Chapter 35
Pediatric Emergencies

Chapter Goal
• Use assessment findings to formulate field impression & implement treatment plan for pediatric patients

Learning Objectives
• Describe EMS for Children (EMSC)
• Discuss how integrated EMSC systems can affect patient outcome
• Outline differences in adult & pediatric anatomy & physiology
• Identify growth & developmental characteristics of infants & children
• Identify common responses of families to acute illness & injury of infant or child
Learning Objectives

- Describe techniques for successful interaction with families of acutely ill or injured infants & children
- Describe techniques for successful assessment of infants & children
- Discuss pediatric patient assessment
- Describe primary causes of altered level of consciousness in infants & children
- Describe epidemiology, including incidence, morbidity/mortality, risk factors, & prevention strategies for respiratory distress/failure in infants & children

Learning Objectives

- Define respiratory distress & respiratory failure
- Discuss pathophysiology of respiratory distress/failure in infants & children
- Discuss assessment findings associated with respiratory distress/failure in infants & children
- Identify major classifications of pediatric cardiac rhythms
- Discuss appropriate equipment used to obtain pediatric vital signs

Learning Objectives

- Identify normal vital sign values for various pediatric age groups
- Describe techniques for successful treatment of infants & children
- Discuss management/treatment plan for respiratory distress/failure in infants & children
- Determine appropriate airway adjuncts & discuss complications of improper use in infants & children
Learning Objectives

- Discuss appropriate ET intubation equipment for infants & children
- Identify type of ET tube used in children >8 y/o
- Identify complications of improper ET intubation procedure in infants & children
- Discuss appropriate ventilation devices & complications of improper use in infants & children
- List indications for gastric decompression for infants & children

- Discuss appropriate equipment for vascular access in infants & children
- Identify complications of vascular access for infants & children
- Discuss age-appropriate vascular access sites for infants & children
- Describe epidemiology, including incidence, morbidity/mortality, risk factors, & prevention strategies & pathophysiology for cardiac dysrhythmias in infants & children

- Discuss primary causes of cardiopulmonary arrest in infants & children
- Integrate ALS skills with BLS skills for infants & children
- Discuss BLS guidelines for infants & children
- Identify appropriate parameters for performing infant & child CPR
Learning Objectives

- Discuss assessment findings & management/treatment plan associated with cardiac dysrhythmias in infants & children
- Differentiate between upper & lower airway obstruction
- Describe epidemiology, including incidence, morbidity/mortality, risk factors, & prevention strategies for hypoperfusion in infants & children
- Discuss pathophysiology of hypoperfusion in infants & children

Learning Objectives

- Discuss common causes and evaluate severity of hypoperfusion in infants & children
- Discuss assessment findings associated with hypoperfusion in infants & children
- Discuss management/treatment plan for hypoperfusion in infants & children
- Describe epidemiology, including incidence, morbidity/mortality, risk factors, & prevention strategies for neurological emergencies in infants & children

Learning Objectives

- Discuss pathophysiology of neurological emergencies in infants & children
- Discuss assessment findings associated with neurological emergencies in infants & children
- Discuss management/treatment plan for neurological emergencies in infants & children
- Describe treatment of infant or child in status epilepticus
Learning Objectives

- Identify signs & symptoms of meningitis in infants or children
- Identify common poisons ingested by children
- Describe epidemiology, including incidence, morbidity/mortality, risk factors, & prevention strategies for trauma in infants & children
- Identify methods/mechanisms preventing injuries to infants & children
- Discuss pathophysiology of trauma in infants & children

Learning Objectives

- Identify common lethal mechanisms of injury in infants & children
- Discuss anatomical features of children predisposing or protecting them from certain injuries
- Discuss assessment findings associated with trauma in infants & children
- Discuss management/treatment plan for trauma in infants & children

Learning Objectives

- Discuss fluid management & shock treatment for infant & child trauma patients
- Describe aspects of infant & child airway management affected by potential cervical spine injury
- Identify infant & child trauma patients who require spinal immobilization
- Describe process for pediatric immobilization
Learning Objectives

- Describe treatment for child with hypothermia
- Define water rescue, submersion, & drowning
- Define SIDS
- Describe epidemiology, including incidence, morbidity/mortality, risk factors, & prevention strategies for infants with SIDS
- Discuss pathophysiology of SIDS in infants
- Discuss assessment findings associated with SIDS
- Discuss management/treatment plan for SIDS
- Discuss parent/caregiver responses to death of infant or child
- Define child abuse & child neglect
- Describe epidemiology, including incidence, morbidity/mortality, risk factors, & prevention strategies for abuse & neglect in infants & children
- Discuss pathophysiology of abuse & neglect in infants & children
- Discuss assessment findings associated with abuse & neglect in infants & children
- Discuss management/treatment plan for abuse & neglect in infants & children
- Determine when pain management & sedation are appropriate for infants & children
- Discuss appropriate transport guidelines for infants & children
- Discuss appropriate receiving facilities for low- & high-risk infants & children
The Pediatric Patient

• Epidemiology
  - ~10% of all EMS treatment for children <14 y/o
    • Children 5-14 y/o—most commonly for trauma
    • Children <5 y/o—most commonly for medical illness

• Anatomical differences
  ➢ Airway
    • Airway occlusion—major cause of death when not managed properly
    • Overall size smaller than adult
      • Children <8 y/o have:
        ➢ Larger tongue compared to mouth
        ➢ Large & floppy epiglottis
        ➢ Airway narrowest at cricoid cartilage
        ➢ Adenoids & tonsils may occlude airway
        ➢ Weak neck muscles
        ➢ Vocal cord are more superior & anterior

• Internal organs
  ➢ Larger in proportion to body size
  ➢ High incidence of internal injuries
    • Liver—most often injured
    • More multisystem injuries than adults

• Head, neck, & bones
  ➢ Head, cervical injuries
  ➢ Fractures
  ➢ Soft bones

• Nervous system
  ➢ Nerves not well insulated
  ➢ Reflexes less developed
The Pediatric Patient

- Approaching pediatric patient
  - Consider psychological aspect
  - Parents
    - If calm, ask for assistance
    - If upset, solicit others to assist parents
  - Personal psychological well-being
    - Pediatric emergencies ranked highest in creating stress
  - Before interacting with child ask:
    - What are child's age & weight?
    - What is child's level of language comprehension
    - Is someone present whom child trusts
    - What is child's medical history?
    - Any special circumstances present?
    - Have equipment specific to pediatrics

The Pediatric Patient

- Family-centered care
  - Trust family when they describe what happened
  - Emotions may vary
  - Allow family members to assist if psychologically able
General Assessment

- Scene survey
  - Observe interaction between child & caregiver

- Initial assessment
  - Pediatric assessment triangle:
    - Appearance
    - Work of breathing
    - Circulation
  - Physical examination
  - Transport decision

General Assessment

- Initial triage decision

- Assess vital functions

- Level of consciousness—AVPU

- Airway

General Assessment

- Breathing
  - Signs of respiratory distress
    - Tachypnea—usually 1st sign
    - ↑ Respiratory effort
    - ↑ Breath sounds
    - ↓ Level of responsiveness
    - Poor muscle tone
    - Cyanosis
    - Nasal flaring
    - Inspiratory retractions
    - Head bobbing
    - Grunting
    - Sistors
    - Prolonged expiration
    - Slow, irregular respiratory rate (dismal sign)
General Assessment

Breathing
- Assess neck
  - Trauma
  - JVD
  - Tracheal deviation
- Assess chest
  - Deformities
  - Contusions
  - Abrasions
  - Penetrations
  - Paradoxical motion
  - Accessory muscle usage
  - Intercostal retractions
- Listen with stethoscope: anterior, posterior, mid-axillary

Circulation
- Normal HR—fast
- Causes of sinus tachycardia
  - Hypovolemia
  - Hypoxia
  - Anxiety
  - Fever
  - Pain
  - ↑ CO2
  - Cardiac impairment
- Bradycardia
  - ↓ Tissue perfusion
  - Precursor to cardiac arrest
  - Proper oxygenation

Circulation (cont’d)
- Assess pulse
  - Brachial—infants, children
  - Femoral—infants, children
  - Carotid—children
  - Radial—older children
- Assess skin color & temperature
- Assess for active bleeding
General Assessment

- Vital signs
  - Respiratory rate & quality
  - BP
  - Pupils
  - Skin color, temperature, condition
- Broselow resuscitation tape helpful

General Assessment

- Transition phase
  - If patient condition not urgent, allow child to become familiar with you & your equipment
  - If patient condition urgent, proceed to physical examination

General Assessment

- Focused history and detailed physical examination
  - History
    - Elicit SAMPLE history from appropriate resource
  - Detailed physical examination
    - Infants & young children—foot-to-foot
    - Capillary refill
    - May be of limited value in young children
General Assessment

- Pulse oximetry
  - Infant sensor
    - Ear lobe
    - Nares
    - Cheek
    - Tongue—unresponsive
  - Adult sensors
    - Hand
    - Foot
- ECG monitor
  - Pediatric electrodes
  - Adult electrodes

General Assessment

- Ongoing examination
  - Respiratory effort
  - Color
  - Mental status
  - Pulse oximetry
  - Vital signs
  - Temperature

Procedures & Equipment: Management of ABCs

- Airway
  - Small blanket roll may be needed under base of neck or shoulders
  - Tongue—primary cause of airway obstruction
  - Do not blindly sweep for foreign objects
  - Do not perform abdominal thrusts on infants; use back blows or chest thrusts
  - Bulb suction may be more effective for infants
Procedures & Equipment: Management of ABCs

- Airway adjuncts
  - Oropharyngeal airway
    - Measure airway from corner of mouth to angle of jaw
    - Using tongue depressor, move tongue—insert airway right-side up

- Nasopharyngeal airway
  - If proper size not available, consider a 3-mm ET tube (trim as needed to correct length)

- Suction
  - Do not use force >120 mm Hg for infant or child
  - Monitor HR during suctioning; if patient becomes bradycardic, stop suction & ventilate with bag-mask

- ET intubation
  - Place head in sniffing position, if no trauma. If trauma suspected, stabilize & maintain neutral position of head & neck
  - Lift mandible & tongue until glottis can be seen
Procedures & Equipment: Management of ABCs

- ET intubation
  - Insert tube into mouth until it passes through vocal cords
  - Ventilate with bag-mask device

- Listen for breath sounds; look for chest rise & fall

- End-tidal CO2 detector can be used in infants >2 kg; use colorimetric detector or capnography for patients >20 kg

- Ventilatory adjuncts
  - Bag-mask ventilation
    - If difficult to obtain seal, invert mask
    - Use chin-lift maneuver if not trauma suspected
    - Ventilation rate with perfusing pulse—12-20 breaths/min
    - If advanced airway in place during CPR—8-10 breaths/min
    - Use bag-mask with ≥450 mL capacity & no pop-off valve
    - Avoid hyperventilation
    - Infants/toddlers—maintain sniffing position; do not hyperextend

Copyright © 2013 by Jones & Bartlett Learning, LLC, an Ascend Learning Company
Procedures & Equipment: Management of ABCs

One rescuer—infant

One rescuer—child

Two rescuers—child

Ventilatory adjuncts:
- Needle decompression
  - 18-20 g over-the-needle catheter
- Nasal cannula
  - Use pediatric size
  - 2-4 L/min
- Oxygen masks
  - Simple partial rebreather
  - Nonrebreather
  - Blow-by method

IV therapy—per local protocol
- Hands
- Arms (at elbow)
- External jugular vein
- Inside ankle above medial malleolus
- Near ankle bone
- Scalp vein/lateral foot

When not to take time on scene
- Trauma
- Epiglottitis/other respiratory distress
Procedures & Equipment: Management of ABCs

- Intraosseous infusion
  - Gather necessary equipment (specialized IO needle)
  - Insert needle perpendicular to bone

- Intraosseous infusion (cont’d)
  - Use boring or twisting motion to advance needle through bone
  - Remove stylet

- IO Procedures & Equipment: Management of ABCs
  - Intraosseous infusion
    - Inject 10 mL of normal saline; look for infiltration
    - Connect infusion
**IO Procedures & Equipment: Management of ABCs**

- Intraosseous infusion
  - Secure IO needle in place

**Fluid Administration**

- Fluid is drawn from IV bag into syringe by moving stopcock position so that "OFF" is toward patient.

- After filling syringe, twist stopcock so that "OFF" position is toward IV bag.

- Infuse bolus of IV fluid.
**IO Infusion**

**Pediatric Resuscitation**

Asystole & PEA decision tree:

- Perform CPR for 5 cycles (about 2 minutes)
- Attempt or verify advanced airway placement
- Attempt or verify vascular access
- Without interrupting CPR, give epinephrine every 3-5 minutes
- Reassess patient, CPR equipment
- Consider alternative medications and special resuscitation circumstances
  - Identify and treat special causes of:
    - Hypovolemia
    - Hypothermia
    - Hypo/hyperkalemia and metabolic disorders
    - Tension
    - Tension pneumothorax
    - Toxins, poisons, or drugs
    - Thromboembolism
Pediatric Resuscitation

- Ventricular fibrillation
  - Rare in children
  - Treatment
    - CPR
    - Ventilating with bag-mask & high-concentration O₂
    - Defibrillate @ 2 J/kg
    - Resume CPR
    - Intubate
    - Infuse IV
    - Defibrillate @ 4 J/kg
    - Resume CPR
    - Administer epinephrine (do not interrupt CPR)
    - Repeat defibrillation @ 4 J/kg
    - Consider antidysrhythmic
    - Identify & treat causes

Pediatric Respiratory Compromise

- Upper airway obstructions
  - Foreign body aspiration
  - Croup
    - Respiratory illness
    - Affects children 3 months-3 yrs old
    - Viral infection
    - Slow onset
    - Signs & symptoms
      - Respiratory stridor
      - Barking cough
      - Wheezing, lower airways involved
    - Administer cool, humidified high-concentration O₂

- Upper airway obstructions
  - Epiglottitis
    - Bacterial infection
    - Sudden onset
    - Affects children 3-7 y/o
    - True emergency
    - Signs/symptoms
      - Child looks ill; quiet
      - Tripod position; working to breathe; drooling
      - Stridor
    - DO NOT attempt to visualize airway
    - DO NOT attempt to place anything in child’s mouth
Pediatric Respiratory Compromise

- **Upper airway obstructions**
  - **Epiglottitis**
    - **Treatment**
      - Handle child gently
      - Administer high-concentration $O_2$ (humidified if possible)
      - Be prepared to ventilate
      - Advanced airway procedures per medical direction

- **Lower airway obstructions**
  - **Asthma**
    - Most common chronic illness among children
    - **Treatment**
      - Position of comfort
      - High-concentration $O_2$ (humidified if possible)
      - ECG
      - Pulse oximetry
      - Bronchodilators or epinephrine per local protocols
      - Be prepared to assist ventilations/intubate

- **Lower airway obstructions**
  - **Bronchiolitis**
    - Infection (usually viral) of lower respiratory tract
    - Affects children 6-18 months old
    - **Signs/symptoms**
      - Mild fever
      - Cough
      - Runny nose
      - Wheezing
    - **Treatment**
      - High-concentration $O_2$ (humidified if possible)
      - ECG
      - Pulse oximetry
      - Nebulized water, epinephrine, or albuterol per local protocol
Pediatric Respiratory Compromise

- Lower airway obstructions
  - Pneumonia
    - Virus or bacterial infection
    - Signs/symptoms
      - Respiratory distress/failure
      - Grunting
      - History of lower respiratory infectious symptoms
      - Fever
      - Poor eating habits
      - Irritability/anxiousness
      - Breath sounds in affected area
      - Rales/rhonchi
      - Chest pain

- Treatment
  - Airway & ventilatory support
  - O₂
  - Position of comfort
  - IV/IO

Common Medical Emergencies

- Shock
  - Child may lose <20% blood volume before change obvious
  - Look at skin color; feel pulse
  - 2 stages:
    - Compensated
    - Children remain in this stage longer than adults
    - Decompensated
    - Children reach this stage quickly, often irreversible
  - Causes
    - Gastroenteritis with dehydration—most common
    - Burns
    - Sepsis
    - Anaphylaxis
Common Medical Emergencies

- **Shock**
  - **Signs**
    - Altered LOC
    - Hyperventilation → respiratory failure
    - Tachycardia
    - Normotension → hypotension
    - Cool/cold, clammy skin
    - ↓ Peripheral pulses
    - Prolonged capillary refill
    - Oliguria
    - Acidosis
  - **Treatment**
    - Same as for adult

Common Medical Emergencies

- **Dehydration**
  - Loss of body fluids
  - ↓ Cardiac output
  - Infants/young children most susceptible
  - Ask specific questions about child’s history
  - Moderate to severe cases
    - High-concentration O₂
    - Monitor VS, ECG
    - IV/IO access, fluid bolus
Common Medical Emergencies

- Seizures/epilepsy
  - Causes
    - Fever
    - Epilepsy
  - Assessment
    - Same as adult
  - Treatment
    - Seizure—same as adult
    - Fever—attempt to reduce

Common Medical Emergencies

- Meningitis
  - Inflammation of membranes that surround brain & spinal cord
  - Cause—virus, bacteria, or microorganism
  - Signs/symptoms
    - Fever
    - Dehydration
    - Disorientation/alteration
    - Ridding (bulging fontanelle)
    - Irritability
    - Loss of appetite
    - Vomiting
    - Seizures
    - Respiratory distress
    - Cyanosis
    - Rash
  - Older child:
    - Stiff neck
    - Kernig’s sign
    - Headache

Common Medical Emergencies

- Meningitis
  - Meningococcemia
    - Symptoms
      - Sudden onset of chills
      - Muscular/joint pain
      - Sore throat
      - Headache
      - Petechiae
      - Severe exhaustion
    - Treatment
      - Monitor VS, ECG
      - IV/IO access, fluid bolus
    - Suspected case of meningitis—protect yourself

Copyright © 2013 by Jones & Bartlett Learning, LLC, an Ascend Learning Company
Common Medical Emergencies

- **Poisoning**
  - Produces harmful physiological/psychological effects
  - Most common types
    - Household products
    - Medications
    - Toxic plants
    - Contaminated foods
  - Most common—school age & adolescence
    - Alcohol
    - Organic solvents
    - Mind-altering drugs/narcotics/ CNS depressants/CNS stimulants
  - Treatment
    - Depends on substance ingested

Pediatric Trauma

- **Unique characteristics of trauma**
  - Causes
    - Falls
    - Vehicular-related
    - Accidental injury
    - Sports-related injury
    - Assaults
  - Physical differences between children & adults
    - Smaller body size
    - Head larger in proportion to rest of body
    - Less body fat
    - Connective tissue more elastic
    - Organs much closer together
    - Skeleton softer
    - Larger surface area; lose heat faster

Pediatric Trauma

- **Assessment**
  - Base index of suspicion on MOI
  - Most common causes of death
    - Same as adult

- **Treatment**
  - If hypovolemic:
    - Fluid bolus
    - Do not waste time trying to start IV if shock or serious injury suspected
Pediatric Trauma

- Head trauma
  - Most common cause of death
  - Management
    - Airway & ventilatory support

- Spinal trauma
  - Causes
    - Acceleration/deceleration injuries
    - Inappropriately secured car safety seats
    - Unrestrained passenger
    - Lap belts
    - Shoulder strap injuries
    - Dirt bikes, ATVs
    - Bicycles
    - Skateboards
    - Swimming
    - Sports
  - Initial assessment
    - Note MOI & surrounding environment
    - Thorough, frequent
  - Treatment
    - Head in neutral, in-line position
    - Immobilize
  - Indications for pediatric immobilization
    - MOI
    - Injuries suggestive of violent interaction
    - Numbness, tingling
**Immobilizing Pediatric Patient**

- Apply properly sized rigid C-collar or towels
- Manually hold head; maintain in-line position of head/body

**Immobilizing Pediatric Patient**

- Logroll child onto rigid board
- Fasten torso to board

**Immobilizing Pediatric Patient**

- Securely fasten child's head to board
Child Safety Seats

- Manually stabilize child’s head & neck; use chest straps whenever possible
- Pad any open areas

- Secure safety seat
- Secure seat in place for transport

- If seat is not adequate for immobilization or child is unstable, place seat on its back. Unstrap child, slide onto long backboard
- Slide child along board, remove safety seat; immobilize child to board
Pediatric Trauma

- C-spine immobilization devices
  - Be sure device does not hyperextend neck
- Backboards
  - Pad all voids
  - Small child—use cravats instead of straps
- Vest devices
  - Not recommended for children

Pediatric Trauma

- Helmets
  - Removal is recommended to assess vital functions & immobilize
- Special considerations
  - Rule out life threats before full-body immobilization

Pediatric Trauma

- Chest & abdominal trauma
  - Rib cage resilient
  - Flail segments rare
  - Internal chest injuries may not present like adults
  - Tension pneumothorax—immediate life threat
  - Evaluate MOI; suspect injury even if child appears to be fine
  - Monitor cardiac rhythm
  - Assess for signs of blunt trauma to abdomen; palpate
    - Most commonly injured—liver, kidney, spleen
  - Crying child—probably hemodynamically stable
  - Quiet child—cause for concern
  - Treatment—same as adult
Pediatric Trauma

- Hypothermia
  - Large body surface area
  - Compensatory mechanisms not well developed
  - Assessment
    - Same as adult
  - Treatment
    - Same as adult
    - Cover head, especially young children
    - Continue resuscitation until temperature normal

Pediatric Trauma

- Drowning
  - Most occur in freshwater
    - Bathtubs
    - Buckets
    - Swimming pools
    - Lakes
    - Toilet
    - Fish tanks
  - Treatment
    - Same as adult
    - If hypothermic, rewarm; do not attempt intubation
    - Transport to pediatric trauma center if possible

Other Pediatric Problems

- Sudden infant death syndrome
  - Sudden, unexplained death of infant <1 y/o
  - High risk
    - Infants with ≥1 episodes requiring CPR or stimulation to breathe
    - Preterm infants with continued apnea
    - Siblings of ≥2 victims of SIDS
    - Infants with conditions affecting respiratory status
**Other Pediatric Problems**

- **Sudden infant death syndrome**
  - Assessment
    - Ask appropriate questions; do not interrogate parents
    - Try to determine what scene was like when baby found
  - Care
    - Follow local protocol
    - Do not be judgmental
    - Provide comfort & support to family
    - Consider critical incident stress management

- **Child abuse or maltreatment**
  - Recent act, or failure to act, that results in imminent risk of serious harm, death, serious physical or emotional harm, sexual abuse, or exploitation of a child
  - Neglect—failure to provide for child’s basic needs & adequate level of care
  - Major types:
    - Physical
    - Sexual
    - Emotional or psychological
    - Neglect

- **Child abuse or maltreatment (cont’d)**
  - Be nonjudgmental
  - Focus on patient care but be aware of surroundings
  - Document:
    - Where child found
    - Condition of home
    - Interactions with family
    - Condition of other children at same location
  - In some states, mandatory to report
  - Shaken baby syndrome
Special Considerations

- Pain management
  - Pain is personal
  - Be familiar with verbal & nonverbal expressions
  - Strategies for relieving pain without medication
    - Be honest with child
    - Express concern about pain
    - Prepare child for potentially painful procedure
    - Use “nonpain” descriptors
    - Encourage parents to stay with child
    - Have child “blow pain away,” say “ouch”
    - Hold infant/child in well-supported position

- Family involvement

- Transport guidelines
  - When determining destination, evaluate seriousness & transport to appropriate facility

Summary

- EMSC program was designed to enhance & expand EMS for acutely ill & injured children
- Try to speak to child as much as possible to explain what is happening
- Potential spinal injury: rule out life-threatening injuries before turning attention to full-body immobilization
Summary

- Pediatric illness or injury can be frightening to even most experienced EMS provider
- EMT-Is must be adequately trained to deal with pediatric emergencies

Questions?