtained from the patient (3) For older adolescent patient question the patient in private regarding sexual activity, pregnancy, illicit drug and alcohol use b. Content (1) Chief complaint (a) Nature of illness/injury (b) How long has the patient been sick/injured (c) Presence of fever (d) Effects on behavior (e) Bowel/urine habits (f) Vomiting/diarrhea (g) Frequency of urination (2) Past medical history (a) Infant or child under the care of a physician (b) Chronic illnesses (c) Medications - when taken? (d) Allergies (e) Last meal
6-2.17 Describe the physical examination of a pediatric patient. (C-1)	4. Detailed physical exam a. Examine all body regions (1) Head-to-toe in older child (2) Toe-to-head in younger child b. Some or all of the following may be appropriate, depending on the situation (1) Pupils (2) Capillary refill (a) Normal - two seconds or less (b) Valuable to assess on patients less than six years of age (c) Less reliable in cold environment (d) Blanch nail bed, base of the thumb, sole of the feet (3) Hydration (a) Skin turgor (b) Sunken or flat fontanelle in an infant (c) Presence of tears and saliva (4) Pulse oximetry (a) May be utilized on any moderately injured or ill infant or child (b) Many factors, including hypothermia and shock can alter reading (5) Cardiac monitor (6) Blood glucose determination
6-2.18 Describe the on-going assessment of the pediatric patient. (C-1)	5. On-going exam - continually monitor the following, as appropriate: a. Respiratory effort b. Color c. Mental status d. Pulse oximetry

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	e. Vital signs f. Patient temperature g. Cardiac monitor
6-2.19 Discuss positioning as a basic airway management in the pediatric patient. (C-1)	C. General management 1. Airway management in pediatric patients a. Basic airway management (1) Manual positioning (a) Allow medical patients to assume position of comfort (b) Support under the torso for trauma patients less than 3 year old (c) Occipital elevation for supine medical patients 3 years of age or older (sniffing position)
6-2.31 Discuss age appropriate vascular access sites for infants and children. (C-1) 6-2.32 Discuss the appropriate equipment for vascular access in infants and children. (C-1) 6-2.33 Identify complications of vascular access for infants and children. (C-1) Editor's note: See Venous Access and Medication Administration Chapter	2. Circulation a. CPR according to AHA standards b. Vascular access c. ~~Intraosseous access in cardiac arrest or if intravenous access unobtainable in 90 seconds~~ d. Fluid resuscitation - 20 ml/kg of lactated ringer's or normal saline bolus as needed

6-2.34 Describe other considerations which may impact on the care of the pediatric patient. (C-2) 6-2.35 Discuss the indications, dosage, route of administration and special considerations for medication administration in infants and children. (C-1)	3. Pharmacological a. Discuss medication administration techniques in children b. See specific pathologies below 4. Non-pharmacological - see specific pathologies below 5. Transport considerations a. Appropriate mode (1) Transport should not be delayed to perform procedures that can be done in route (2) Proper BLS care must be performed prior to any ALS interventions b. Appropriate facility - the availability of a receiving hospital with expertise in pediatric care may improve the patient's outcome 6. Psychological support/communication strategies a. Utilize the parent/guardian to assist in making the infant or child more comfortable b. Encourage parents to help calm the child during painful procedures c. Infants, toddlers, preschool and school aged patients do not like to be separated from parent/guardian d. Infants and children have a natural fear of strangers. For stable patients, allow them to become accustomed to you before your hands-on assessment e. Give some control of what is going to happen to the patient (which arm to have their IV) f. When possible and practical, physically position your face at the same level as the patient's face to facilitate communication and minimize fear g. Use age-appropriate vocabulary h. Keep patient warm i. Allow child to take their favorite toy/blanket if possible j. Permit the child to express their feelings (e.g., fear, pain, crying,) k. Let the child know that certain physical actions (e.g., hitting, biting, spitting) are not permitted
6-2.37 *Describe the risk factors and prevention strategies for respiratory distress/failure in infants and children. (C-1)*	A. Respiratory compromise 1. Introduction *a. Risk factors* *b. Prevention strategies* c. Categories of respiratory compromise (1) Upper airway obstruction (2) Lower airway disease
6-2.38 Define respiratory distress. (C-1)	d. Definitions (1) Respiratory distress (a) Increased work of breathing (b) Carbon dioxide tension in the blood initially decreases, then increases as condition deteriorates (c) If uncorrected, respiratory distress leads to respiratory failure

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6-2.41 Review the assessment findings associated with respiratory distress/ failure in infants and children. (C-1) Editor's Note: See Airway Management and Intervention	e. Assessment (1) Chief Complaint (2) History (3) Physical findings (a) Signs and symptoms of respiratory distress (i) Normal mental status => irritability or anxiety (ii) Tachypnea (iii) Retractions (iv) Nasal flaring (v) Good muscle tone (vi) Tachycardia (vii) Head bobbing (viii) Grunting (ix) Cyanosis which improves with supplemental oxygen (b) Signs and symptoms of respiratory failure (i) Irritability or anxiety ==> lethargy (ii) Marked tachypnea ==> bradypnea (iii) Marked retractions ==> agonal respirations (iv) Poor muscle tone (v) Marked tachycardia ==> bradycardia (vi) Central cyanosis (c) Signs and symptoms of respiratory arrest (i) Obtunded ==> coma (ii) Bradypnea ==> apnea (iii) Absent chest wall motion (iv) Limp muscle tone (v) Bradycardia ==> asystole (vi) Profound cyanosis (4) On-going assessment - improvement indicated by: (a) Improvement in color (b) Improvement in oxygen saturation (c) Increased pulse rate (d) Increased level of consciousness
6-2.42 Differentiate between upper airway obstruction and lower airway disease. (C-3) 6-2.43 Describe the general approach to the treatment of children with respiratory distress, failure, or arrest from upper airway obstruction or lower airway disease. (C-3) 6-2.44 Discuss the management/treatment plan for respiratory distress/failure in infants and children. (C-1)	f. Management (1) Graded approach to treatment (2) Consider separating parent and child (3) Airway (a) Manage upper airway obstructions as needed (b) Insert airway adjunct if needed (4) Ventilation and oxygenation (a) Respiratory distress/early respiratory failure - administer high flow oxygen (b) Late respiratory failure/ respiratory arrest (i) BVM - ventilate patient with 100% oxygen via age- appropriate sized bag (5) Circulation – consider vascular access (6) Supportive care

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6-2.45 Discuss appropriate transport guidelines for infants and children. (C-1) 6-2.46 Discuss appropriate receiving facilities for low and high risk infants and children. (C-1)	(7) Transport considerations (a) Appropriate mode (b) Appropriate facility
6-2.47 Discuss other considerations that may impact on patient care. (C-2)	(8) Psychological support/ communication strategies
6-2.52 Discuss the *incidence*, pathophysiology, assessment findings and management techniques for asthma. (C-1)	2. Lower airway disease a. Acute episode of asthma (1) *Epidemiology* (a) Incidence (i) Usually occurs in children older

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	than 2 years of age (ii) Very common (b) Risk factors (i) Typically in child with known history of asthma (ii) Triggered by upper respiratory infections, allergies, changes in temperature, physical exercise and emotional response (iii) Children that experience prolonged asthma attacks tire easily; watch for signs of respiratory failure *(c) Prevention strategies* (2) Pathophysiology (a) Bronchospasm (b) Excessive mucus production (c) Inflammation of the small airways (3) Assessment (a) Signs and symptoms - respiratory distress or failure depending on severity, plus: (i) Appears anxious (ii) Wheezes (iii) Prolonged expiratory phase (iv) A silent chest means danger (b) History - usually follows exposure to known trigger (c) Bronchiolitis and asthma may present very similarly (4) Management (a) Airway maintenance (i) Administer oxygen by tolerated method (ii) BVM ventilations for respiratory failure/arrest (progressive lethargy, poor muscle tone, shallow respiratory effort) (b) Circulation - Consider vascular access (c) Pharmacological (i) Beta-2 agonists per nebulizer (d) Transport considerations - allow patient to assume position of comfort (e) Psychological support/ communication strategies - keep caregiver with child if appropriate
6-2.56 Describe the epidemiology, including the incidence, morbidity/mortality, risk factors and *prevention strategies* for hypoperfusion in infants and children. (C-1)	B. Shock 1. Introduction a. *Epidemiology* (1) Incidence (2) Morbidity/mortality (3) Risk factors *(4) Prevention strategies*
6-2.57 Discuss the common causes of hypoperfusion in infants and children. (C-1)	b. Categories of shock (1) Non-cardiogenic (2) Cardiogenic
6-2.58 Discuss the pathophysiology of hypoperfusion in infants and children.	2. Pathophysiology a. An abnormal condition characterized by

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(C-1)	inadequate delivery of oxygen and metabolic substrates to meet the metabolic demands of tissues b. Severity (1) Compensated (early) (a) Patient's blood pressure is normal although signs of inadequate tissue perfusion are present (b) Reversible (2) Decompensated (late) (a) Hypotension and signs of inadequate organ perfusion are present (b) Often irreversible
6-2.59 Discuss the assessment findings associated with hypoperfusion in infants and children. (C-1)	c. Assessment (1) Chief complaint (2) History
6-2.60 Evaluate the severity of hypoperfusion in infants and children. (C-3)	(3) Physical findings (a) Signs and symptoms of compensated shock (i) Irritability or anxiety (ii) Tachycardia (iii) Tachypnea (iv) Weak peripheral pulses, full central pulses (v) Delayed capillary refill (vi) Cool, pale extremities (vii) Systolic blood pressure within normal limits (viii) Decreased urinary output (b) Signs and symptoms of decompensated shock (i) Lethargy or coma (ii) Marked tachycardia or bradycardia (iii) Marked tachypnea or bradypnea (iv) Absent peripheral pulses, weak central pulses (v) Markedly delayed capillary refill (vi) Cool, pale, dusky, mottled extremities (vii) Hypotension (viii) Markedly decreased urinary output

6-2.61 Discuss the management/treatment plan for hypoperfusion in infants and children. (C-1)	d. Management (1) Graded approach to treatment (2) Consider separating parent and child (3) Airway (consider possibility for cervical injury) (4) Ventilation and oxygenation (a) Compensated shock - oxygen (b) Decompensated shock (i) BVM - consider ventilating patient with 100% oxygen via appropriate-sized bag (5) Circulation (a) Compensated shock (i) Oxygen (ii) Fluid resuscitation (b) Decompensated shock (i) Oxygen (ii) Fluid resuscitation (6) Supportive care (7) Transport considerations (a) Appropriate mode (b) Appropriate facility (8) Psychological support/ communication strategies
6-2.62 Discuss the *incidence*, pathophysiology, assessment findings and management techniques for Hypovolemic shock in the pediatric patient. (C-1)	3. Non-cardiogenic a. Hypovolemia (1) Epidemiology - common (2) Pathophysiology - intravascular volume depletion

	(a) Severe dehydration (i) Vomiting (ii) Diarrhea (iii) Burns (b) Blood loss (i) Trauma (ii) Other, e.g., GI bleed (3) Assessment (a) Signs and symptoms of compensated or decompensated shock depending on severity, plus: (i) Blood loss a) External hemorrhage b) Major trauma (ii) Dehydration a) Poor skin turgor b) Decreased saliva and or tears c) Sunken fontanelle (infants) (b) History (4) Management (a) Airway maintenance (i) Oxygen (ii) Trauma - immobilize c-spine (b) Circulation (i) Compensated shock a) Oxygen b) 20 cc/kg of Lactated Ringers or Normal Saline c) Re-bolus X1 if no improvement ii) Decompensated shock a) Oxygen b) Vascular access c) 20 ml/kg of lactated ringers or NS bolus as needed d) Re-bolus if no improvement (c) Supportive care (d) Transport considerations (e) Psychological support/ communication strategies

6-2.76 Describe the primary etiologies of seizures in infants and children. (C-1)

6-2.77 Describe the *epidemiology*, including the incidence, morbidity/mortality, risk factors and *prevention strategies* for seizures in infants and children. (C-1)

6-2.78 Discuss the pathophysiology of seizures in infants and children. (C-1)

6-2.79 Discuss the assessment findings associated with seizures in infants and children. (C-1)

6-2.80 Discuss the management/treatment plan for seizures in infants and children. (C-1)

Ed. Note: See Neonatal and neurologic chapters for additional information

C. Seizure
1. *Epidemiology*
   a. Incidence
   b. Morbidity/mortality
   c. Risk factors/common causes
      (1) Febrile
      (2) Hypoxic encephalopathies
      (3) Intracranial hemorrhage
      (4) Metabolic disturbance
      (5) Meningitis or encephalopathy
      (6) Drug ingestion
      (7) Developmental abnormalities
      (8) Epilepsy
   d. Prevention strategies
2. Pathophysiology
   a. Generalized seizures
   b. Focal seizures
   c. Status epilepticus
3. Assessment
   a. Signs and symptoms of seizure
      (1) Generalized
         (a) Sudden jerking of both sides of the body followed by tenseness and relaxation of the body
         (b) Loss of consciousness
         (c) Post-ictal period
      (2) Focal
         (a) Sudden jerking of a part of the body (arm, leg)
         (b) Lip smacking
         (c) Eye blinking
         (d) Staring
         (e) Confusion
         (f) Lethargy
      (3) Status - continuous or recurrent seizures without period of recovery
   b. History
   c. Assess for underlying cause
      (1) Blood glucose
      (2) Fever
      (3) Head injury
      (4) Ingestion
      (5) Noncompliance with medication routine
4. Management
   a. Airway maintenance
      (1) Maintain patent airway
      (2) Administer high-flow oxygen
   b. Circulation
   c. Pharmacological
      (1) Consider dextrose if hypoglycemic
   d. Non-pharmacological
      (1) Protect patient from further injury
      (2) Protect head and cervical spine if injury has occurred
      (3) Consider fever reduction
   e. Transport considerations
   f. Psychological support/communication strategies
   g. Infection control considerations

6-2.81 Describe the primary etiologies of hypoglycemia in infants and children. (C-1) 6-2.82 Describe the epidemiology, including the incidence, morbidity/mortality, risk factors and prevention strategies for hypoglycemia in infants and children. (C-1) 6-2.83 Discuss the pathophysiology of hypoglycemia in infants and children. (C-1) 6-2.84 Discuss the assessment findings associated with hypoglycemia in infants and children. (C-1) 6-2.85 Discuss the management/treatment plan for hypoglycemia in infants and children. (C-1)	D. Hypoglycemia 1. *Epidemiology* a. Incidence b. Morbidity/mortality c. Incidence d. Risk factors *e. Prevention strategies* 2. Pathophysiology a. Children have limited glucose storage b. In severe cases, if not treated promptly, can cause brain damage 3. Assessment a. Signs and symptoms (1) Mild (a) Hunger (b) Weakness (c) Tachypnea (d) Tachycardia (2) Moderate (a) Sweating (b) Tremors (c) Irritability (d) Vomiting (e) Mood swings (f) Blurred vision (g) Stomach ache (h) Headache (i) Dizziness (3) Severe (a) Decreased level of consciousness (b) Seizure b. Measure blood glucose c. History 4. Management a. Airway and ventilation b. Circulation – consider IV access c. Pharmacological (1) Dextrose (2) Administer Glucagon IM if IV access is not possible d. Non-pharmacological - repeat blood glucose test 10-15 minutes after dextrose infusion e. Transport considerations f. Psychological support communication strategies
6-2.86 Describe the primary etiologies of hyperglycemia in infants and children. (C-1) 6-2.87 Describe the epidemiology, including the incidence, morbidity/mortality, risk factors and prevention strategies for hyperglycemia in infants and children. (C-1) 6-2.88 Discuss the pathophysiology of hyperglycemia in infants and children. (C-1)	E. Hyperglycemia 1. *Epidemiology* a. Morbidity/mortality b. Incidence c. Risk factors *d. Prevention strategies* 2. Pathophysiology - hyperglycemia leads to dehydration and ketoacidosis 3. Assessment a. Signs and symptoms (1) Early (a) Increased thirst (b) Increased urination (c) Weight loss

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6-2.89 Discuss the assessment findings associated hyperglycemia in infants and children. (C-1) 6-2.90 Discuss the management/treatment plan for hyperglycemia in infants and children. (C-1)	(d) Hunger (2) Late (dehydration and early ketoacidosis) (a) Weakness (b) Abdominal pain (c) Generalized aches (d) Loss of appetite (e) Nausea (f) Vomiting (g) Signs of dehydration except decreased urinary output (h) Fruity breath odor (i) Tachypnea (j) Hyperventilation (k) Tachycardia (3) If untreated, progresses to: (a) Coma (b) Kussmaul's (c) dehydration b. Measure blood glucose c. History 4. Management a. Airway maintenance b. Circulation – consider IV access with LR or NS c. Pharmacological – none indicated d. Non-pharmacological e. Transport considerations f. Psychological support communication strategies

6-2.91 Describe the primary etiologies of poisoning in infants and children. (C-1) 6-2.92 Describe the epidemiology, including the incidence, morbidity/mortality, risk factors and prevention strategies for poisoning in infants and children. (C-1) 6-2.93 Discuss the pathophysiology of poisoning in infants and children. (C-1) 6-2.94 Discuss the assessment findings associated with poisoning in infants and children. (C-1) 6-2.95 Discuss the management/treatment plan for poisoning in infants and children. (C-1)	F. Poisoning and toxic exposure 1. *Epidemiology* a. Children account for the majority of poisoning events b. A cause of preventable death in children c. Risk factors *d. Prevention strategies* 2. Pathophysiology depends upon the type of poison or toxin and the extent of exposure 3. Common substances of pediatric poisonings a. Alcohol, barbiturates, sedatives b. Amphetamines, cocaine, hallucinogens c. Anticholinergic d. Aspirin/acetaminophen e. Corrosives f Digitalis, beta-blockers g. Hydrocarbons h. Narcotics i. Organic solvents (inhaled) j. Organophosphate k. Antidepressants l. Ibuprofen 4. Assessment a. Signs and symptoms - vary depending upon both the poisoning/toxic substance and the time since the child was exposed (1) Respiratory system depression or stimulation (2) Circulatory system depression or stimulation (3) Central nervous system stimulation or depression (4) Alteration of perception (5) Gastrointestinal system irritation b. History 5. Management a. Airway maintenance - consider oxygen b. Circulation - consider IV access c. Contact poison control center or medical direction to obtain directions for specific treatment d. Take pills, substances, containers to the hospital e. Transport considerations f. Psychological support communication strategies
6-2.96 Discuss the pathophysiology of trauma in infants and children. (C-1)	VI. Pediatric trauma A. Pathophysiology 1. Blunt a. Thinner body wall allows forces to be readily transmitted to body contents b. Predominant cause of injury in children 2. Penetrating

6-2.102 Identify common lethal mechanisms of injury in infants and children. (C-1) 6-2.103 Discuss anatomical features of children that predispose or protect them from certain injuries. (C-1)	B. Mechanism of injury 1. Fall a. Single most common cause of injury in children b. Accidental falls less than 10 feet in height are unlikely to produce serious injury or death *c. Prevention strategies* 2. Motor vehicle crash a. Leading cause of permanent brain injury and new cases of epilepsy b. Leading cause of death and serious injury in children *c. Prevention strategies* 3. Pedestrian vehicle crash (Waddell's triad) a. Particularly lethal form of trauma in children b. Initial injury due to impact with vehicle (extremity/trunk) c. Child is thrown from force of impact causing additional injury (head/spine) upon impact with other objects (ground, another vehicle, light standard, etc.) *d. Prevention strategies* 4. Near-drowning a. Third leading cause of injury or death in children between birth and 4 years of age b. Causes approximately 2000 deaths annually c. Severe, permanent brain damage occurs in 5-20% of hospitalized children for near drowning *d. Prevention strategies* 5. Penetrating injuries a. Risk of death from firearm injuries increase with age b. Stab wounds and firearm injuries account for an increasing proportion of all pediatric trauma admissions c. Visual inspection of external injuries can not evaluate the extent of internal involvement *d. Prevention strategies* 6. Burns a. The leading cause of accidental death in the home for children under the age of 14 years b. Burn survival is a function of burn size and concomitant injuries c. Modified "rule of nines" is utilized to determine percentage of surface area involved *d. Prevention strategies* 7. Physical abuse a. Has been classified into four categories – physical abuse, sexual abuse, emotional abuse and child neglect b. Social phenomena such as increased poverty, domestic disturbance, younger aged parents, substance abuse, and community violence have been attributed to increase of abuse c. Document all pertinent findings, treatments and interventions *d. Prevention strategies*

6-2.104 Describe aspects of infant and children airway management that are affected by potential cervical spine injury. (C-1) Ed. Note: See Airway Management and Ventilation	C. Special considerations in prehospital care 1. Airway control a. Maintain in-line stabilization in neutral position b. Administer 100% oxygen to all trauma patients c. Patent airway must be maintained via suctioning and jaw thrust d. Be prepared to assist ineffective respirations e. Intubation should be performed when the airway remains inadequate f. Gastric tube should be placed after intubation g. Needle cricothyroidotomy is rarely indicated for traumatic upper airway obstruction
6-2.105 Identify infant and child trauma patients who require spinal immobilization. (C-1) 6-2.106 Discuss the immobilization management/treatment plan for trauma in infants and children. (C-1)	2. Immobilization a. Indications for stabilization and immobilization of cervical spine (1) Consider mechanism of injury (2) High index of suspicion b. Utilize appropriate sized pediatric immobilization equipment c. Maintain supine neutral in-line position for infants, toddlers and pre-schoolers by placing padding from the shoulders to the hips
6-2.107 Discuss fluid management and shock treatment for infant and child trauma patient. (C-1) 6-2.108 Discuss the fluid management/ treatment plan for trauma in infants and children. (C-1)	3. Fluid management a. Management of the airway and breathing take priority over management of circulation b. Vascular access (1) Large-bore intravenous catheter should be inserted into a large peripheral vein (2) Do not delay transport to gain access ~~(3) Consider intraosseous if intravenous access fails~~ c. Fluid resuscitation (1) Initial fluid bolus of 20 ml/kg of an lactated ringers or NS (2) Reassess vital signs and re-bolus with 20 ml/kg if no improvement (3) If improvement does not occur after the second bolus, there is likely to be significant blood loss and the need for rapid surgical intervention
6-2.109 Describe the assessment and management of the child with traumatic brain injury. (C-1)	4. Traumatic brain injury a. Seizures and/or vomiting are common in children following even minor head/brain injury b. Severity (1) Mild - GCS is 13 to 15 (2) Moderate - GCS is 9 to 12 (3) Severe - GCS is less than or equal to 8 c. Signs of increased intracranial pressure (1) Elevated blood pressure (2) Bradycardia (3) Altered respiratory patterns (4) Altered mental status (5) Seizures (6) Headache (7) Bulging fontanelle (infant) (8) Asymmetrical/non-reactive pupils (9) Posturing d. Specific management

NOTE: Content in italics is optional and may be included at the discretion of the training center.

	(1) Administer high concentration of oxygen for mild to moderate head injuries (GCS 9-15)
6-2.110 Explain the difference between head and neck injury in a child and in an adult. (C-2)	D. Specific injuries 1. Head and neck injury a. Larger relative mass of the head and lack of neck muscle strength provides increased momentum in acceleration-deceleration injuries and a greater stress to the cervical spine region b. Fulcrum of cervical mobility in the younger child is at the C2-C3 level c. 60% to 70% of pediatric cervical spine fractures occur in C1 or C2 d. Head injury is the most common cause of death in pediatric trauma victim e. Diffuse brain injuries are more common in children than focal injuries are rare f. Due to open fontanelles and sutures, infants up to an average age of 16 months may be more tolerant to an increase of intracranial pressure and can have delayed signs g. Subdural bleeds in a infant can produce hypotension (extremely rare) h. Significant blood loss can occur through scalp lacerations and should be controlled immediately i. The Modified Glasgow Coma Scale should be utilized for infants and young children Ed. Note: See appended table.
6-2.130 Define children with special health care needs. (C-1)	IX. Infants and children with special needs A. Children with special needs may include: 1. Premature babies 2. Lung disease 3. Heart diseases 4. Neurological diseases 5. Chronic diseases 6. Altered functions from birth
Insert information on Child Alert here.	

PSYCHOMOTOR OBJECTIVES

6-2.141	Demonstrate the appropriate approach for treating infants and children. (P-2)
6-2.142	Demonstrate appropriate intervention techniques with families of acutely ill or injured infants and children. (P-2)
6-2.143	Demonstrate an appropriate assessment for different developmental age groups. (P-2)
6-2.144	Demonstrate an appropriate technique for measuring pediatric vital signs. (P-2)
6-2.145	Demonstrate the use of a length-based resuscitation device for determining equipment sizes, drug doses and other pertinent information for a pediatric patient. (P-2)
6-2.146	Demonstrate the appropriate approach for treating infants and children with respiratory distress, failure, and arrest. (P-2)
6-2.147	Demonstrate proper technique for administering blow-by oxygen to infants and children. (P-2)
6-2.148	Demonstrate the proper utilization of a pediatric non-rebreather oxygen mask. (P-2)
6-2.149	Demonstrate proper technique for suctioning of infants and children. (P-2)
6-2.150	Demonstrate appropriate use of airway adjuncts with infants and children. (P-2
6-2.151	Demonstrate appropriate use of ventilation devices for infants and children. (P-2)
6-2.152	Demonstrate an appropriate technique for insertion of peripheral intravenous catheters for infants and children. (P-2)
6-2.153	Demonstrate an appropriate technique for administration of intramuscular, inhalation, and subcutaneous medication for infants and children. (P-2)
~~6-2.154~~	~~Demonstrate an appropriate technique for insertion of an intraosseous line for infants and children. (P-2)~~
6-2.155	Demonstrate appropriate interventions for infants and children with a partially obstructed airway. (P-2)
6-2.156	Demonstrate age appropriate basic airway clearing maneuvers for infants and children with a completely obstructed airway. (P-2)
6-2.157	Demonstrate appropriate airway and breathing control maneuvers for infant and child trauma patients. (P-2)
6-2.158	Demonstrate appropriate immobilization techniques for infant and child trauma patients. (P-2)
6-2.159	Demonstrate treatment of infants and children with head injuries. (P-2)
6-2.160	Demonstrate appropriate treatment of infants and children with chest injuries. (P-2)
6-2.161	Demonstrate appropriate treatment of infants and children with abdominal injuries. (P-2)
6-2.162	Demonstrate appropriate treatment of infants and children with extremity injuries. (P-2)
6-2.163	Demonstrate appropriate parent/caregiver interviewing techniques for infant and child death situations.(P-2)

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Glasgow Coma Scale

Eye Opening (Total points 4)

Spontaneous	4
To voice	3
To pain	2
None	1

Verbal Response (Total points 5)

Older Children		Infants and Young Children	
Oriented	5	Appropriate words, smiles, fixes and follows	5
Confused	4	Consolable crying	4
Inappropriate	3	Persistently irritable	3
Incomprehensible	2	Restless, agitated	2
None	1	None	1

Motor Response (Total points 6)

Obeys	6
Localizes pain	5
Withdraws	4
Flexion	3
Extension	2
None	1

AGE-RELATED VITAL SIGNS

AGE	HEART RATE (Beats/min)	BLOOD PRESSURE (mm Hg)	RESPIRATORY RATE (breaths/min)
Premature	120-170	55-75/35-45	40-70
0-3 months	100-150	65-85/45-55	35-55
3-6 months	90-120	70-90/50-65	30-45
6-12 months	80-120	80-100/55-65	25-40
1-3 years	70-110	90-105/55-70	20-30
3-6 years	65-110	95-110/60-75	20-25
6-12 years	60-95	100-120/60-75	14-22
12+ years	55-85	110-135/65-85	12-18

From: Nelson Textbook of Pediatrics, 16th edition

APPROXIMATE NORMAL VALUES AND AIRWAY ADJUNCTS SIZES

(Blood pressure, respiratory rate and heart rate usually increase with anxiety)

Age[1]

	< 1 wk	**1 mo**	**6 mo**	**1 yr**	**2yr**	**3 yr**	**6 yr**	**10 yr**	**Teen**
Weight (kg/lb)	3/6.6	4/9	7/15	10/22	12/26	14/30	20/44	35/77	40-70/ 90-155
Resp.rate/min	30–60	30–60	25–50	20–40	20–40	20–35	18–30	15–20	12–16
Spontaneous tidal volume (ml)	20	30	50	70	85	100	150	250	300-500
Heart rate/min	100–160	100–160	100–160	90–120	90–120	80–120	70–100	70–100	60–90
Minimum systolic blood pressure (mmHg)	> 50	> 60	> 60	> 70	> 70	> 75	> 80	> 85	> 90
Blood volume(ml)	240	320	560	800	1000	1100	1600	2800	3200-5600
Usual maintenance fluid rate (ml/hr)	12	15	30	40	45	50	60	75	80-100
ET tube size (mm)	3-3.5	3.5	3.5-4.0	4.0	4.5	4.5	5.0-5.5	6.0-6.5	7.0-8.0
ETT length: teeth/gum to mid trachea (cm)	10	11	12	13	14	15	15	17	19-22

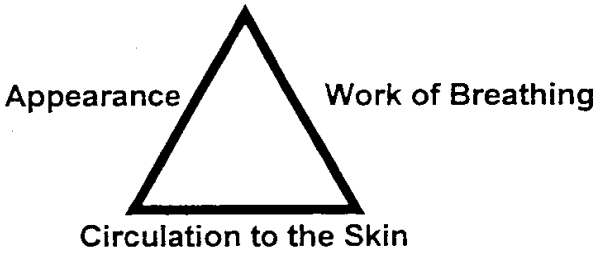
DRUG DOSAGES

(Specific drug dosages may vary according to local protocol)

			Dose range		
Drug Category	**Dose**	**Route**	**3 kg infant**	**Maximum**	**Notes**
Generic/Trade Name					
Bronchodilators					
Nebulizers:					
Albuterol (0.5%) /Ventolin	2.5 mg (0.5 ml)	inhalation			Mix with 3ml of normal saline in nebulizer
Ipratropium (0.02%)/Atrovent	0.5 mg (1 ml)	inhalation			Use undiluted in nebulizer
Subcutaneous					
Epinephrine (1:1000)	0.01mg/kg (0.01ml/kg)	SQ	0.03 mg (0.03 ml)	0.5 mg (0.5 ml)	
Narcotic reversal					
Naloxone/Narcan (full reversal)	0.1 mg/kg dose	IV	0.3 mg	2 mg	May titrate to respiratory rate with frequent doses of 1 mcg/kg (0.003 mg for 3 kg infant)
Anti-Hypoglycemic Agents					
Glucagon	0.1 mg/kg	IM	0.3 mg	1 mg	
Dextrose 50% *See Notes	1ml/kg	IV	N/A		For children over 2 years of age.
Dextrose 25% *See Notes	2ml/kg	IV	6ml		For children under 2 years of age. Dilute Dextrose 50% 1:1 with Sterile Water

IV & MEDICATION ADMINISTRATION EQUIPMENT & SUPPLIES

1. Micro-drip (60 gtts/min) administration sets or adjustable administration sets
2. Flow control device
3. IV over the needle catheters through 24 gauge
4. Arm board
5. D_5W
6. NS
7. LR
8. 3-way stopcocks (w/ or w/o extension)
9. 60 cc syringe w/ Luer lock tips
10. 10 cc syringes w/ Luer lock tips
11. Butterfly infusion sets
12. ~~Intraosseous needles~~



THE PEDIATRIC ASSESSMENT TRIANGLE

Appearance: The general appearance is the single most useful indicator of serious illness or injury. It can usually be judged from across the room. Assess by:

- **Tone:** normal *vs.* limp, listless or flaccid
- **Interactiveness:** alert *vs.* agitated *vs.* lethargic
- **Consolability:** Can be comforted *vs.* unconsolable
- **Look/gaze:** Can fix and follow *vs.* glassy-eyed stare
- **Speech/cry:** Strong *vs.* weak, muffled or hoarse

Interactiveness is the most important characteristic to note. **Regardless of cause, if the appearance is abnormal perform the pediatric primary survey and begin life support to optimize oxygenation, ventilation and perfusion.**

Work of breathing. Assess by:

- **Abnormal breath sounds:** stridor, grunting, wheezing
- **Abnormal positioning:** tripoding, refusing to lie down
- **Retractions**
- **Nasal Flaring**

Circulation to the skin: Indicates perfusion of vital organs. Assess visually by noting skin or mucous membrane color:

- **Pallor, mottling, cyanosis**

The three elements of the triangle are interdependent, and together provide a rapid assessment of physiologic stability, severity of abnormality, and category of abnormality (see over).

SEVERITY OF PHYSIOLOGIC ABNORMALITY
DETERMINED USING THE ASSESSMENT TRIANGLE

	Severity of abnormality		
Observation	Stable	Unstable	Critical
Tone	Normal	↑↑	↓↓
Interactiveness	Appropriate	Agitated	Depressed
Consolability	Comforts	Won't comfort	Unresponsive
Look/gaze	Regards	Won't regard	Glassy-eyed stare
Speech/cry	Normal	Weak	None
Work of breathing	↑	↑↑	↑↑↑ or ↓↓↓
Skin color	Normal	Dusky	Cyanotic in O_2

CATEGORY OF PHYSIOLOGIC ABNORMALITY
DETERMINED USING THE ASSESSMENT TRIANGLE

N = Normal, A = Abnormal

Appearance	Work of Breathing	Circulation to the skin	Illness/injury Category
N	N	N	Normal
N	A	N	Respiratory distress
A	A	N	Respiratory failure
A	N	N	Systemic failure or CNS injury
A	N	A	Shock
A	A	A	Multiple organ failure

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