Pediatric Emergencies and The General Approach to Infants and Children

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Notice

Topics

- Roles of the Paramedic in Pediatric Care
- Growth and Development
- Assessment
- Airway Adjuncts and Intravenous Access
- Medical Emergencies
- Traumatic Injuries

Introduction

- Ill or injured child represents special problems for emergency medical providers
- Few problems encountered pose same degree of anxiety and stress as the pediatric patient
- Major source of anxiety
  - Infrequent exposure to pediatric emergencies
  - Infrequent opportunity to practice and develop assessment and management skills

Special Considerations

- Emergency medical provider must be particularly observant in caring for pediatric patients
  - Margin for error is slight in managing
    - Airway
    - Respiratory and circulatory system
    - Medicating pediatric patient

Role of Paramedics in Pediatric Care

- **Pediatric injuries have become major concerns.**
- **Children are at higher risk of injury than adults.**
- **Children are more likely to be adversely affected by the injuries they receive.**

Morbidity and Mortality

- Reduction
  - Educational programs
    - Schools, community, parents
  - Prevention
    - Community involvement
    - Safety inspections
  - Documentation
    - Prehospital and trauma registries
    - Epidemiological research and surveillance

It is important to organize or participate in programs that educate children about injury prevention and health care.

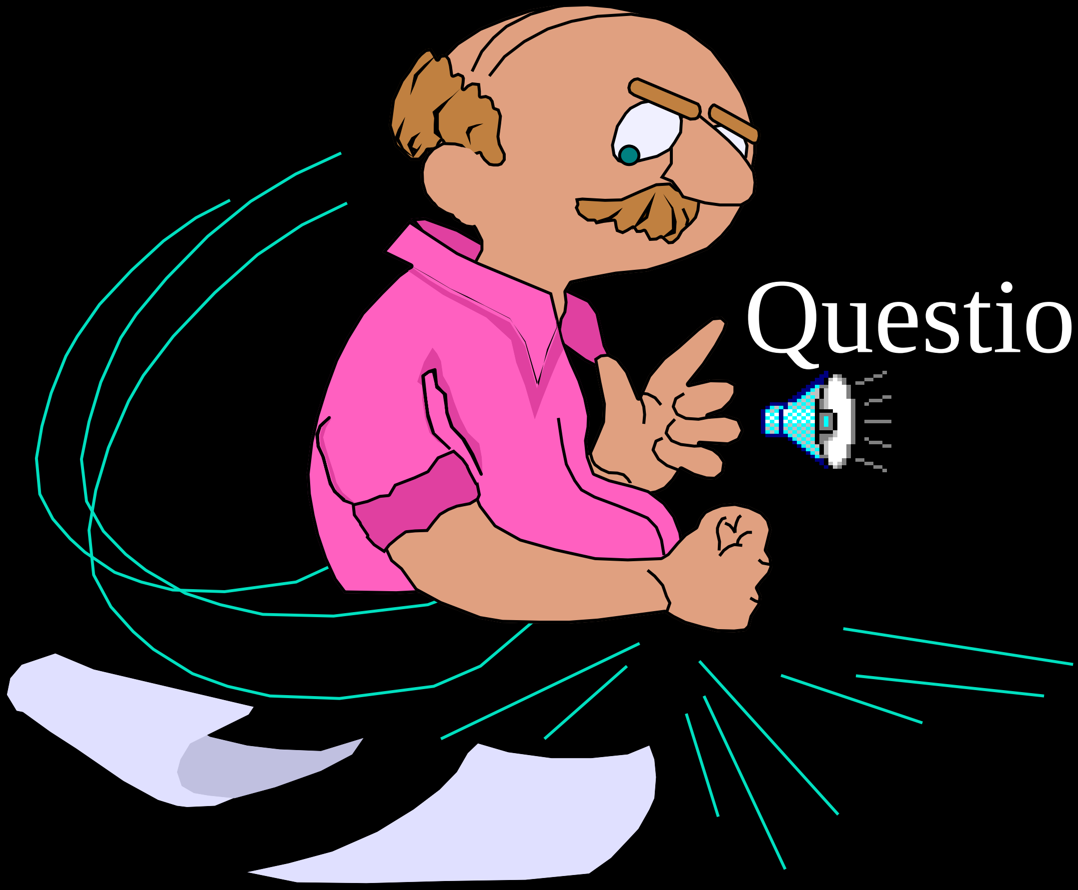
EMS For Children

Federally-funded program aimed at improving the health of pediatric patients who suffer from life-threatening illnesses and injuries

EMSC Areas of Concern

- System approach
- Education
- Data collection
- Quality improvement
- Injury prevention
- Access
- Prehospital care
- Emergency care
- Definitive care
- Rehabilitation
- Finance
- On-going health care from birth to young adulthood

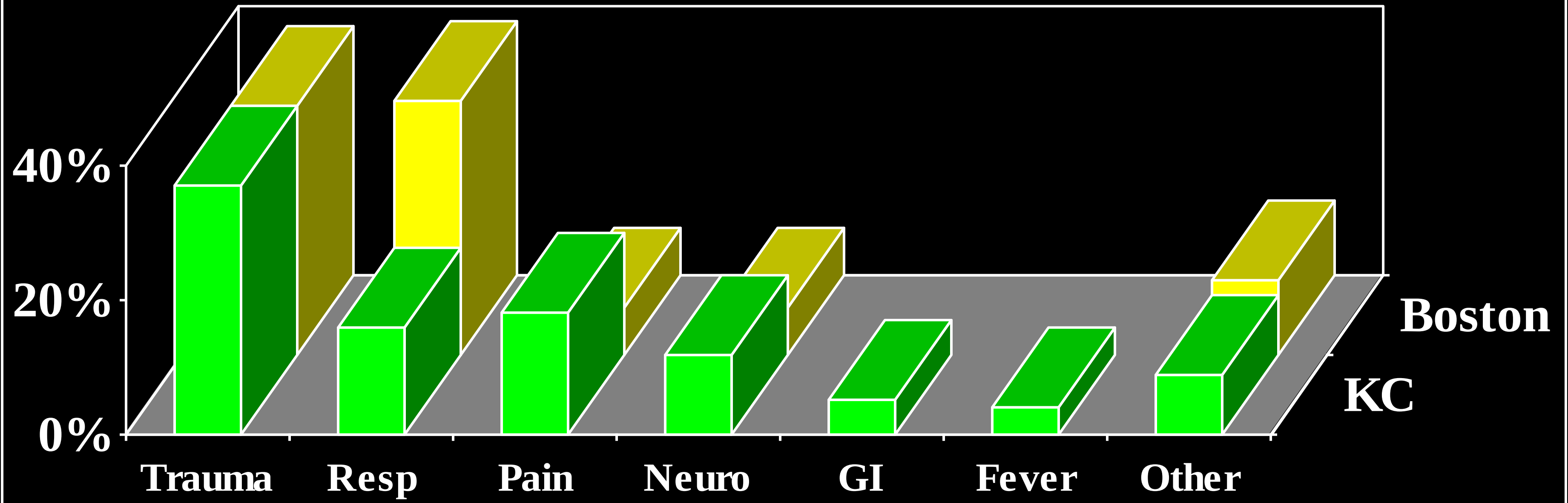
Questions



Question

- **What is the most common indication for EMS transport of children**
  - **Fever**
  - **GI (Vomiting/Abdominal Pain)**
  - **Respiratory**
  - **Neurologic (Seizure/Altered LOC)**
  - **Trauma**

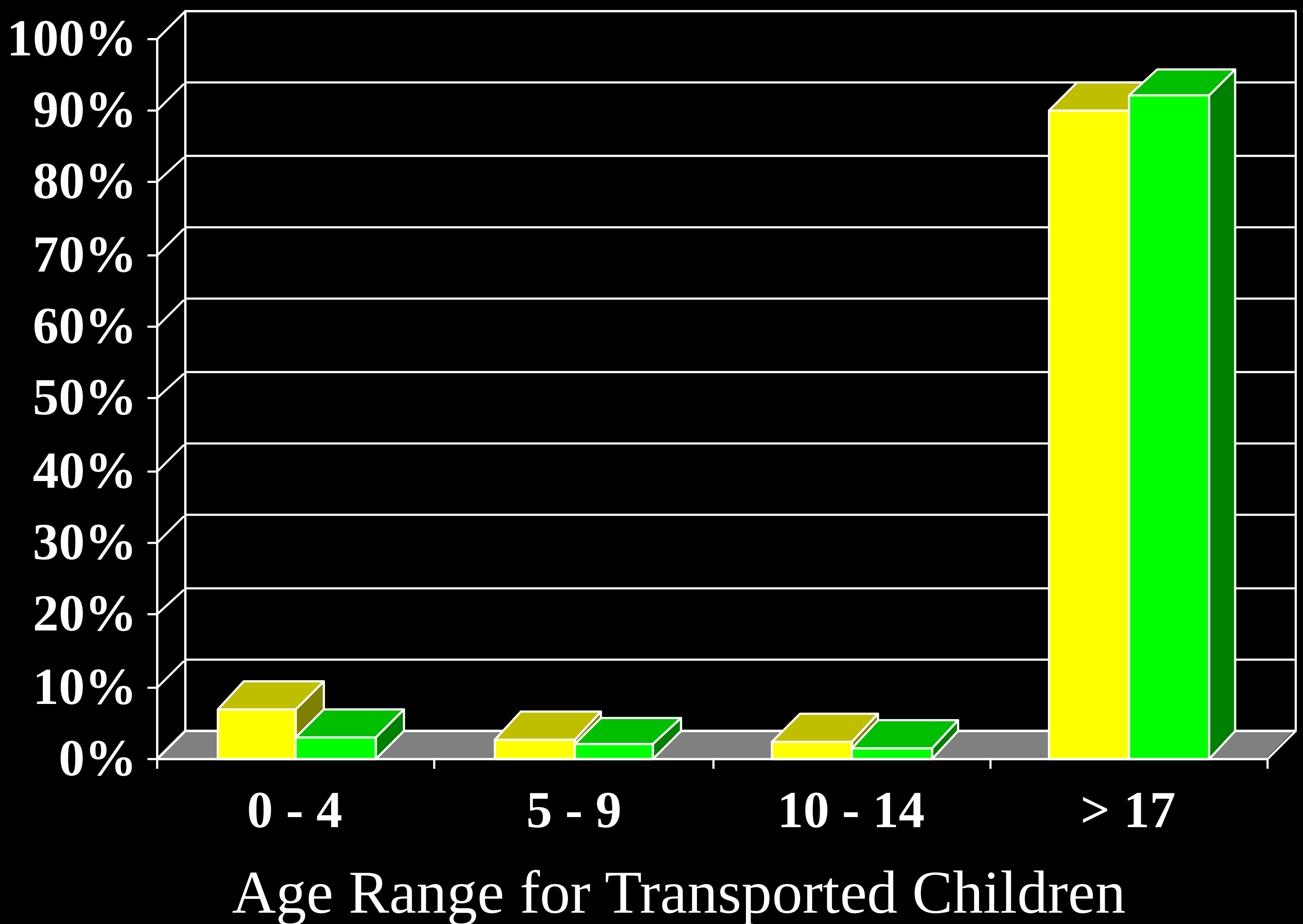
Who Is Transported



7300 Pediatric Transports, Kansas City
5280 Pediatric Transports, Boston

Murdock *Arch Pediatr Adolesc Med* 1999; 153: 281
Babl. Pediatric Emerg Care 2001; 17: 5.

Who Gets Transported



Murdock *Arch Pediatr Adolesc Med* 1999; 153: 281

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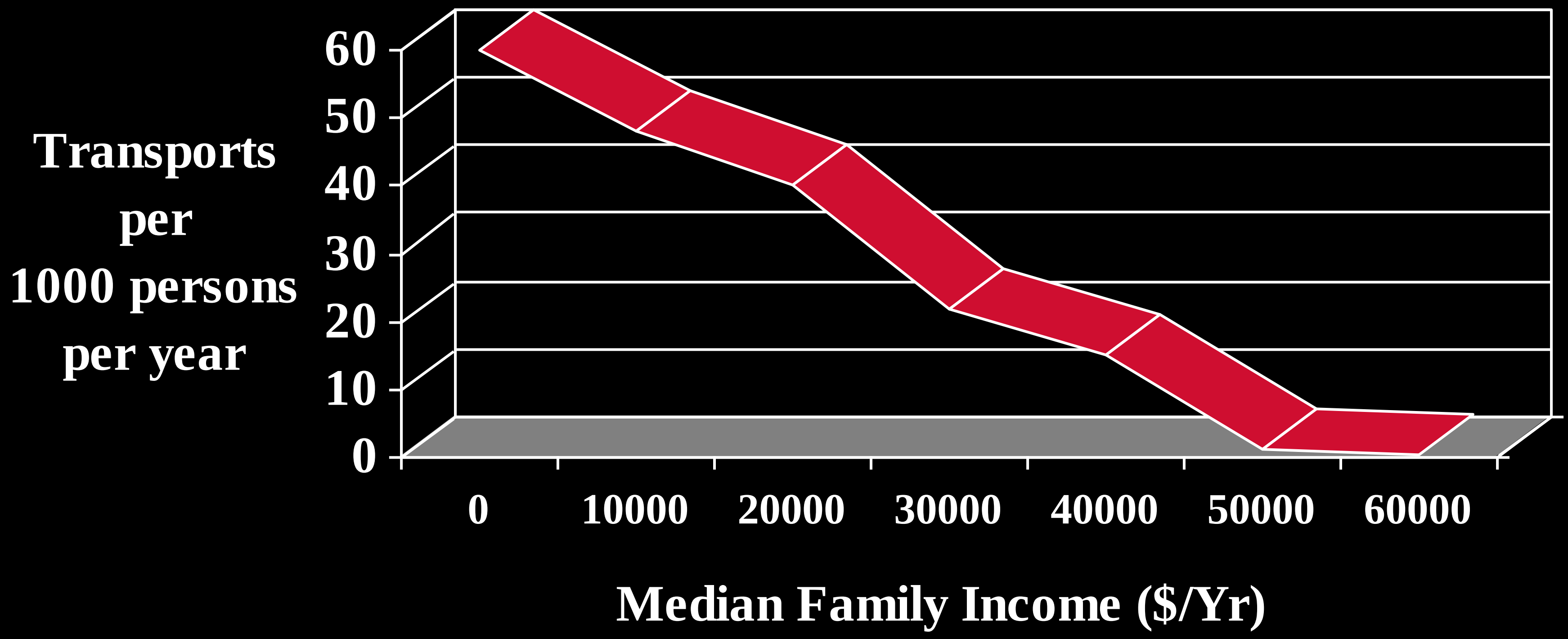
Who Gets Transported



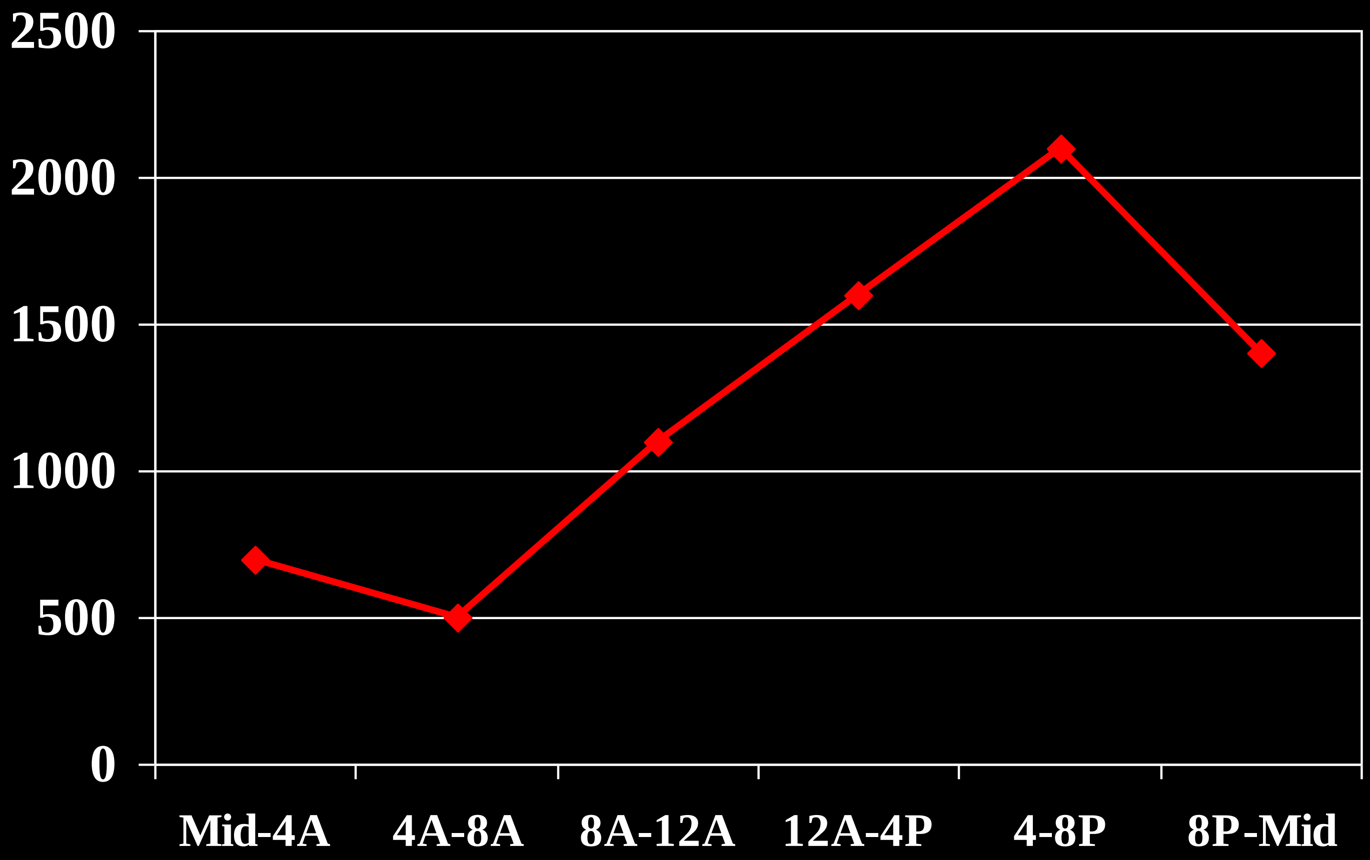
Rate of Transports vs. Median Family Income, Kansas City 1999

Murdock *Arch Pediatr Adolesc Med* 1999; 153: 281

Question

- **What is the most common time period for EMS transports?**
  - **Mid - 4A**
  - **4A - 8A**
  - **8A - Noon**
  - **Noon - 4 P**
  - **4P - 8 P**
  - **8P - Mid**

Time of Day

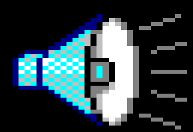


Timing of Pediatric EMS transports, Kansas City, Mo

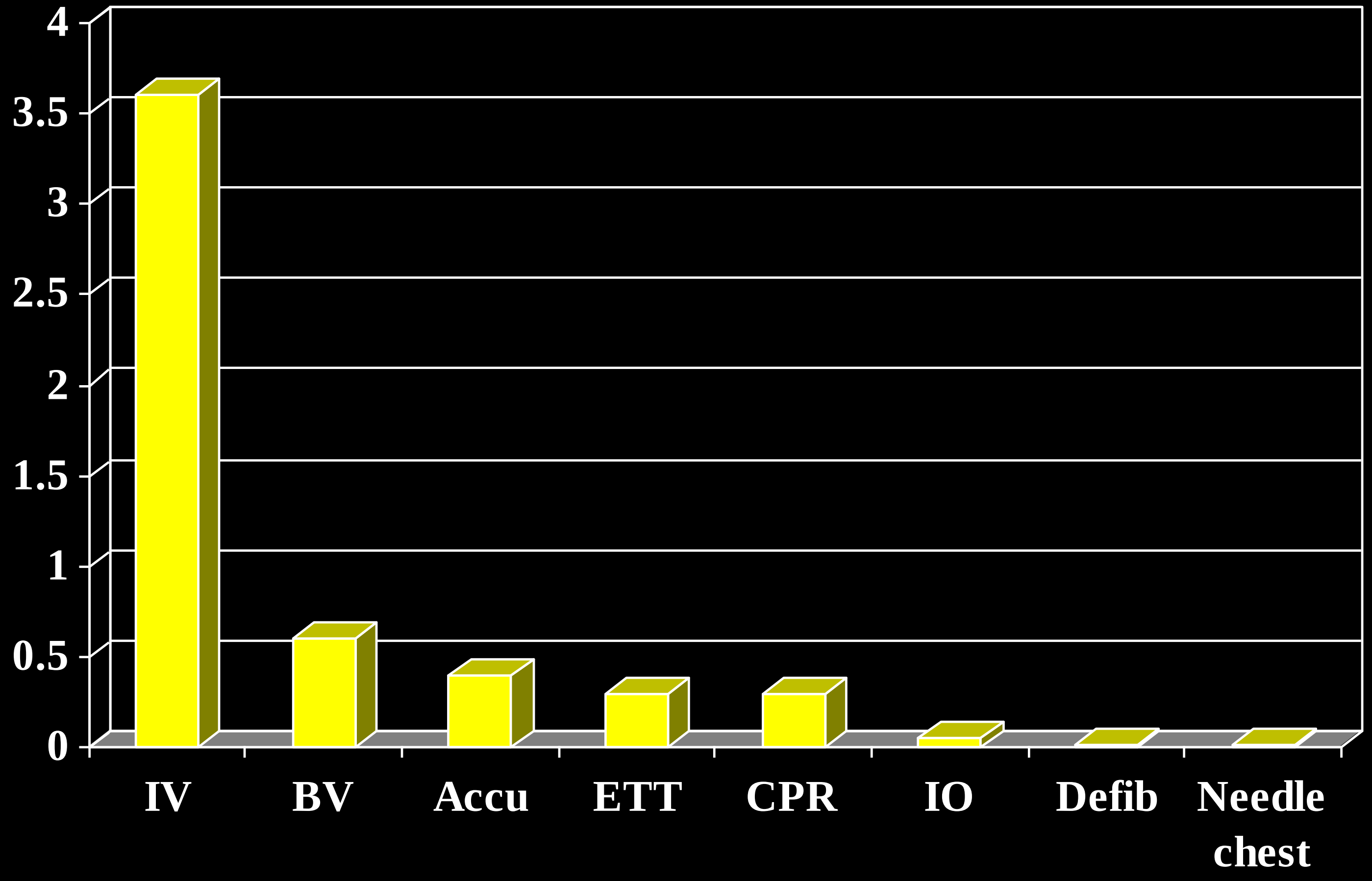
Murdock TC. *Arch Pedatr Adolesc Med* 1999; 153: 281.

Question

- Why are most pediatric runs at night?



Procedures/Paramedic/Year



Murdock TC. *Arch Pedatr Adolesc Med* 1999; 153: 281.

Definitions

- **Newborn**
  - **First few hours of life (perinatal period)**
- **Infant**
  - **Neonatal period (first 28 days of life) is included**
  - **First month after birth to approximately 12 months of age**

Definitions

- **Toddler**
  - **Child between 12 and 36 months of age**
- **Preschool**
  - **Child between three and five years of age**
- **School age**
  - **Child between 6 and 12 years of age**

Definitions

- Adolescent
  - Period between the end of childhood and adulthood (18 years)
    - Early (puberty)
    - Middle (middle school/high school age)
    - Late (high school/college age)
  - End of childhood is usually defined as the beginning of puberty
    - Highly child specific
    - Male child average 13 years/female 11 years

General Approach
to
Pediatric Emergencies

Communication and Psychological Support

Treatment begins with communication and psychological support.

Patients and families

Responding to Patient Needs

The child's most common reaction to an emergency is fear of:

- ✧Separation
- ✧Removal from a family environment
- ✧Being hurt
- ✧Being mutilated or disfigured
- ✧The unknown

Responding to the Parents

- Communication!
- One paramedic speaks with the adults.
- Introduce yourself and appear calm.
- Be honest and reassuring.
- Keep parents informed.

Growth and Development

Newborns

- First hours after birth
- Newborn, neonate
- Assessed with APGAR scoring system
  - Appearance
  - Pulse
  - Grimace
  - Activity
  - Respiratory rate

Neonates

- Birth to one month.
- Tend to lose 10% of birth weight, but regain in 10 days.
- Development centers on reflexes.
- Personality begins to form.
- Mother, occasionally father, can comfort child.

Paramedic Implications

- Keep patient warm and dry
- Handle gently, supporting head and neck
- Speak quietly
- Involve caregivers in treatment whenever possible
- Persistent crying, irritability, or inability to console or arouse patient may indicate physiologic distress
- Foreign body airway obstruction risk begins at approximately 6 months and increases

Neonates

- Common illnesses include jaundice, vomiting, and respiratory distress.
- Bacteremia (slam dunk admit)
- Do not develop fever with minor illness.
- Allow patient to remain in caregiver’s lap.

Infants

- Ages 1 to 12 months.
- May stand or walk without assistance.
- Follow movements.
- Muscle development
  - develops in cephalocaudal progression.
- Allow patient to remain in caregiver's lap.

Infants and young children should be allowed to remain in their mothers' arms.

Toddlers

- Ages 1 to 3 years.
- Great strides in motor development.
- May stray from parents frequently.
- Parents are the only ones who can comfort
- Language development begins.
- Approach child slowly.

Toddlers

- Examine from toe-to-head.
- Avoid asking “yes” or “no” questions.
- Allow child to hold a favorite blanket or item.
- Tell child if something will hurt.

Preschoolers

- Ages 3 to 5 years.
- Increase in fine and gross motor skills.
- Children know how to talk.
- Fear mutilation.
- Seek comfort and support from within home.
- Distorted sense of time.

Preschoolers

- Keep patient warm
- Handle gently
- Speak quietly in clear and unambiguous language, avoid baby talk
- Offer patient treatment choices if possible
- Respect patient modesty
- Avoid frightening or misleading comments

Emotional support of the infant or child continues during transport

Common Preschooler Illnesses

- Croup
- Asthma
- Poisoning
- Auto accidents
- Burns
- Child abuse
- Ingestion of foreign bodies
- Drowning
- Epiglottitis
- Febrile seizures
- Meningitis

School-Age Children

- Ages 6–12 years.
- Active and carefree age group.
- Growth spurts are common.
- Give this age group responsibility of providing history.
- Respect modesty.

School-Age Children

- Speak in clear and unambiguous terms
- Be honest about procedures inducing pain
- Involve patient in treatment whenever possible
- Reassure patient of body integrity
- Address preoccupations about death when appropriate

A small toy may calm a child in the 6–10 year age range

Common Illness and Injuries in School-Age Children

- Drowning
- Auto accidents
- Bicycle accidents
- Falls
- Fractures
- Sports injuries
- Child abuse
- Burns

Adolescents

- Ages 13 to 18.
- Begins with puberty, which is very child-specific; are very “body conscious.”
- May consider themselves “grownup.”
- Desire to be liked and included by peers.
- Are generally good historians.
- Relationships with parents may be strained.

Adolescents

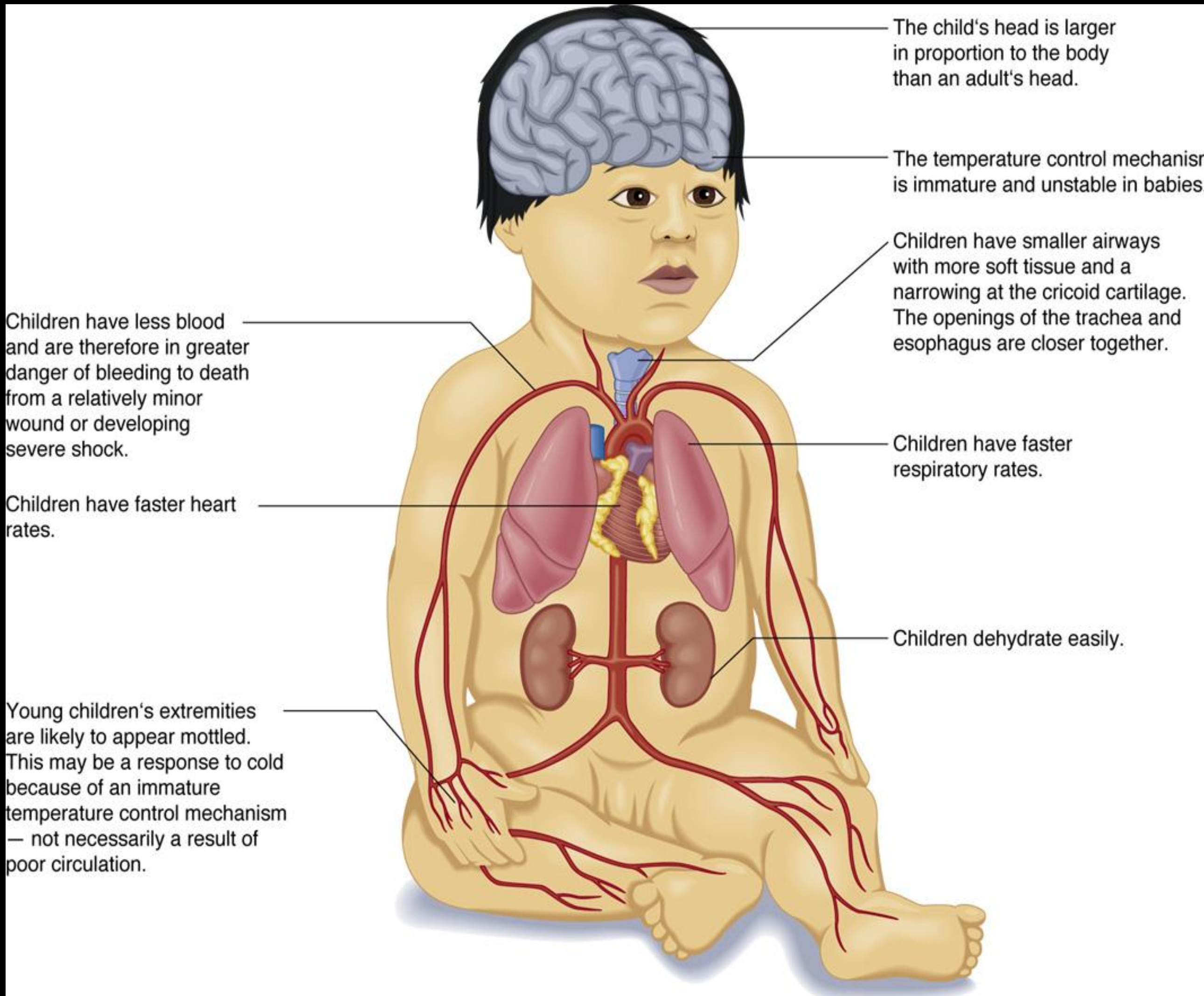
- Explain things clearly and honestly
- Involve patient in treatment whenever possible
- Respect patient modesty
- Address patient concerns of body integrity/disfigurement
- Deal with patient tactfully and fairly
- Vital signs approach adult values
- Consider possibility of substance abuse, endangerment of self or others

Common Adolescent Illness/Injuries

- Mononucleosis
- Asthma
- Auto accidents
- Sports injuries
- Drug and alcohol problems
- Suicidal gestures
- Sexual abuse

Anatomical and Physiological Differences

Anatomical and Physiological Considerations in the Infant and Child



Head

- Proportionally larger size
- Larger occipital region
- Fontanelles open in infancy
  - Close at 14 – 18 months of age
- Face is small in comparison to size of head
  - Flat nasal bridge

Head Positioning

- A. In the supine position, an infant's or child's larger head tips forward, causing airway obstruction.

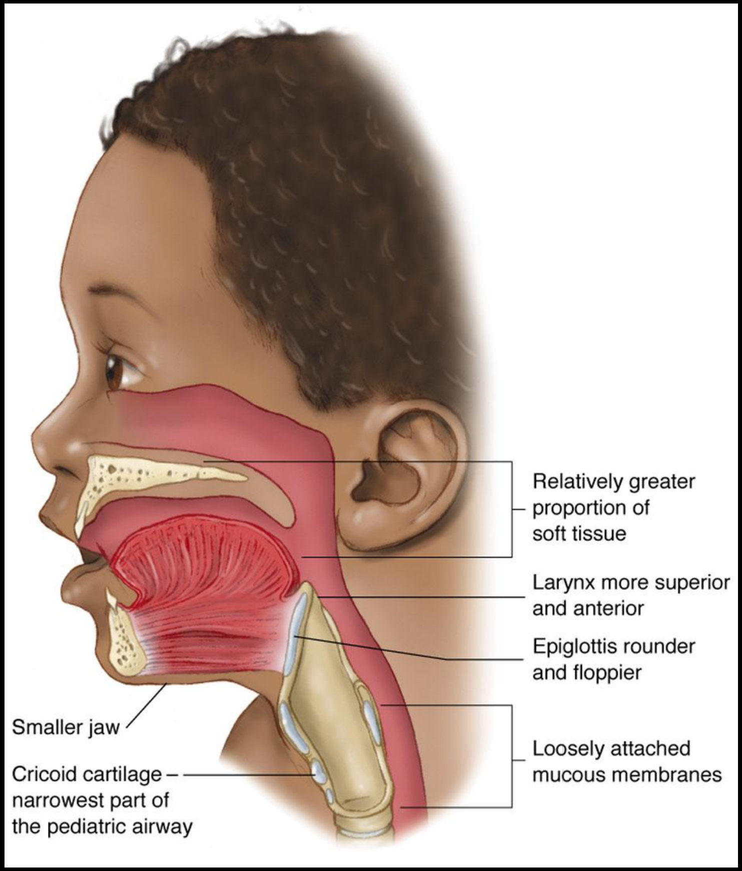
- B. Placing padding under the patient's back and shoulders will bring the airway to a neutral or slightly extended position.

Paramedic Implications

- Higher proportion of blunt trauma involves head
- Different airway positioning techniques
- Place thin layer of padding under back of seriously injured child < 3 years of age to obtain neutral position
- Place folded sheet under occiput of medically ill child > 3 years of age to obtain sniffing position
- Examine fontanels in infants
  - Bulging suggests ICP
  - Sunken suggests dehydration

Airway

- Narrow at all levels
- Infants are obligate nasal breathers
- Jaw is proportionally smaller in young children
- Larynx is higher (C3-4) and more anterior
  - Adult C5-6
- Cricoid ring is narrowest part of airway in young children
- Tracheal cartilage softer
- Trachea smaller in both length and diameter



Airway

- Epiglottis
  - Omega shaped in infants
  - Extends at a 45 degree angle into airway
  - Epiglottic folds have softer cartilage, therefore are more floppy, especially in infants

Paramedic Implications

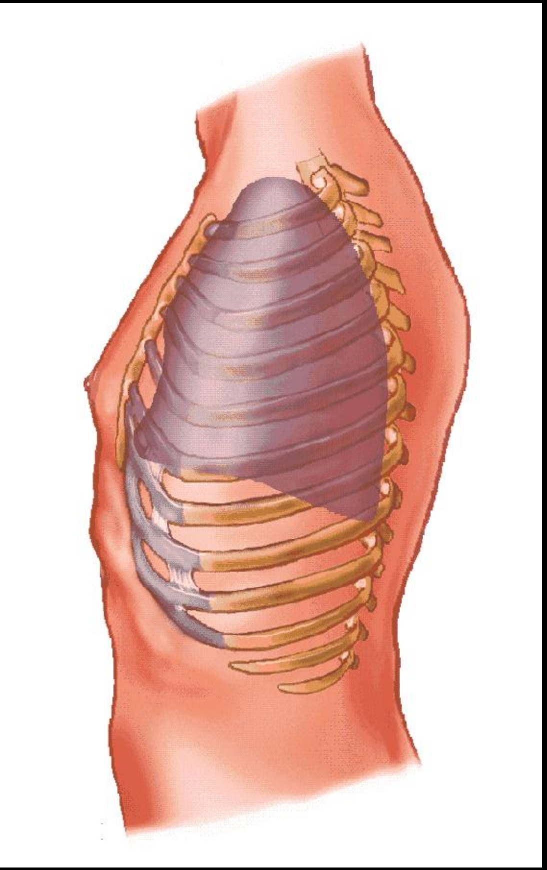
- **Keep nares clear in infants < 6 months of age**
- **Narrow upper airways are more easily obstructed**
  - **Flexion or hyperextension**
  - **Particulate matter**
  - **Soft tissue swelling (injury, inflammation)**

Paramedic Implications

- **Difference in intubation technique**
  - **Gentler touch**
  - **Straight blade**
  - **Lift epiglottis**
  - **Uncuffed tube**
    - **Children < 8**
  - **Precise placement**

Chest and Lungs

- Ribs are positioned horizontally
- Ribs are more pliable and offer less protection to organs
- Chest muscles immature and fatigue easily
- Lung tissue is more fragile
- Mediastinum is more mobile
- Thin chest wall allows for easily transmitted breath and heart sounds

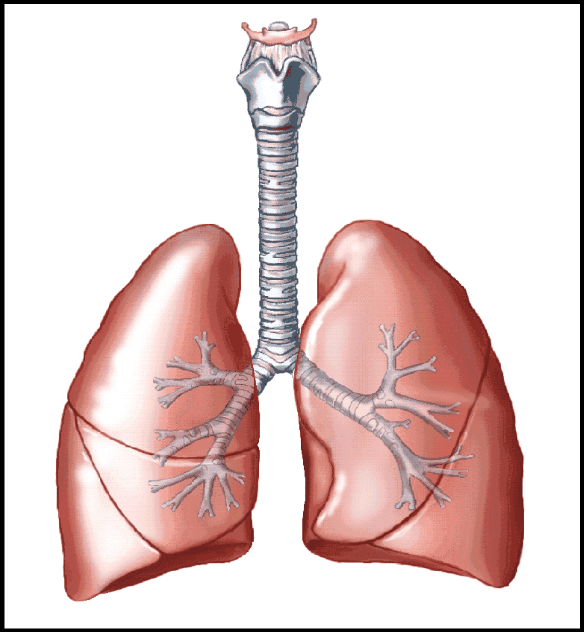


Paramedic Implications

- Infants and children are diaphragmatic breathers
- Infants and children are prone to gastric distention
- Rib fractures are less frequent, but not uncommon in child abuse and trauma
- Greater energy transmitted to underlying organs following trauma
  - Significant internal injury can be present without external signs

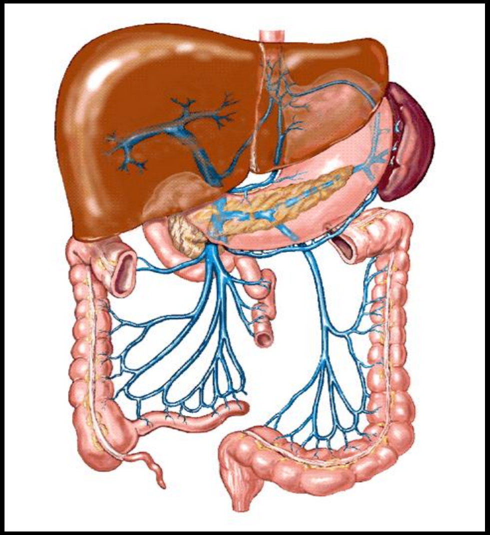
Paramedic Implications

- Pulmonary contusions are more common in major trauma
- Lungs prone to pneumothorax following barotrauma
- Mediastinum has greater shift with tension pneumothorax
- Easy to miss a pneumothorax or misplaced intubation due to transmitted breath sounds



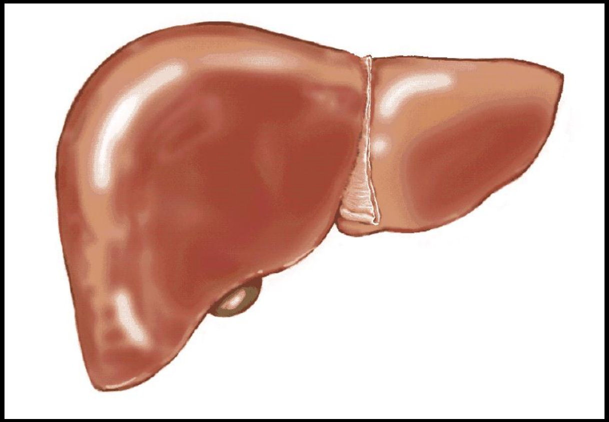
Abdomen

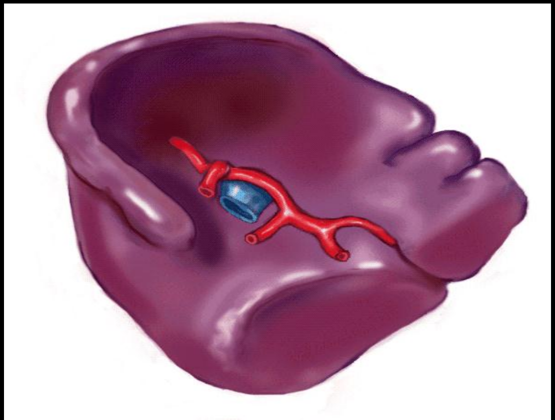
- Immature abdominal muscles offer less protection
- Abdominal organs are closer together
- Liver and spleen proportionally larger and more vascular



Paramedic Implications

- Liver and spleen more frequently injured
- Multiple organ injuries more common





Extremities

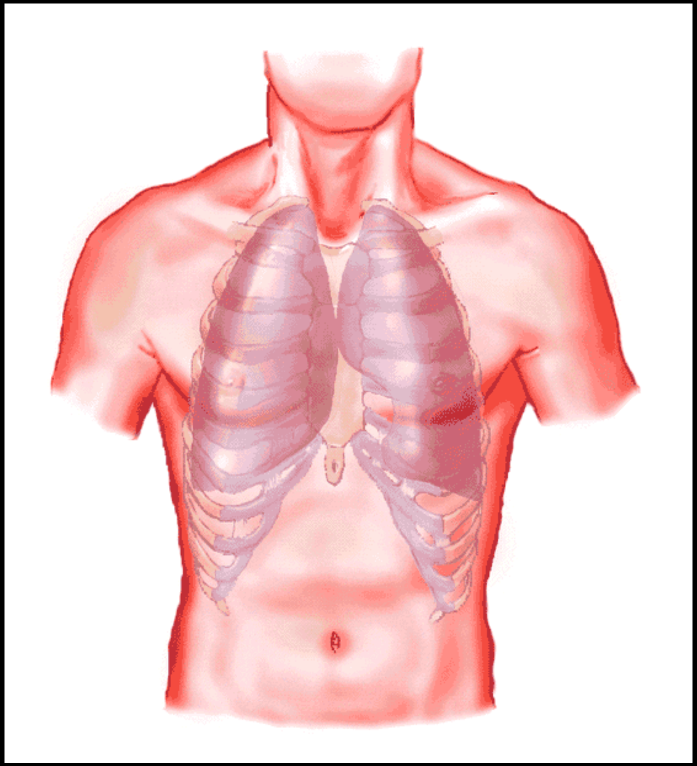
- Bones are softer and more porous until adolescence
- Injuries to growth plate may disrupt bone growth
- Paramedic implications
  - Immobolize any “sprain” or “strain” as it is likely a fracture
  - Avoid piercing growth plate during intraosseous needle insertion

Skin and Body Surface Area

- Thinner and more elastic
- Thermal exposure results in deeper burn
- Less subcutaneous fat
- Larger surface area to body mass
- Paramedic implications
  - More easily and deeply burned
  - Larger losses of fluid and heat

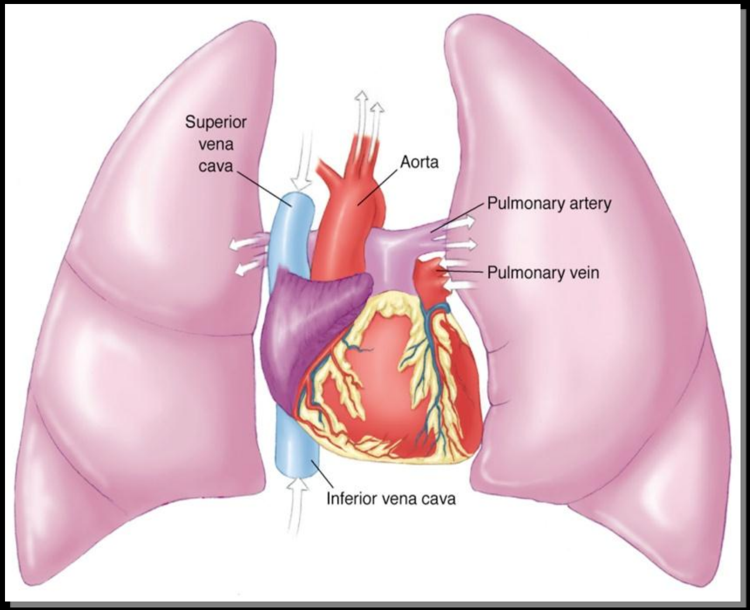
Respiratory System

- Tidal volume proportionally similar to that of adolescents and adult
- Metabolic oxygen requirements of infants and children are approximately double those of adolescents and adults
- Proportionally smaller functional residual capacity therefore proportionally smaller oxygen reserves
- Paramedic implications
  - Hypoxia develops rapidly because of increased oxygen requirements and decreased oxygen reserves



Cardiovascular System

- Cardiac output is rate dependent in infants and small children
- Vigorous but limited cardiovascular reserves
- Bradycardia is a response to hypoxia
- Can maintain blood pressure longer than an adult
- Circulating blood volume is proportionally larger than in an adult
- Absolute blood volume is smaller than in an adult

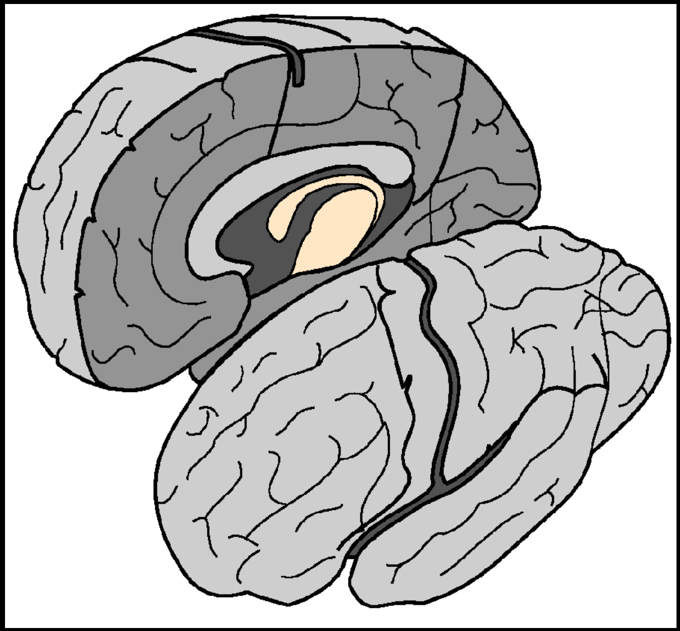


Paramedic Implications

- Smaller absolute volume of fluid/blood loss needed to cause shock
- Larger proportional volume of fluid/blood loss needed to cause shock
  - Hypotension is late sign of shock
  - Child may be in shock despite normal BP
  - Shock assessment is based upon clinical signs of tissue perfusion
  - Carefully assess for shock if tachycardia present
  - Monitor closely for development of hypotension

Nervous System

- Develops throughout childhood
- Developing neural tissue is more fragile
- Brain and spinal cord are less well protected by skull and spinal column



Paramedic Implications

- Brain injuries are more devastating in young children
- Greater force transmitted to underlying brain of young children
- Spinal cord injury can occur without spinal column injury

Metabolic Differences

- Infants and children have a limited glycogen and glucose stores
- Significant volume loss can result from vomiting and diarrhea
- Prone to hypothermia due to increased body surface area
- Newborns and neonates are unable to shiver to maintain body temperature

Paramedic Implications

- Keep child warm during treatment and transport
- Cover head to minimize heat loss

Summary of Anatomical and Physiological Characteristics of Infants and Children

Table 2-1 Anatomical and Physiological Characteristics of Infants and Children

Differences in Infants and Children as Compared to Adults	Potential Effects That May Impact Assessment and Care
Tongue proportionately larger	More likely to block airway
Smaller airway structures	More easily blocked
Abundant secretions	Can block the airway
Deciduous (baby) teeth	Easily dislodged; can block the airway
Flat nose and face	Difficult to obtain good face mask seal
Head heavier relative to body and less-developed neck structures and muscles	Head may be propelled more forcefully than body producing a higher incidence of head injury in trauma
Fontanelle and open sutures (soft spots) palpable on top of young infant's head	Bulging fontanelle can be a sign of increased intracranial pressure (but may be normal if infant is crying); shrunken fontanelle may indicate dehydration
Thinner, softer brain tissue	Susceptible to serious brain injury
Head larger in proportion to body	Tips forward when supine; possible flexion of neck, which makes neutral alignment of airway difficult
Shorter, narrower, more elastic (flexible) trachea	Can close off trachea with hyperextension of neck
Short neck	Difficult to stabilize or immobilize
Abdominal breathers	Difficult to evaluate breathing
Faster respiratory rate	Muscles easily fatigue, causing respiratory distress
Newborns breathe primarily through the nose (obligate nose breathers)	May not automatically open mouth to breathe if nose is blocked; airway more easily blocked
Larger body surface relative to body mass	Prone to hypothermia
Softer bones	More flexible, less easily fractured; traumatic forces may be transmitted to internal organs, causing injuring without fracturing the ribs; lungs easily damaged with trauma
Spleen and liver more exposed	Organ injury likely with significant force to abdomen

General Approach
to
Pediatric Assessment

Basic Considerations

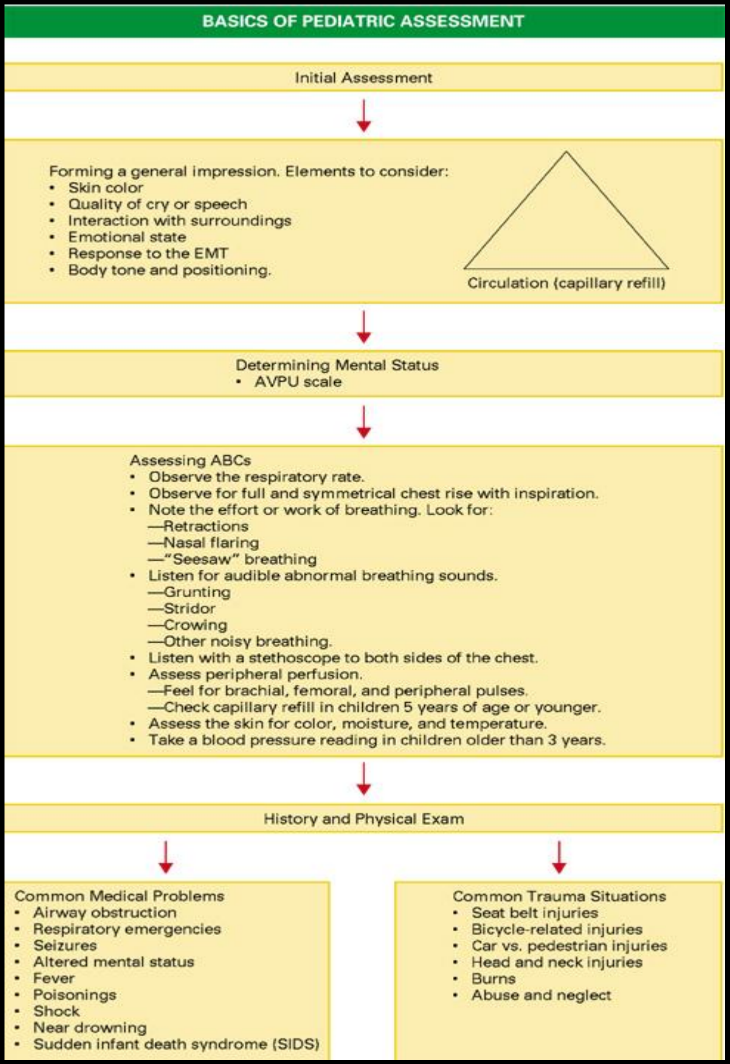
- Much of the initial patient assessment can be done during visual examination of the scene.
- Involve the caregiver or parent as much as possible.
- Allow parent to stay with child during treatment and transport.

Scene Survey

- Observe parent/guardian/caregiver interaction with the child
  - Do they act appropriately
  - Is parent/guardian/caregiver concerned
  - Is parent/guardian/caregiver angry
  - Is parent/guardian/caregiver indifferent

Initial Assessment

- **General impression of the patient/**Pediatric Assessment Triangle
  - **Structure and/or technique for assessing the pediatric patient**
  - **Focus on most valuable information for pediatric patients**
  - **Used to ascertain if any life-threatening condition exists**



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Assessment

- **Appearance**
  - Mental status
  - Milestones
- **Circulation**
  - Vitals - BP/HR//0_2 saturation
  - Capillary refill
  - Mental status
- **Work of Breathing**
  - Effort and rates
  - Upper vs. Lower Airway disease
- **Disease specific exam**
  - temperature, heart, lungs, neurologic

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PAT

Mental Status

Question

- **What is the typical age at which infants develop a social smile?**
  - **4-5 weeks**
  - **7-8 weeks**
  - **10-12 weeks**
  - **14-15 weeks**
  - **17-18 weeks**

Mental Status

- Milestones
  - Social Smile 7-8 weeks
    - < 1% chance meningitis is fever
    - < 5% chance serious bacterial infection
  - Sitting up 7-8 months
  - Walk with hand hold 1 year
  - 3 word sentences 2 year
- Interactions
  - Eyes follow object 1 month
  - Grabs/Hold object 6-9 months
    - (foreign body aspiration)
  - Playing/Waving/Smiling at any age
- AVPU/GCS for children

Glasgow Coma Scale Modifications for Infants

Table 2-4 GLASGOW COMA SCALE MODIFICATIONS FOR INFANTS

Category	Response	Score
Verbal	Happy, coos, babbles, or cries spontaneously	5
	Irritable crying, but consolable	4
	Cries to pain, weak cry	3
	Moans to pain	2
	None	1
Motor	Spontaneous movement	6
	Withdraws to touch	5
	Withdraws to pain	4
	Abnormal flexion	3
	Abnormal extension	2
	None	1
Eye Opening (same as adult)	Spontaneous	4
	To speech	3
	To pain	2
	None	1

Source: *Adapted from James, H.E., (1986): "Neurological evaluation and support in the child with acute brain insult,"* Pediatric Annals, 15(1): 17.

Level of Consciousness

- **Glasgow Coma Score**
  - **Mild GCS 13–15**
  - **Moderate GCS 9–12**
  - **Severe GCS less than or equal to 8**

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Appearance

Work of Breathing

Circulation to Skin

Normal Vital Signs
Infants and Children

Table 2-2 Normal Vital Signs: Infants and Children*

Normal Pulse Rates (Beats per Minute, at Rest)		
Newborn	100 to 180	
Infant 0–5 Months	100 to 160	
Infant 6–12 Months	100 to 160	
Toddler 1–3 Years	80 to 110	
Preschooler 3–5 Years	70 to 110	
School Age 6–10 Years	65 to 110	
Early Adolescence 11–14 Years	60 to 90	
Normal Respiration Rates (Breaths per Minute, at Rest)		
Newborn	30 to 60	
Infant 0–5 Months	30 to 60	
Infant 6–12 Months	30 to 60	
Toddler 1–3 Years	24 to 40	
Preschooler	22 to 34	
School Age 6–10 Years	18 to 30	
Early Adolescence 11–14 Years	12 to 26	
Normal Blood Pressure Ranges (mmHg, at Rest)		
	Systolic	Diastolic
	Approx. 90 plus 2 × age	Approx. 2/3 systolic
Preschooler 3–5 Years	average 98 (78 to 116)	average 65
School age 6–10 Years	average 105 (80 to 122)	average 69
Early Adolescence 11–14 Years	average 114 (88 to 140)	average 76

*Adolescents ages 15 to 18 approach the vital signs of adults.

Note: A high pulse in an infant or child is not as great a concern as a low pulse. A low pulse may indicate imminent cardiac arrest. Blood pressure is usually not taken in a child under 3 years of age. In cases of blood loss or shock, a child's blood pressure will remain within normal limits until near the end, then fall swiftly.

Circulation

- How do we detect circulation problems?
  - Blood pressure - what's normal?
    - Broeslow
    - 80 + age X 2 (70 + age X 2 hypotensive)
    - DOT states BP not necessary < 3 years.
  - Pulses
    - quality
    - central vs. peripheral
    - heart rate
  - Capillary refill
  - Mental status

Questions?

- **Can an infant have a "normal BP" and be in shock?**

- **Can an infant have an "abnormal BP" and NOT be in shock?**

Question

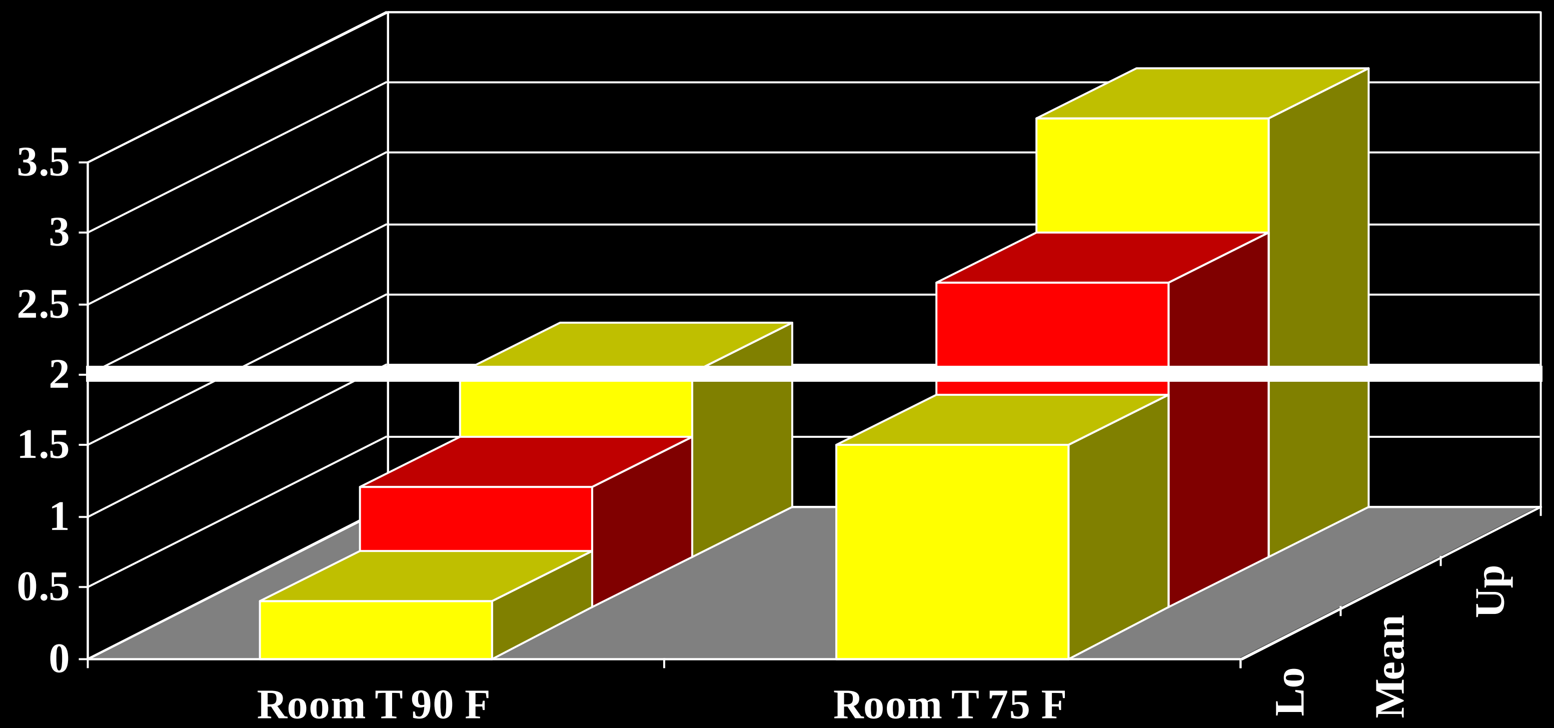
- What is the standard site for performing Capillary Refill Time?
- How long should you press tissue?

Capillary Refill (> 2 seconds)

- Performance
  - palmar surface distal fingertip
  - hand at level of heart
  - apply pressure X 2 seconds (up to 5 seconds)
  - time = time to return to normal/baseline color
- $\geq$ 5% dehydration
  - 50% Sensitive
  - 80% NPV
    - (if negative test, still 20% chance dehydrated)

Gorelick. *Pediatr Emerg Care* 1997; 13: 305.

Capillary Refill



Capillary Refill in Well Children Waiting for 15 minutes in Air conditioned (75) and Non-Air Conditioned (90)

Gorelick. *Pediatrics* 1993; 92: 699.

Capillary Refill Time (CRT)

- Other Problems
  - Average Newborn CRT = 4.4 seconds
  - Male CRT > Female children
  - Ambient lighting
- American Heart Association/International Liason Committee on Resuscitation
  - reviewed 80 Cap refill articles
  - a lot can make CRT abnormal
  - if NORMAL - good (not perfect sign) = healthy

Atkins *Ann Emerg Med* 2001; 37: S41.

Circulation

- Nothing is perfect - so what do we do?
  - USE ALL TOOLS TOGETHER
  - Mental status most important
  - BP plus HR, pulse differential, RR effort
  - Capillary refill time
    - be aware of limitations of all of above

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Appearance

Work of Breathing

Circulation to Skin

Respiratory Effort & Rate

Upper vs. Lower Disease?

Question

- A 17 month old female has had vomiting and fever for 2 days
  - She is awake, and alert, and smiling
  - Her RR is <u>44</u>

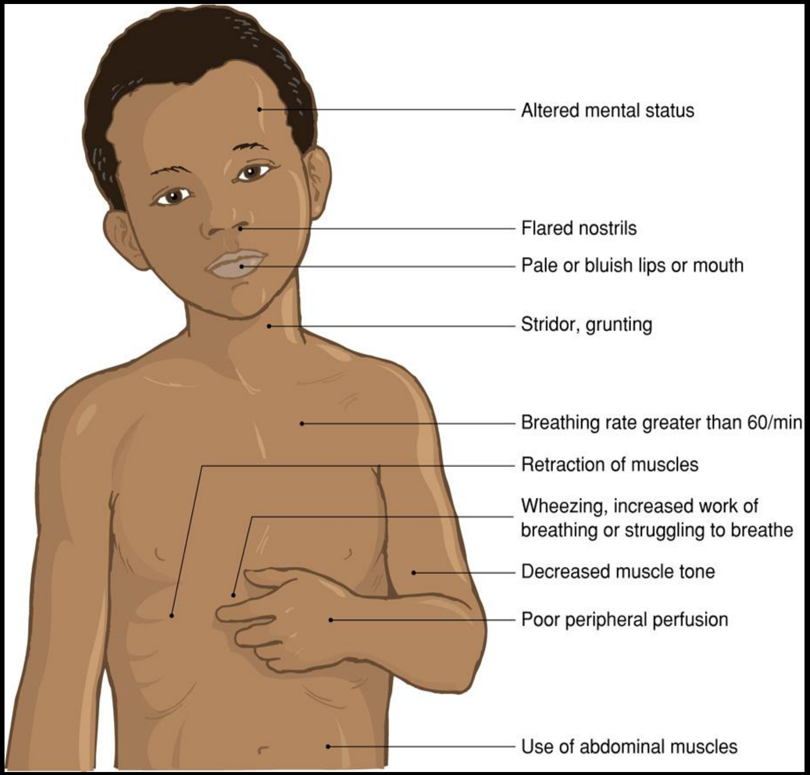
- Is this normal or is she tachypneic?

Respiratory Rate

- **What is Normal?**
  - **Broeslow tape**
  - ***Different* textbook - *different* numbers**
  - **World Health Organization**
    - **neonate** $\geq$ **60**
    - **1 month - 1 year** $\geq$ **50**
    - **1 - 5 years** $\geq$ **40**
  - **Altered by**
    - **Temperature $\geq$ 39C (102.4)**
      - **< 6 months** $\geq$ **59**
      - **6-12 months** $\geq$ **52**
      - **1-2 years** $\geq$ **49**
    - **Pain / Fear / Hydration**

Respiratory Rate

- Effort may be more important
- Working hard
  - Grunting
  - Nasal flaring
  - Rib (intercostal) retractions
  - Subcostal retractions
  - Tracheal tugging
  - Sternocleidomastoid use
- Slow is bad
  - PRETERMINAL



Signs of Increased Respiratory Effort

Table 2-3 Signs of Increased Respiratory Effort

Retraction	Visible sinking of the skin and soft tissues of the chest around and below the ribs and above the collarbone
Nasal flaring	Widening of the nostrils; seen primarily on inspiration
Head bobbing	Observed when the head lifts and tilts back as the child inhales and then moves forward as the child exhales
Grunting	Sound heard when an infant attempts to keep the alveoli open by building back pressure during expiration
Wheezing	Passage of air over mucous secretions in bronchi; heard more commonly upon expiration; a low- or high-pitched sound
Gurgling	Coarse, abnormal bubbling sound heard in the airway during inspiration or expiration; may indicate an open chest wound
Stridor	Abnormal, musical, high-pitched sound, more commonly heard on inspiration

Respiratory Effort

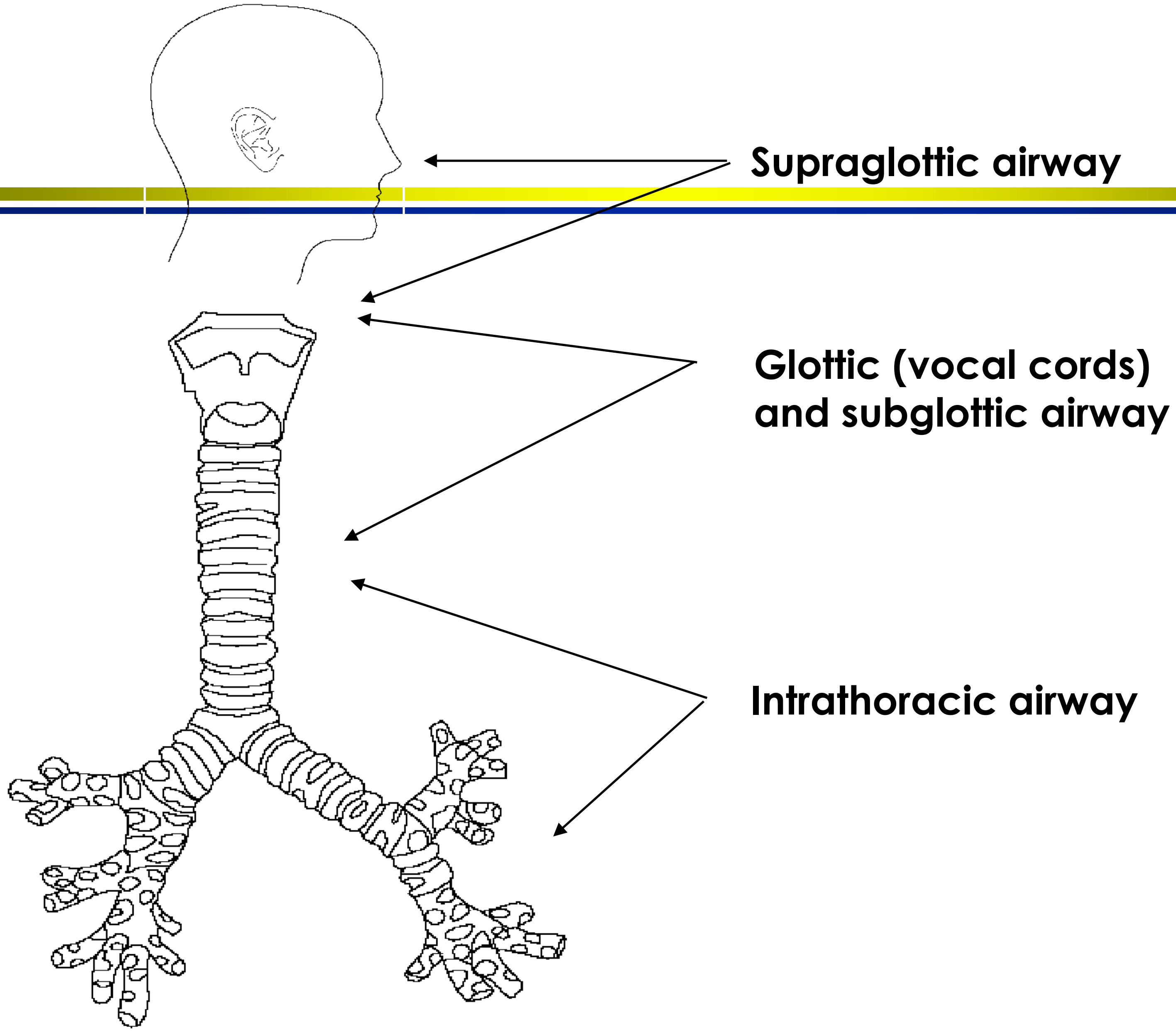
- A 2 year old presents with loud noisy breathing. You are undecided if the breathing signifies stridor (upper airway) or wheezing (lower airway). Which of the following features helps to distinguish?
  - A stridor is only inspiratory
  - B wheezing is only expiratory
  - C wheezing is either expiratory alone or combined expiratory/inspiratory (*if its inspiratory there also has to be an expiratory component*)_
  - D none of the above

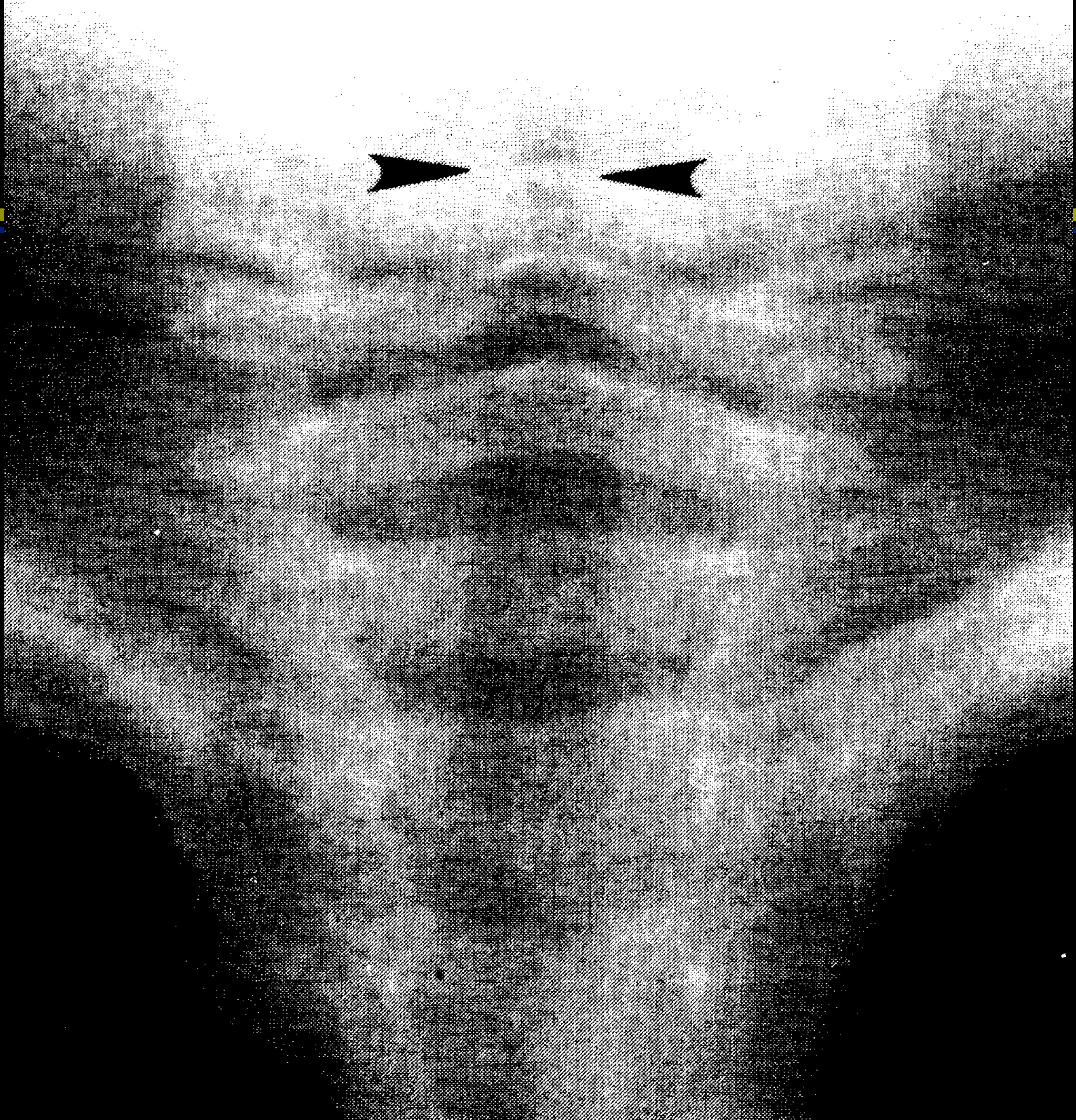
Upper vs. Lower Airway

- **Hoarseness Comes From Inflammation of which site?**
  - **Vocal cords (glottis)**
  - **Subglottic Larynx (below vocal cords)**
  - **Trachea**
  - **Supraglottic**
  - **Epiglottis**
  - **Pharynx**

Question

- A Barking cough comes from inflammation of which site
  - Vocal cords (glottis)
  - Subglottic Larynx (below vocal cords)
  - Trachea
  - Supraglottic
  - Epiglottis
  - Pharynx


Supraglottic airway
Glottic (vocal cords)
and subglottic airway
Intrathoracic airway



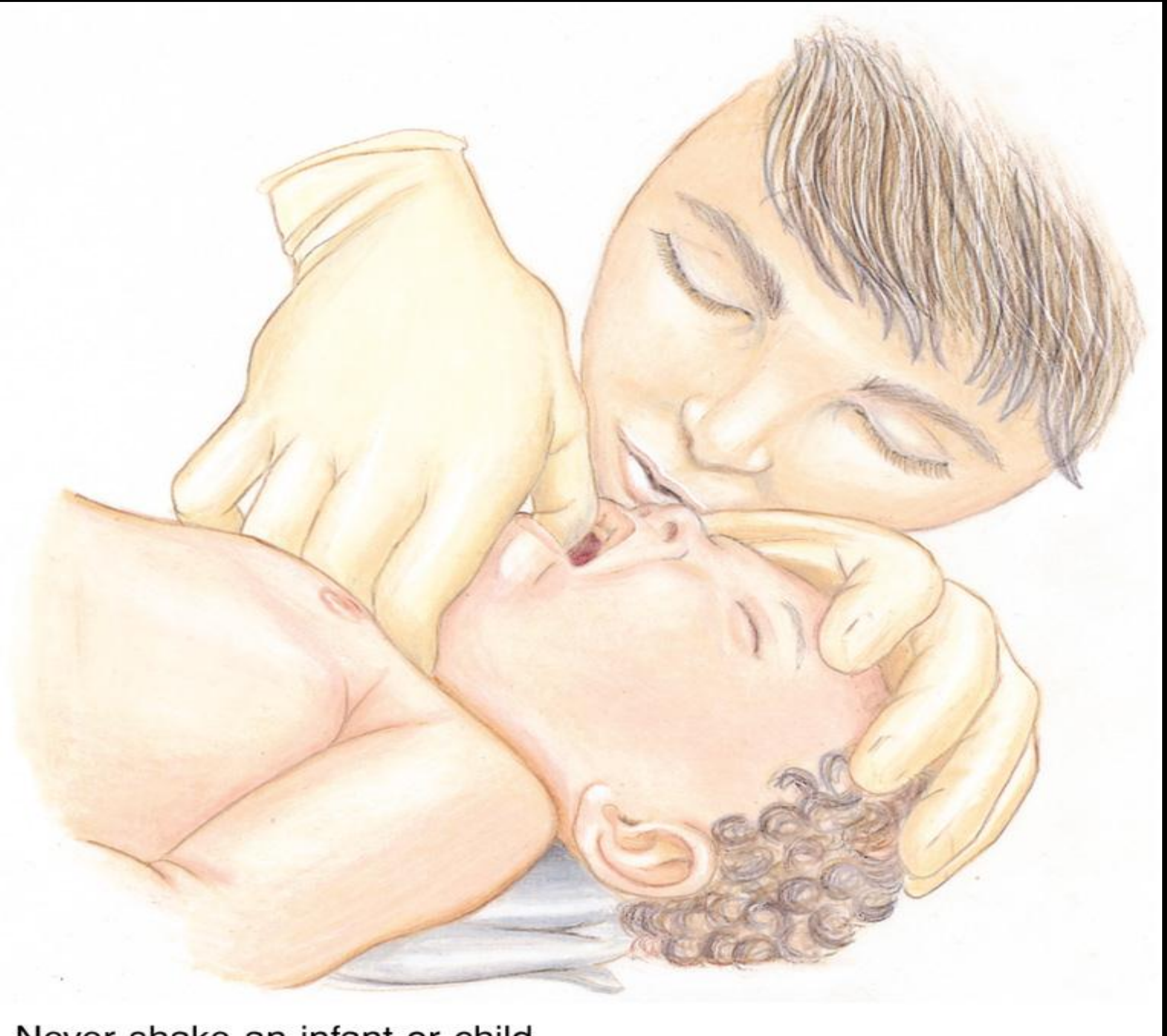
Anticipating Cardiopulmonary Arrest

- Respiratory rate greater than 60
- Heart rate greater than 180 or less than 80 (under 5 years)
- Heart rate greater than 180 or less than 60 (over 5 years)
- Respiratory distress
- Trauma
- Burns
- Cyanosis
- Altered level of consciousness
- Seizures
- Fever with petechiae

Vital Functions

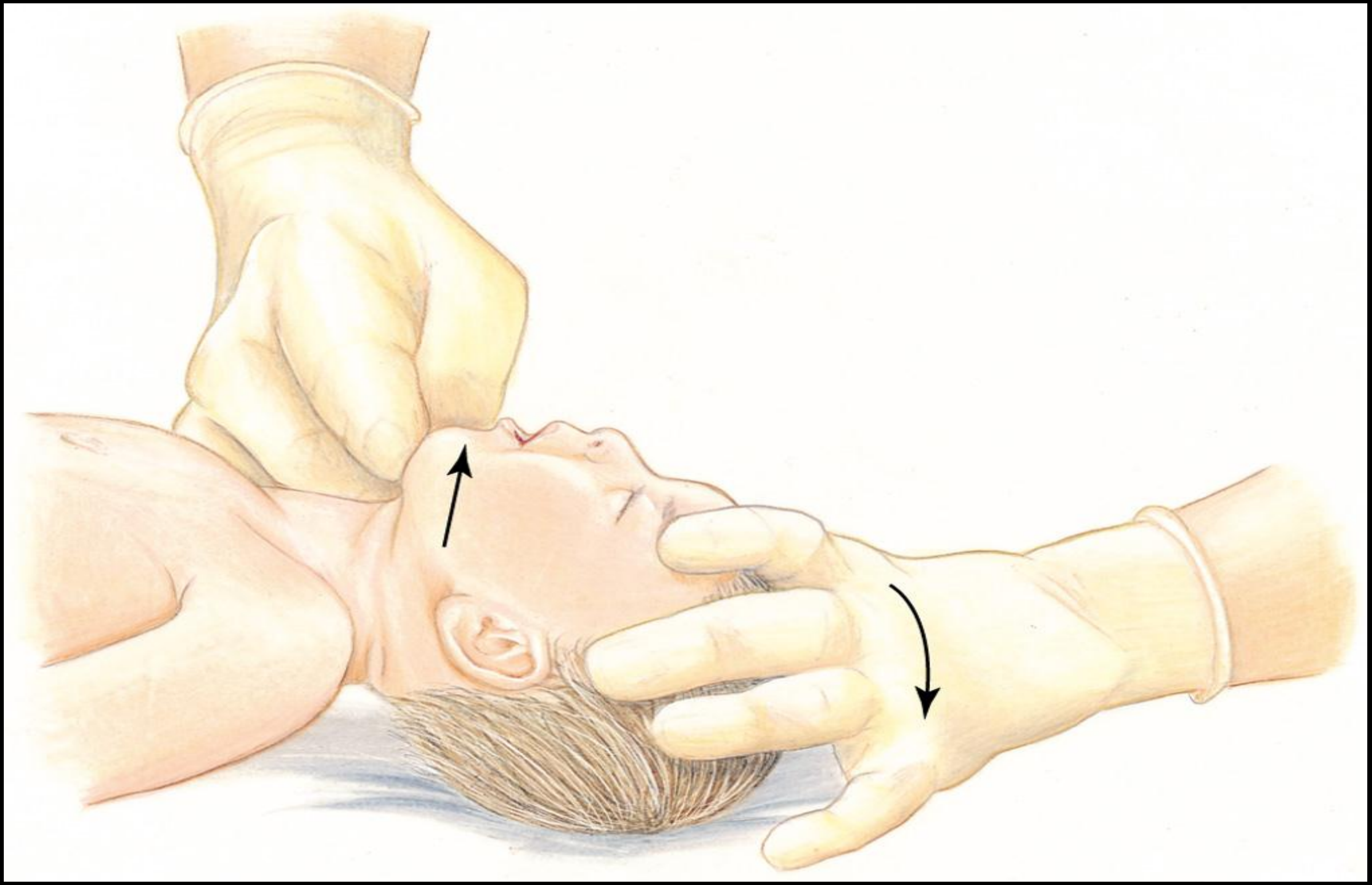
- Determine Level of consciousness
  - AVPU scale
  - Modified Glasgow Coma Score
- Signs of inadequate oxygen
- Airway
  - Determine patency

Opening the Airway in a Child

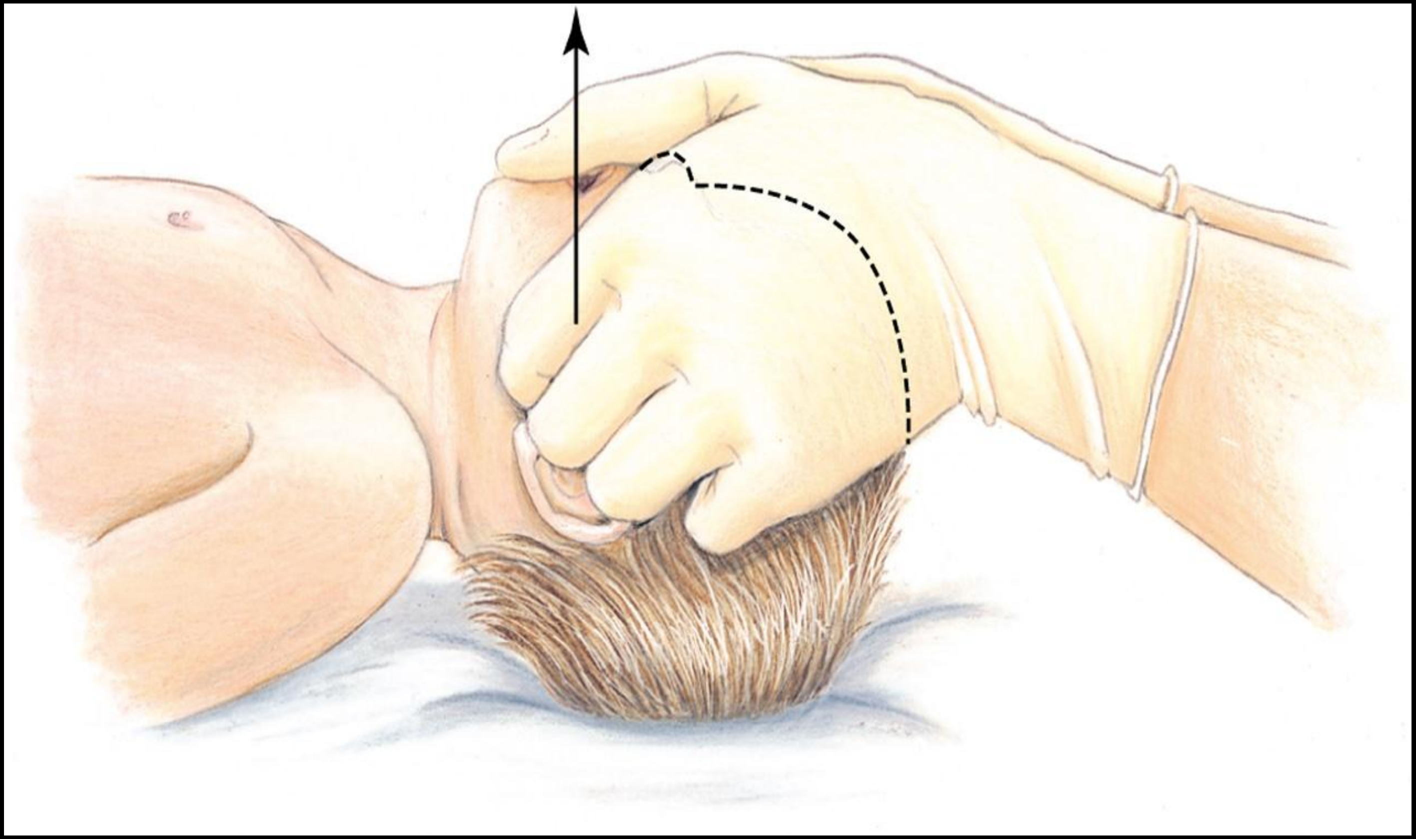


Never shake an infant or child.

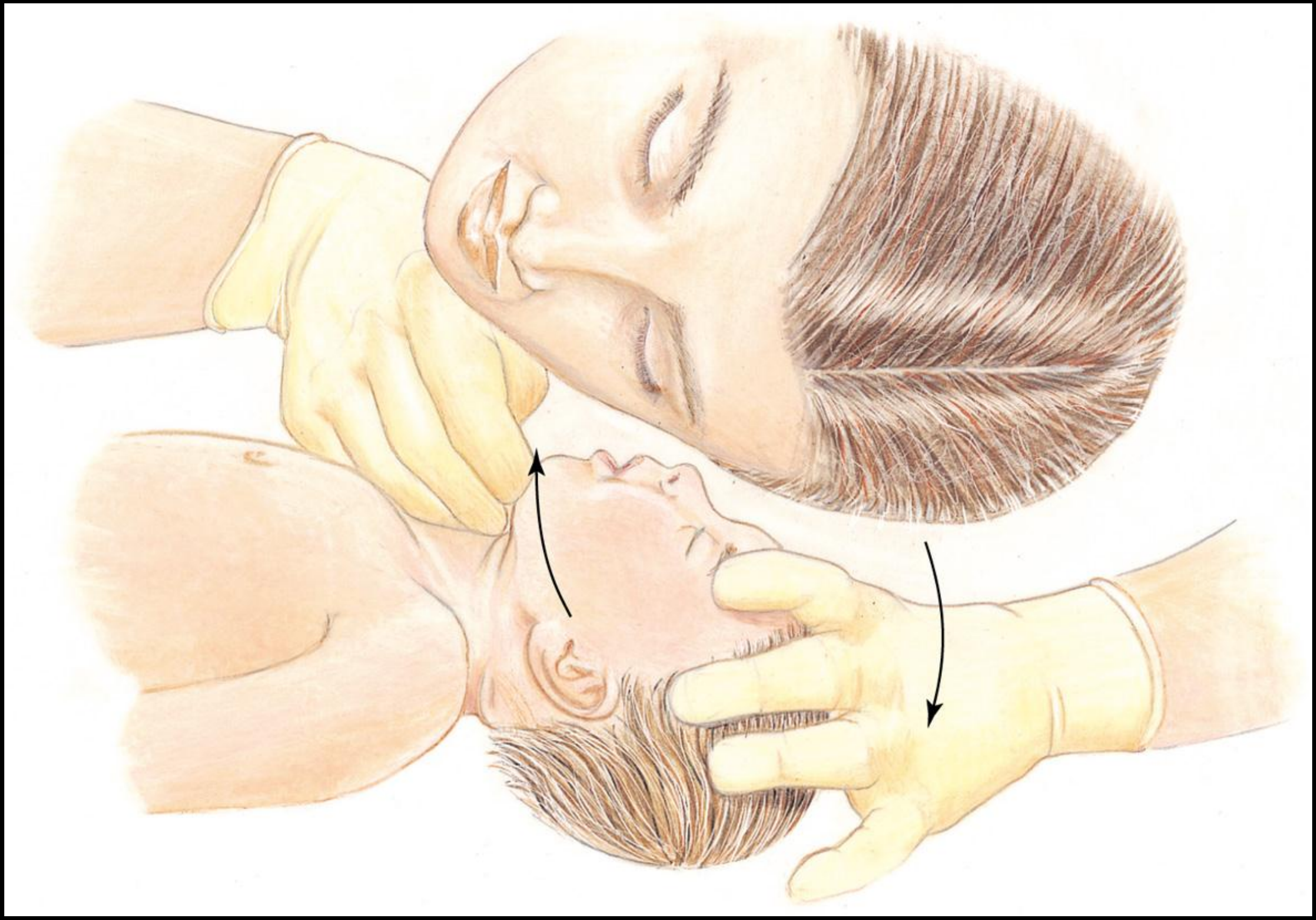
Head-tilt/Chin-lift Method



Jaw-thrust Method



Assessing the Airway



Foreign Body Airway Obstruction

- Basic clearing methods
  - Infants
    - Back blows
    - Chest thrusts
  - Children
    - Abdominal thrusts

Summary of BLS Maneuvers Infants and Children

Table 2-6 Summary of BLS Maneuvers in Infants and Children

Target of Maneuver	Infant (< 1 year)	Child (1 to 8 years)
Airway		
Open airway	Head tilt/chin lift (unless trauma present) Jaw thrust	Head tilt/chin lift (unless trauma present) Jaw Thrust
Clear foreign body obstruction	Back blows/chest thrusts	Heimlich maneuver
Breathing		
Initial	2 breaths at 1 to 1½ seconds/breath	2 breaths at 1 to 1½ seconds/breath
Subsequent	20 breaths/minute	20 breaths/minute
Circulation		
Pulse check	Brachial/femoral	Carotid
Compression area	Lower third of sternum	Lower third of sternum
Compression width	2 or 3 fingers	Heel of 1 hand
Depth	Approximately ½ to 1 inch (Newborn ½ to ¾ inch)	Approximately 1 to 1½ inches
Rate	At least 100/minute (Newborn 120/minute)	100/minute
Compression-ventilation ratio	5:1 (Newborn 3:1)	5:1

Dispatch Information

- You (paramedic) and your EMT partner are returning to your station after leaving the ED
- You hear another ambulance dispatched to a "baby not breathing" and note that you are 1 block from the address
- You inform dispatch that you will take the call and arrive on scene 30 seconds later

Discussion

- *What are some of the causes of apnea in children?*
- *What equipment are you going to bring into the scene with you?*

Initial Impression

- You walk up to the house and can hear the mom inside, frantic, talking to the dispatcher
- You announce your presence, walk inside, and find mom and infant in the kitchen
- The infant is in its mother's arms

Initial Impression

- 1 y/o male
- Conscious
- In distress
- Coughing forceably
- Stridor between coughs

Discussion

- ***How would you describe the patient's status?***

- ***What would be your immediate actions?***

Assessment

- As you approach the child, mom states that the patient is choking on a piece of hard candy
- Suddenly, the stridor and coughing stop
- The infant becomes unresponsive and starts turning blue

Discussion

- *How would you describe the patient's status now?*
- *What would be your immediate actions?*

Assessment

- You open the airway with a head-tilt chin lift
- Your partner prepares a BVM

Assessment/Treatment

- You attempt to ventilate the patient without success, reposition, and try again without success

Discussion

- *What is wrong with the previous picture?*
- *What specific forms of BSI should be considered for:*
  - *Basic patient interaction?*
  - *Airway management?*

Assessment

- While trying to manage the airway, you explore the patient's history
  - Patient was fine earlier today
  - Has been eating and drinking normally
  - No recent illnesses
  - No problems with pregnancy or delivery
  - No congenital defects, no medical history

Treatment

- You tell your partner to prepare the Magill forceps and a laryngoscope with a #1 straight blade
- You perform a jaw lift, visualize the airway, and do not see an object
- You perform 5 back blows, then 5 chest thrusts

Treatment

- You lay the patient supine on a table, perform a jaw lift, and visualize the airway
  - No object seen
- Your partner hands you the laryngoscope and Magill forceps
- You visualize the larynx and are able to see what appears to be a small piece of hard candy in the patient's airway

Treatment

- Your partner utilizes the Broselow tape to determine proper endotracheal tube size
- You are unable to grasp the candy with the Magills

Discussion

- ***What are your options at this point?***
- ***What are your immediate actions?***

Treatment

- You begin another round of back blows and chest thrusts
- Visualization of the airway after chest thrusts does not reveal the candy

Treatment

- You attempt intubation and find that you cannot intubate around the obstruction

Discussion

- ***What are your remaining options?***

- ***What are your immediate actions?***

Treatment

- You tell your partner that you will attempt one more round of BLS FBAO maneuvers followed by another attempt with the Magill forceps
  - If unsuccessful, you are out the door and transporting to the nearest hospital
- You note that the patient is now unconscious and unresponsive

Discussion

- ***What are your immediate actions?***

Treatment/Assessment

- You lay the infant on the kitchen table and begin CPR
- You note an odd sound from the airway, visualize, and sweep the piece of candy from the oropharynx

Discussion

- ***What are your assessment and management priorities?***
- ***What are your immediate actions?***

Assessment

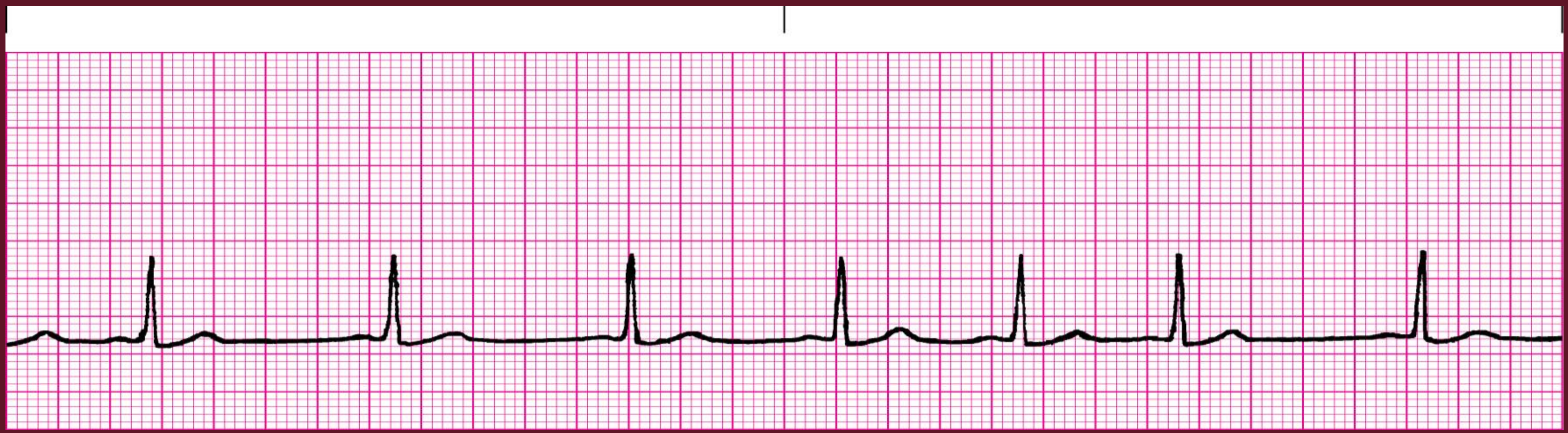
- You lay the patient supine on a table with a towel behind his shoulders and open the airway with a head-tilt chin-lift
- You are able to provide 2 rescue breaths and see chest rise and fall
- Your partner feels for a brachial pulse and reports a HR of 84

Discussion

- ***Do you provide CPR?***

Assessment/Treatment

- You continue to ventilate the patient at a rate of 20/min, taking 1 to 1-1/2 seconds for each breath
- Your partner places the patient on the cardiac monitor and pulse oximeter
  - SpO_2 = 82% and rising
  - HR = 80, cardiac rhythm:



Treatment

- Your partner prepares the equipment for transport.
- You disconnect the O_2, rest the infant on your forearm, and transport to the ambulance while providing BVM ventilations

Ongoing Assessment

- Once in the ambulance, you continue BVM ventilations with 100% O_2 at 15 lpm and perform a reassessment
- You note:
  - The infant is starting to move his limbs
  - Weak, spontaneous respirations
  - HR up to 88 bpm
  - SpO_2 up to 90%, cyanosis improving
- Your partner takes a BP of 82/60

Discussion

- What are your treatment options at this time?
- Do you:
  - Intubate?
  - Start IV access?
  - Administer epinephrine?
  - Continue what you are doing?
  - Begin transport?

Treatment

- You tell your partner to begin transport to the ED and decide that mom seems able to handle sitting in the patient compartment with you
- You continue to assist the infant's improving ventilations, explain to mom what has happened up to this point, and encourage her to hold the infant's hand

Ongoing Assessment

- You note:
  - HR = 106 regular
  - RR = 20
  - SpO_2 = 96%
- You contact the receiving ED and provide a report

Treatment

- You switch to blow-by oxygen and have mom hold the mask by the patient's face

Ongoing Assessment

- While backing up in the ED parking lot, you note:
  - HR = 130 regular
  - RR = 36 regular, deep
  - SpO_2 = 100%
  - Child is crying actively, moving all limbs

ED Treatment and Beyond

- You are met by ED staff and a PICU critical care team in the resuscitation room
  - As you enter the room, you hear someone remark, “Now *that’s* a healthy cry”

Epidemiology

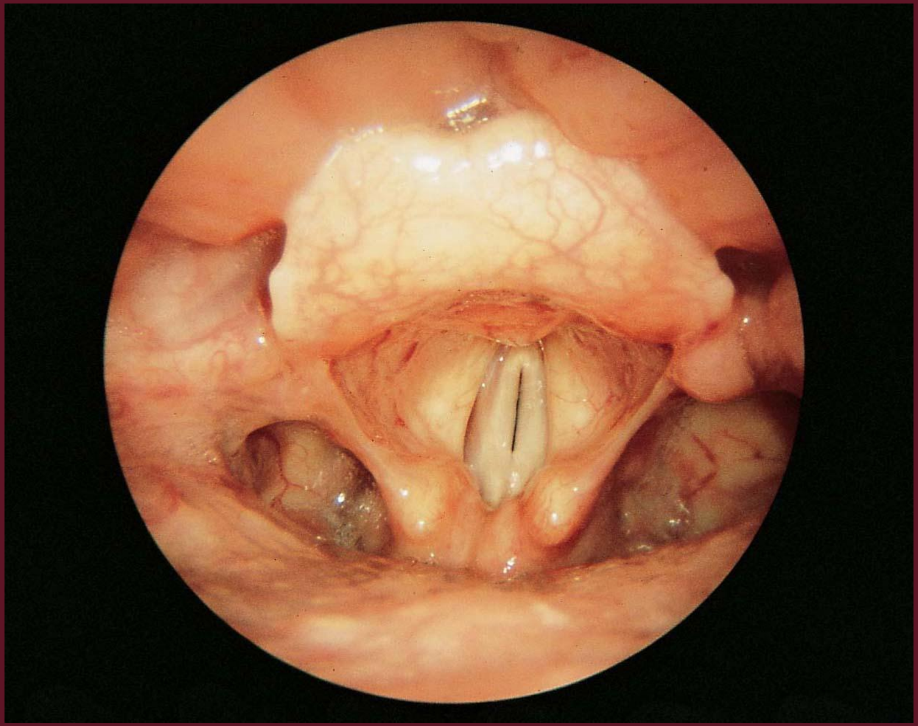
- In year 2000 in US, foreign body aspiration accounted for:
  - >17,000 ED visits
  - 160 deaths in children < 14 years
- National Safety Council estimates 2,900 deaths a year from aspiration
- Peak ages for foreign body aspiration are toddler through preschool age
  - Though aspiration can occur at any age

Epidemiology

- > 90% of deaths from foreign body airway obstruction (FBAO) in children occur in those aged < 5 years
- 65% of FBAO deaths occur in infants

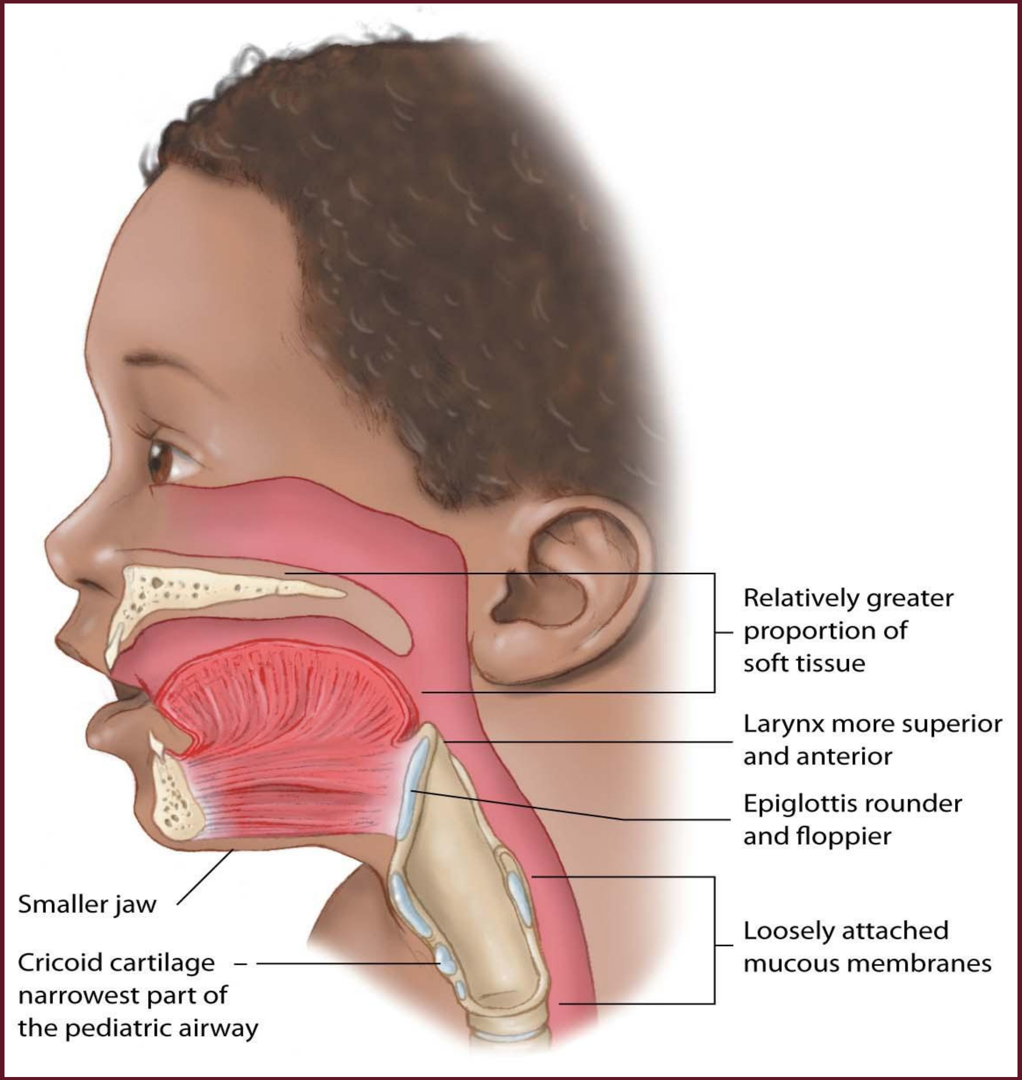
A & P Review

- Airway anatomy
  - Corniculate cartilage
  - Cuneiform cartilage
  - Vocal cords
  - False vocal cords
  - Epiglottis



A & P Review

- Pediatric airway anatomy



Pathophysiology

- Children more prone to foreign body aspiration
  - Lack of molar teeth decreases ability to properly chew food into small pieces
  - Children more likely to run, laugh, talk with food in mouth; sudden inspiration may lodge food in airway
  - Children often examine their environment by putting things in their mouths

Pathophysiology

- Most common materials aspirated include:
  - Small smooth items such as hot dogs, sausages, and grapes
  - Nuts, raisins, improperly chewed pieces of meat, seeds
  - Popcorn, round candies
  - Small toys

Pathophysiology

- Worst-case scenario is full airway occlusion
  - Hypoxic brain damage or death occurs unless foreign body promptly removed
- Smaller objects aspirated into the lung can result in:
  - Difficulty breathing
  - Chemical pneumonitis

Clinical Assessment

- History
  - Was there a sudden onset of respiratory distress/apnea after an episode of choking or while eating?
  - Previous episodes of choking?

Clinical Assessment

- Physical exam: Severe or complete occlusion
  - Inability to speak or cry
  - Silent or weak cough
  - Severely decreased or absent breath sounds
  - High-pitched sounds during inspiration, apnea
  - Cyanosis
  - Cardiac arrest

Clinical Assessment

- Physical exam: partial occlusion
  - Forceful cough
  - Able to speak
  - Stridor
  - Decreased breath sounds

Treatment

- BLS maneuvers first
- ALS maneuvers second
- Specific situations:
  - Responsive infant
  - Unresponsive infant
  - Responsive child
  - Unresponsive child

Treatment

- Responsive infant: BLS maneuvers
  - 5 back blows
  - 5 chest thrusts
  - Repeat until object expelled or patient becomes unresponsive

Treatment

- Unresponsive infant: BLS maneuvers
  - Open airway, visualize, finger sweep if object seen, attempt rescue breath
  - Lay infant on flat surface
  - Begin CPR
  - Each time you open the airway, visualize, finger sweep if object seen, attempt rescue breath
  - Repeat

Treatment

Unresponsive infant: BLS maneuvers

Treatment

- Unresponsive infant: ALS maneuvers
  - Magill forceps under direct laryngoscopy
  - Endotracheal intubation
    - Attempt to intubate through or around object
    - Attempt to push object into right mainstem bronchus
  - Needle, surgical cricothyroidotomy not a wise option in infants

Treatment

- Responsive child: BLS maneuvers
  - Stand behind patient, perform Heimlich maneuver
  - 5 quick thrusts
  - Repeat until object expelled or patient becomes unresponsive

Treatment

- Unresponsive child: BLS maneuvers
  - Open airway, visualize, finger sweep if object seen, attempt rescue breaths
  - Perform CPR
  - Repeat until object expelled or rescue breaths go in

Treatment

Unresponsive child: BLS maneuvers

Treatment

Unresponsive child: BLS maneuvers

Treatment

- Unresponsive child: ALS maneuvers
  - Magill forceps under direct laryngoscopy
  - Endotracheal intubation
    - Attempt to intubate through or around object
    - Attempt to push object into right mainstem bronchus
  - Needle cricothyroidotomy
  - Surgical cricothyroidotomy

Treatment

- Immediately after FBAO removal:
  - Assess airway and breathing
  - Administer high-flow O_2 via appropriate delivery device depending on patient status
    - Blow-by
    - Nonrebreather mask
    - BVM with face mask
    - BVM with endotracheal tube

Treatment

- Immediately after FBAO removal:
  - Assess circulation
    - Determine need for CPR

ED Treatment

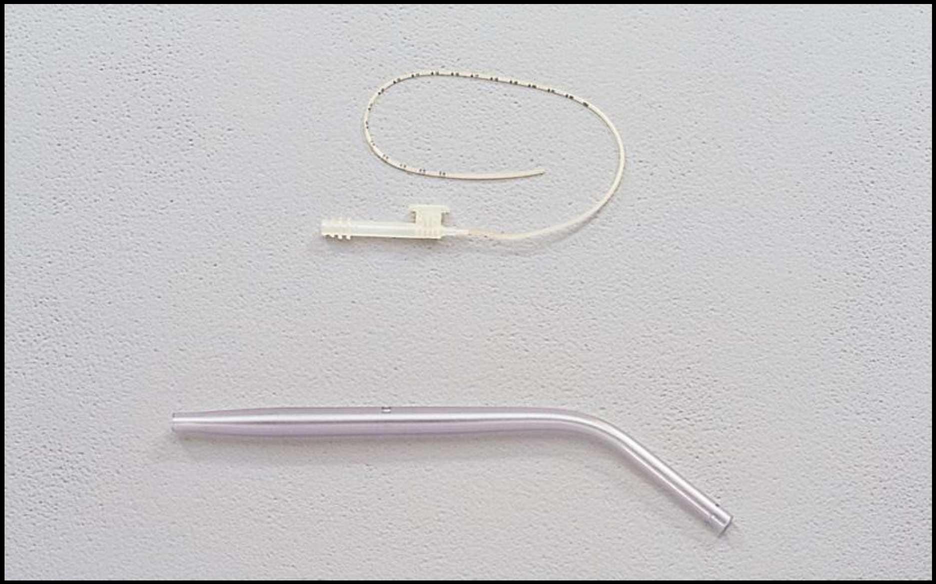
- ED treatment mirrors that of prehospital
- BLS maneuvers
- Magill forceps under direct laryngoscopy
- Endotracheal intubation
  - Attempt to intubate through or around object
  - Attempt to push object into right mainstem bronchus
- Surgical cricothyroidotomy, tracheostomy

Suctioning

- Decrease suction pressure to less than 100 mm/Hg in infants.
- Avoid excessive suctioning time—less than 15 seconds per attempt.
- Avoid stimulation of the vagus nerve.
- Check the pulse frequently.

Pediatric-size Suction Catheters

- **Top: soft suction catheter**
- **Bottom: rigid or hard suction catheter**



Suction Catheter Sizes
Infants and Children

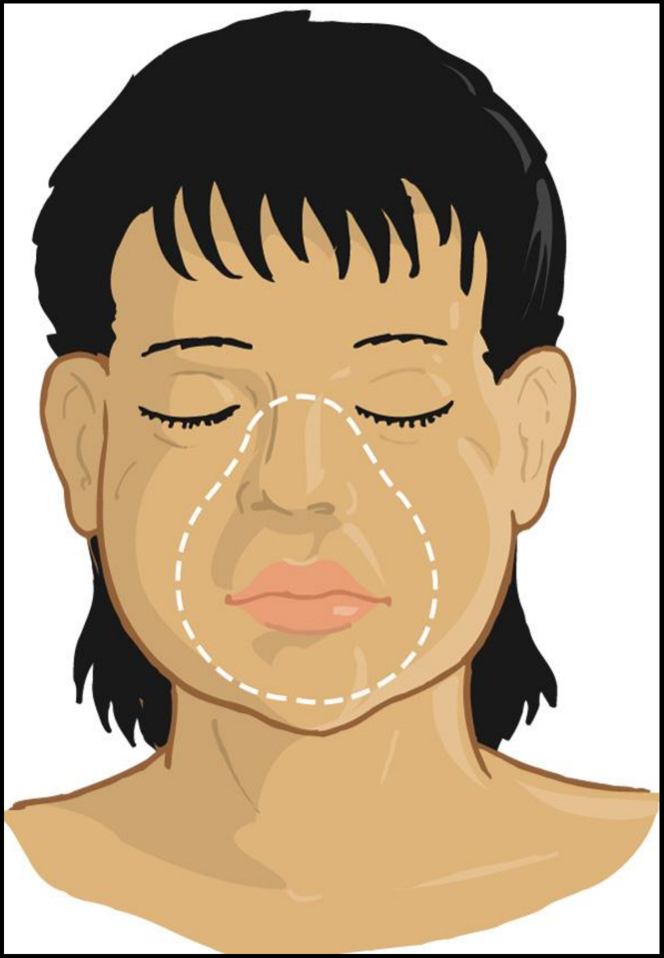
Table 2-7 Suction Catheter Sizes for Infants and Children

Age	Suction Catheter Size (French)
Up to 1 Year	8
2 to 6 Years	10
7 to 15 Years	12
16 Years	12 to 14

Oxygenation

- Adequate oxygenation is hallmark of pediatric patient management
  - Non-rebreather masks
  - Blow-by oxygen if mask is not tolerated
  - Utilize parent or guardian to deliver oxygen if patient condition warrants
  - Maintain proper head position

In placing a mask on a child, it should fit on the bridge of the nose and cleft of the chin



Oxygenation

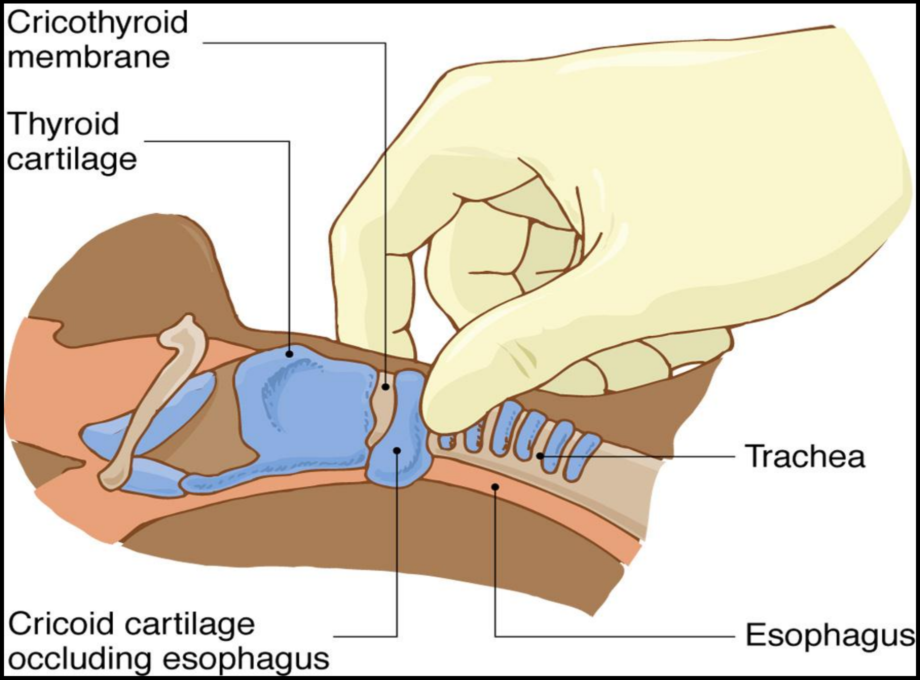
- To overcome a child’s fear of the non-rebreather mask, try it on yourself or have the parent try it on before attempting to place it on the child.

Ventilation

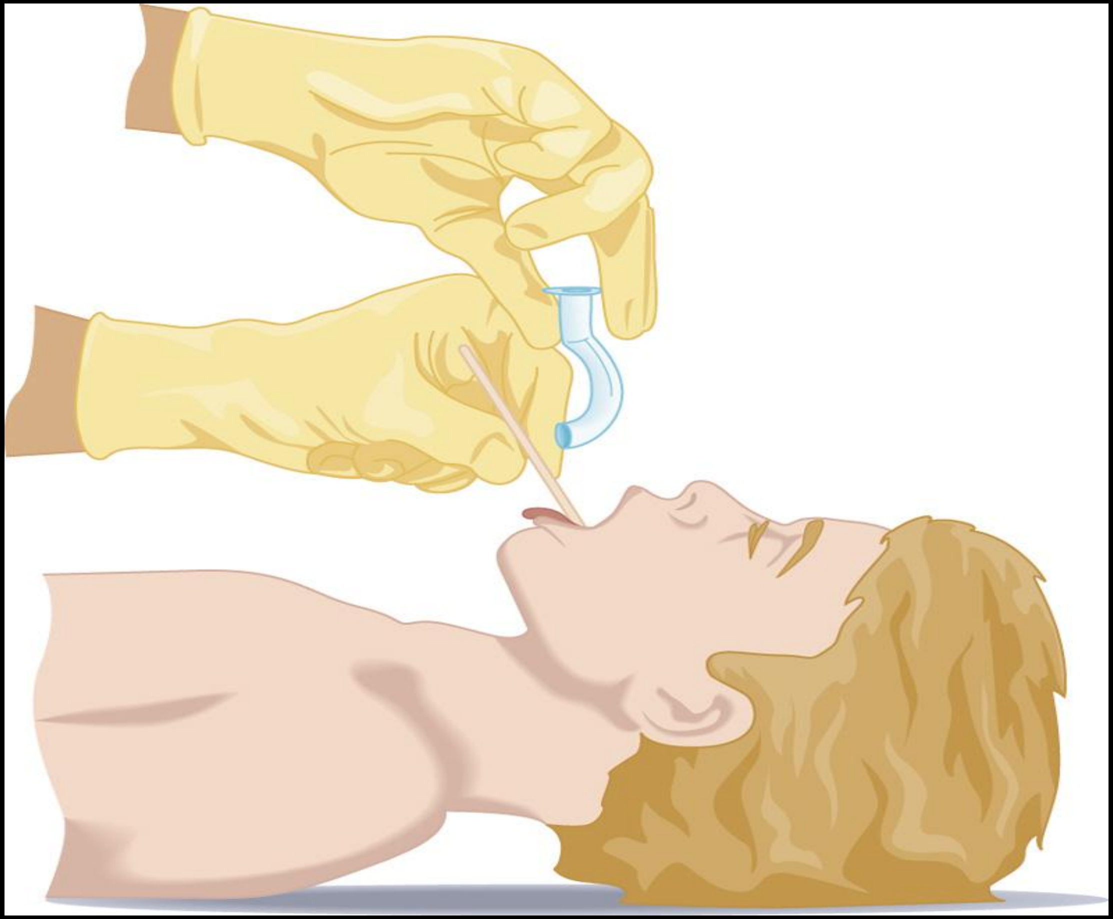
- Avoid excessive bag pressure and volume.
- Obtain chest rise and fall.
- Allow time for exhalation.
- Flow-restricted, oxygen-powered devices are contraindicated.
- Do not use BVMs with pop-off valves.
- Apply cricoid pressure.
- Avoid hyperextension of the neck.

Sellick's Maneuver

- In Sellick's maneuver, pressure is placed on the cricoid cartilage, compressing the esophagus, which reduces regurgitation and helps bring the vocal cords into view

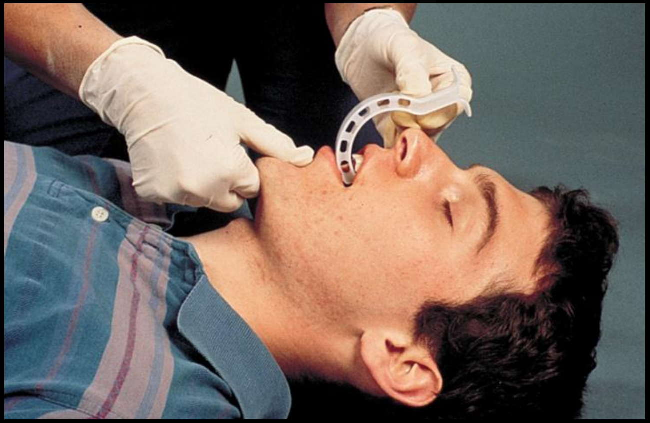


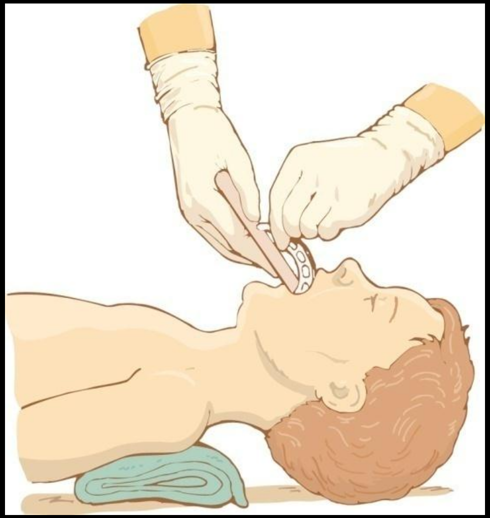
Inserting an oropharyngeal airway in a child with the use of a tongue blade



Oral Airways

- a. In an adult, the airway is inserted with the tip pointing to the roof of the mouth, then rotated into position.
- b. In an infant or small child, the airway is inserted with the tip pointing toward the tongue and pharynx, in the same position it will be in after insertion.





Advanced Airway and Ventilatory Management

Pediatric Airway

- A straight blade is preferred for greater displacement of the tongue.
- The pediatric airway narrows at the cricoid cartilage.
- Uncuffed tubes should be used in children under 8 years of age.
- Intubation is likely to cause a vagal response in children.

Endotracheal Intubation Indications

- Need for prolonged artificial ventilation
- Inadequate ventilatory support with a BVM
- Cardiac or respiratory arrest
- Control of an airway in a patient without a cough or gag reflex
- Providing a route for drug administration
- Access to the airway for suctioning

Pediatric Endotracheal Tube Size

$$\frac{\text{(Patient's age in years + 16)}}{4}$$

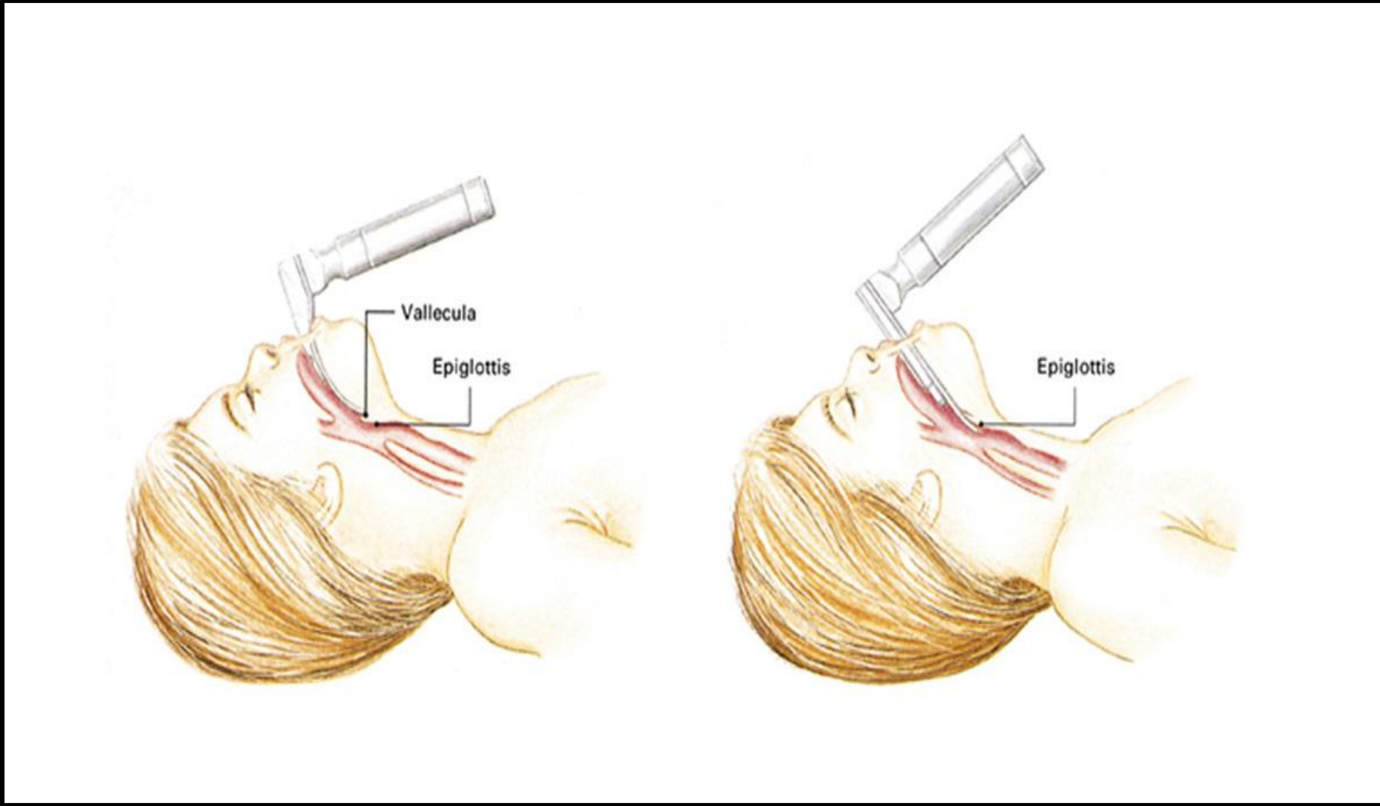
- **Use a resuscitation tape which estimates based on height/length.**
- **Estimate the correct diameter, based on the child's little finger.**

Hyperoxygenate-ventilate the child

Position the head

Insert the laryngoscope and visualize the airway

Placement of the laryngoscope



Insert the tube and ventilate the child

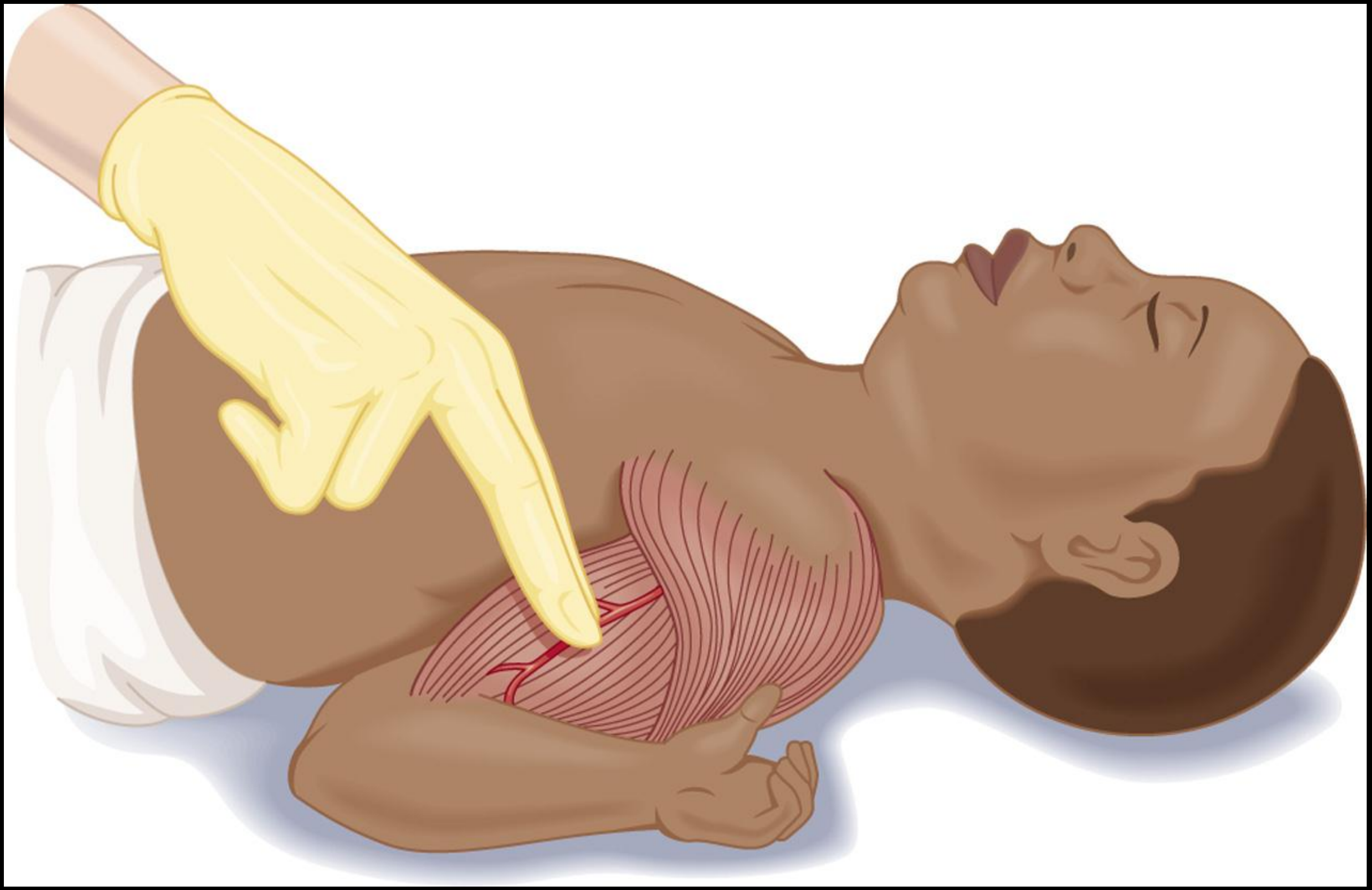
Confirm tube placement

Circulation

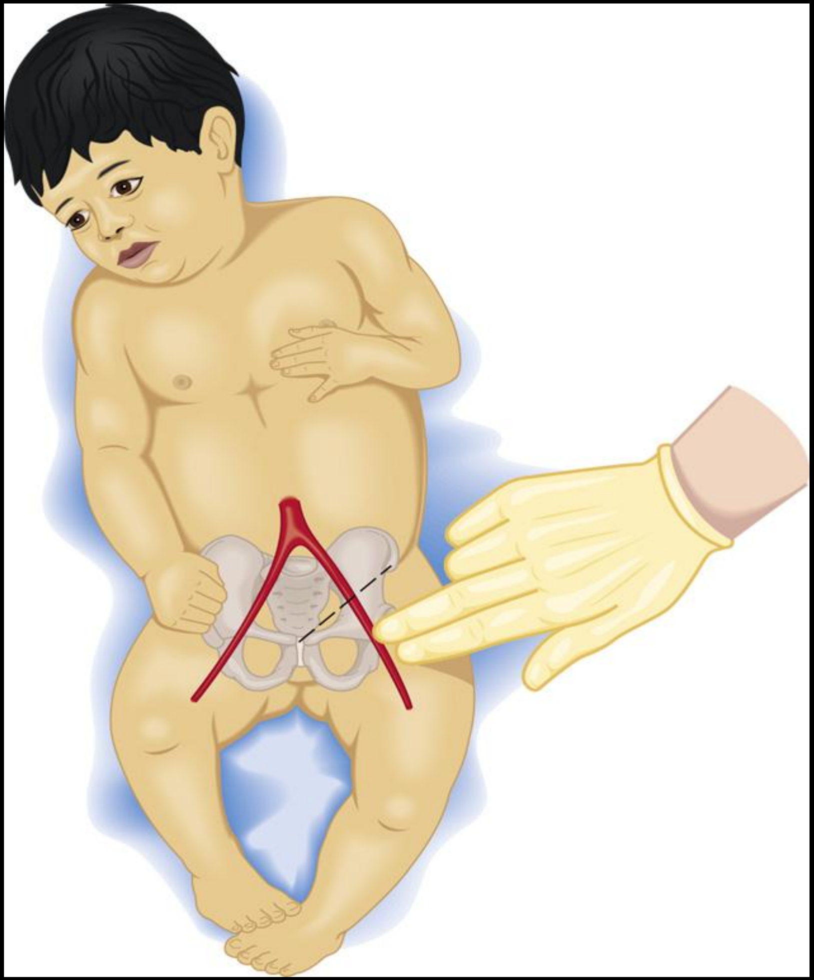
Two problems lead to cardiopulmonary arrest in children:

- **Shock**
- **Respiratory failure**

Assessing the Brachial Pulse



Assessing the Femoral Pulse



Vascular Access

- Neck veins
- Scalp veins
- Arms
- Hands
- Feet
- Intraosseous infusion

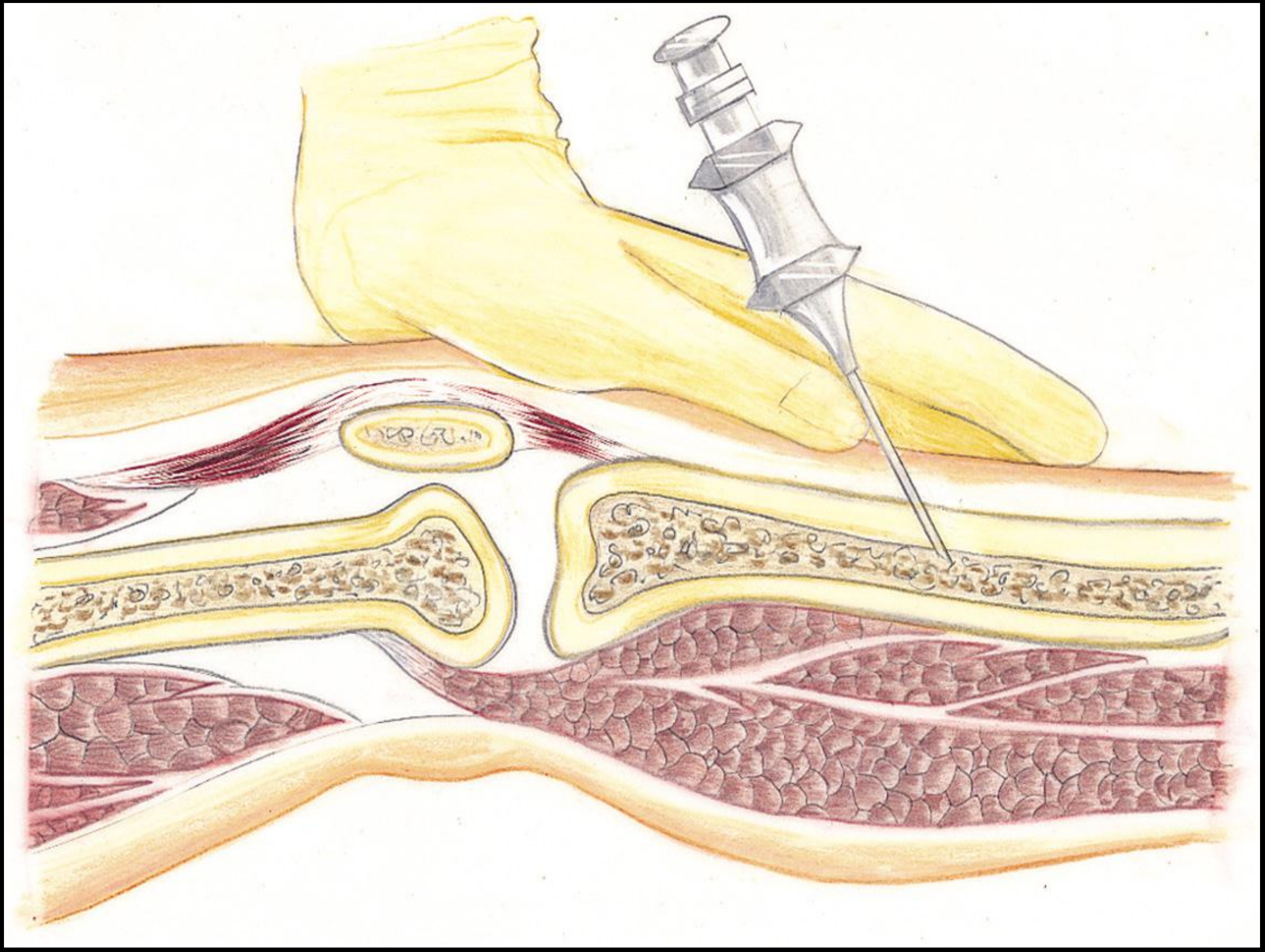
Intraosseous Infusion Indications

- Children less than 6 years of age
- Existence of shock or cardiac arrest
- Unresponsive patient
- Unsuccessful peripheral IV

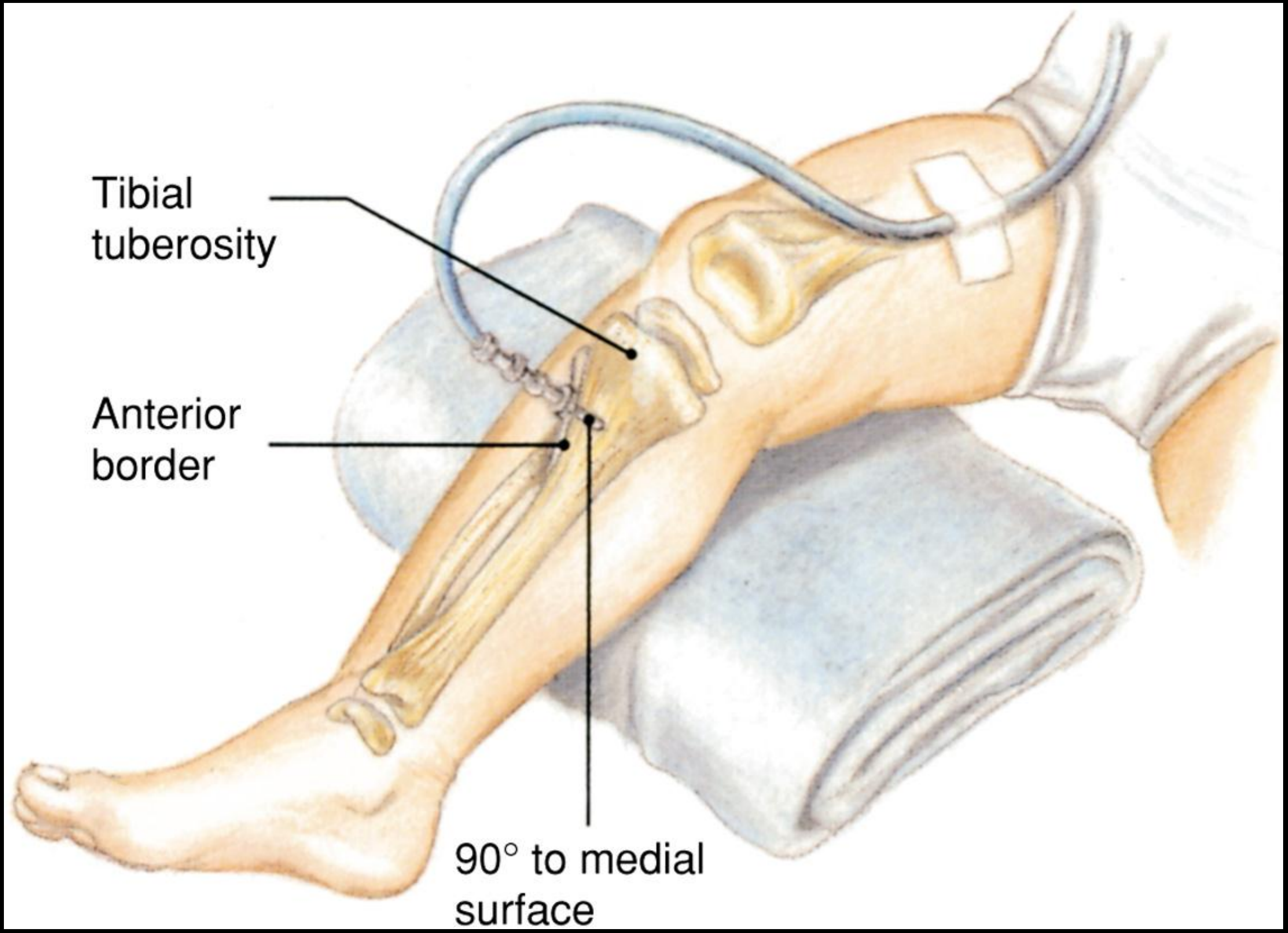
Intraosseous Infusion Contraindications

- Fracture in the bone chosen for IO
- Fracture of the pelvis or extremity fracture of bone, proximal to the chosen site

Correct needle placement for intraosseous administration



Intraosseous Administration



Drugs Administered by IO Route

- Epinephrine
- Atropine
- Dopamine
- Lidocaine
- Sodium bicarbonate
- Dobutamine

Fluid Administration

Accurate fluid dosing in children is crucial!

10ml/kg NS or LR

20ml/kg NS or LR

Equipment Guidelines According to Age and Weight

Table 2-8 EQUIPMENT GUIDELINES ACCORDING TO AGE AND WEIGHT

	Age (50th Percentile Weight)					
Equipment	**Premie (1–2.5 kg)**	**Neonate (2.5–4.0 kg)**	**6 Months (7.0 kg)**	**1–2 Years (10–12 kg)**	**5 Years (16–18 kg)**	**5–10 Years (24–30 kg)**
Airway						
Oral	infant (00)	infant (small) (0)	small (1)	small (2)	medium (3)	medium large (4.5)
Breathing						
Self-inflating bag	infant	infant	child	child	child	child/adult
O_2 ventilation mask	premature	newborn	infant/child	child	child	small adult
Endotracheal tube	2.5–3.0 (uncuffed)	3.0–3.5 (uncuffed)	3.5–4.0 (uncuffed)	4.0–4.5 (uncuffed)	5.0–5.5 (uncuffed)	5.5–6.5 (uncuffed)
Laryngoscope blade	0 (straight)	1 (straight)	1 (straight)	1–2 (straight)	2 (straight or curved)	2–3 (straight or curved)
Suction/stylet (F)	6–8/6	8/6	8–10/6	10/6	14/14	14/14
Circulation						
BP cuff	newborn	newborn	infant	child	child	child/adult
Venous access						
Angiocath	22–24	22–24	22–24	20–22	18–20	16–20
Butterfly needle	25	23–25	23–25	23	20–23	18–21
Intracath	—	—	19	19	16	14
Arm board	6″	6″	6″–8″	8″	8″–15″	15″
Orogastric tube (F)	5	5–8	8	10	10–12	14–18
Chest tube (F)	10–14	12–18	14–20	14–24	20–32	28–38

Weight Determination

- Treatment of children is prescribed by their weight
- Estimation formula
  - Child's age in years x 2 + 8 = Weight in Kg

Pediatric Weights
Pound-Kilogram Conversion

Table 2-5 Pediatric Weights and Pound-Kilogram Conversion

Age	Weight (lb)	Weight (kg)
Birth	7	3.5
3 Months	10	5
6 Months	15	7
9 Months	18	8
1 Year	22	10
2 Years	26	12
3 Years	33	15
4 Years	37	17
5 Years	40	18
6 Years	44	20
7 Years	50	23
8 Years	56	25
9 Years	60	28
10 Years	70	33
11 Years	75	35
12 Years	85	40
13 Years	98	44

Special Disorders/Complaints

- Isolated Fever
- Febrile vs. Simple Seizure
- Respiratory Distress
- Vomiting/Diarrhea
- Hypoglycemia/Hyperglycemia
- Poisonings
- Minor Trauma

Fever

Fever Defined

- Has a fever ever harmed a child without?
  - Serious infection
  - Normal brain
  - Normal ability to sweat

  - *Excluding - False fevers*
    - CNS - direct effect (bleed, drugs)
    - Heat production (thyroid, salicylates)
    - Heat load (environment)
    - Defective heat loss

WHAT IS A FEVER?
from published studies

- ≤ 3 months
  - ≥ 38 (100.4) or ≥ 38.2 (100.7)
- > 3 months
  - ≥ 38.3 (101)
  - ≥ 39-39.5 (102.3-103) for bacteremia
- Numbers are not absolutes
  - Afebrile meningitis and bacteremia
  - Hypothermia is common < 1-2 months

Is fever a good or bad thing?

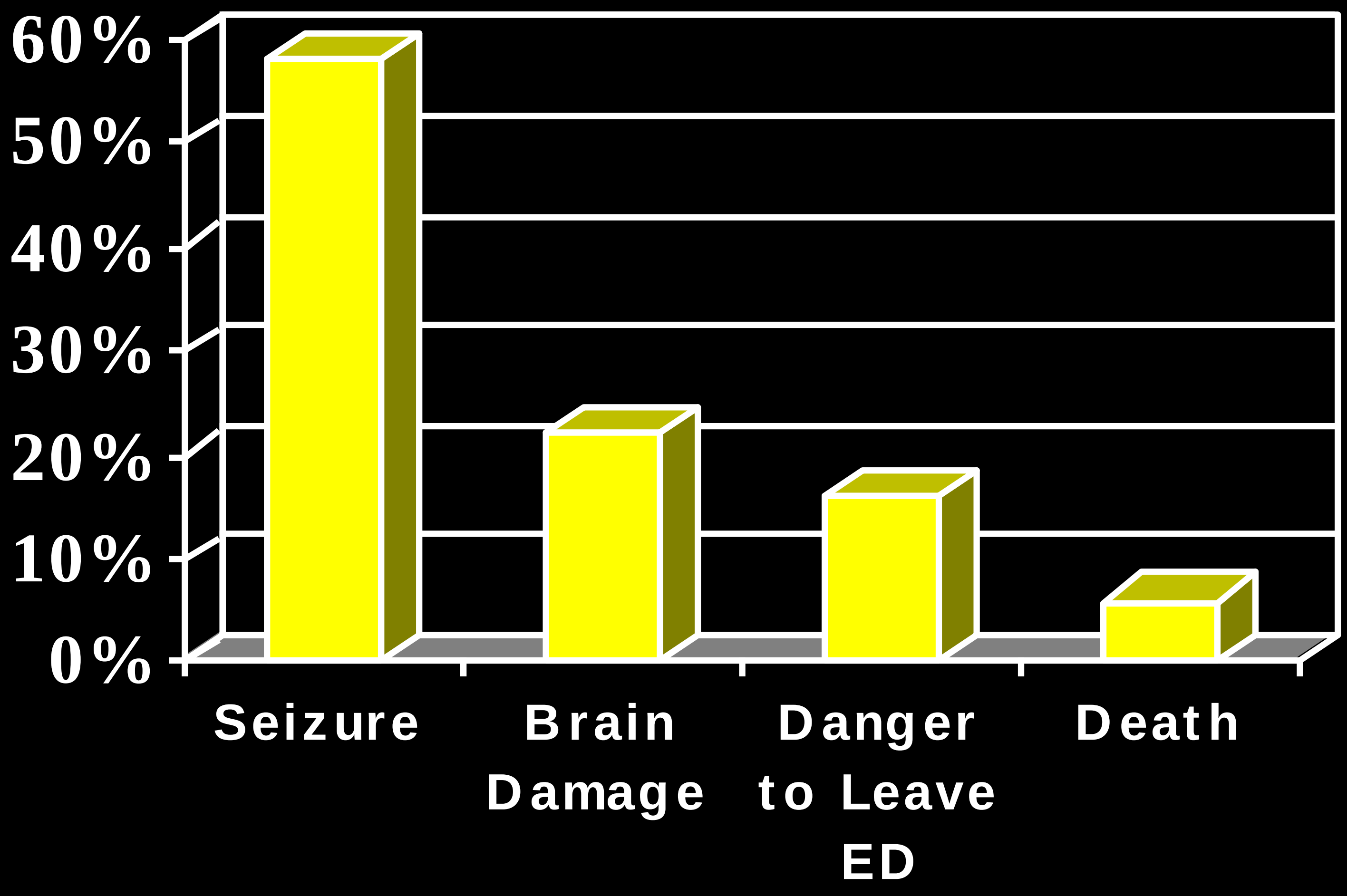
Fever Phobia

- 1/3 thought that a temp. of 100 - 104 would harm their child
- 2/3 thought that 104 - 106 would harm their child
- All thought that brain damage would occur above 106.

Kramer: Parental fever phobia and its correlates.
Pediatrics **1984; 75: 1110.**

Fever Phobia

- **Nurse contribution to fever phobia**



Poirier. *Pediatr Emerg Care* 2000; 16: 9.

MYTHS
Tylenol vs Motrin

- Head to head comparisons
  - Tylenol 10-15mg/kg q4-6 hours
  - Motrin 5-10mg/kg q6-8 hours
- Renal Failure and Dehydration
  - equal risk
- Does a 0.5 C difference matter

MYTHS
Sponge baths

- Mean temperature reduction 0.5-1C
- 1/3 have temperature elevation
  - shivering
  - fighting
- Alcohol baths
  - isopropanol toxicity
  - derm, resp, and GI absorption

TRUE TEMPERATURE

What is a true Core temperature?

Estimates of Core temperature

- rectal
- axillary
- oral
- tympanic
- esophageal

TEMPERATURE Measurement

- Rectal - gold standard
  - time, energy, cleanliness
  - allegedly takes time to respond

- Tympanic
  - How does it work?
  - What does it touch?

TEMPERATURE Measurement

Accuracy of tympanic thermometry in detecting temperature ≥ 38-38.5C

Author	N	Sens	Spec
Nypaver	939	72%	-
Kenney	964	79%	74%
Terndrup	303	51%	84%
Brennan	**370**	**61%**	**92%**
Terndrup	251	68%	93%

Brennan. *Ann Emerg Med* 1995; 24.

Fever - Healthy Infants & Children

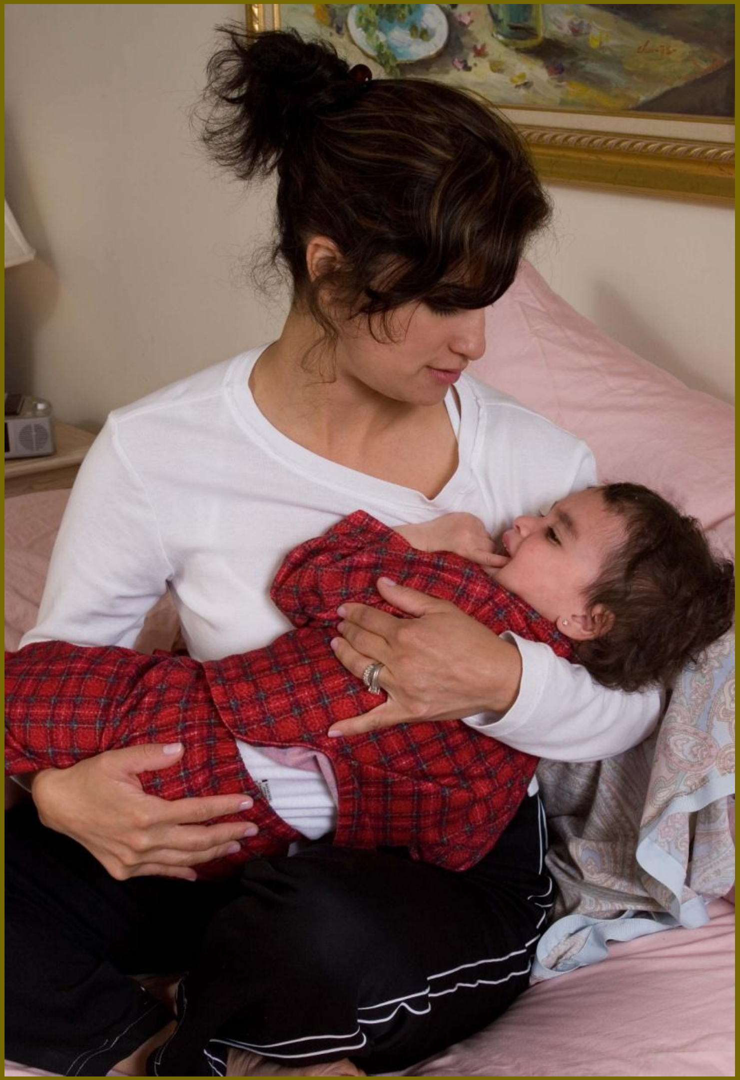
❖ < 1 month	Slam Dunk Admit
❖ 1-3 months	Spinal Tap
❖ 3-24(36) months	Some semi-hidden infections
	Meningitis
	Bacteremia
	Urinary Infection
❖ > 2-3 years	Trust history/physical exam

Dispatch Information

- It's 0130 hrs, and you (paramedic) and your EMT partner are dispatched to a "sick infant" at a residential address.
- You arrive on scene and note that the front door is open; mom calls out to "come on in."
- You feel that the scene is safe, and you enter.

Initial Impression

- You note:
  - Patient is in mom's arms
  - Male, about 12 months old
  - Slightly irritable
  - Crying
  - Color looks normal



Discussion

- ***What is your initial impression?***

- ***Do you think that the patient is unstable?***
  - ***Why or why not?***

Initial Assessment

- Mom says that the infant is 12 months old, developed a fever this afternoon.
- She took a rectal temperature, was 101.2
- She gave the infant Tylenol about 2 hours ago

Discussion

- ***What are your concerns, if any?***
- ***What additional information would you like?***
- ***Is there anything you want to know about the Tylenol administration?***

Assessment

- **You talk to mom while your partner performs a detailed assessment**

Assessment

- History of present illness
  - Child has not been ill prior to onset of fever
    - Has not been around other ill children
    - No one in home sick
    - No one is using antibiotics
  - No complications with pregnancy, delivery

Assessment

- History of present illness
  - Child does not have a pediatrician, goes to a local health clinic if necessary
  - Tylenol administered 2 hr ago, no change in temperature
    - Mom had children's Tylenol at home
    - Went online, found dose of 10-15 mg/kg
    - Child weighs 22 lbs, administered 100 mg
    - Temp = 101.2°F

Assessment

- History of present illness
  - Child crying a bit more than usual but is otherwise acting normal
  - Has been feeding normally
  - No diarrhea, normal number of wet diapers

Discussion

- ***What is your impression after hearing the history?***

- ***What information would you like from the detailed assessment?***

Detailed Assessment

- Your partner reports:
  - Child active, crying, producing tears
  - Fontanels normal
  - Good muscle tone
  - Lungs clear
  - No rash

Detailed Assessment

- Vital signs
  - HR = 120 regular
  - RR = 38 regular
  - BP = 80/palpation
    - (80 plus age X 2)
  - SpO_2 = 99% room air

Assessment

- Mom states that she does not want to go to the ED if you don't think the child has to
- She "trusts your judgment"

Discussion

- ***Do you recommend transport to the ED?***
  - ***Why or why not?***

Treatment

- You tell mom to continue giving the child Tylenol every 4-6 hours and to take him to the health clinic should he stop feeding.
- You obtain a signed release from the mother

Dispatch Information

- 5 hours later, you are dispatched to the same address for an unconscious infant

Initial Impression

- Infant is obtunded
- Cyanotic, diaphoretic
- RR = 50, shallow
- Hot to touch
- Tachycardic
- Hypotensive

Discussion

- ***What would be going through your mind now?***
- ***What mistakes were made?***
- ***Why, as a paramedic or EMT, should you always suggest that an infant with a fever be evaluated immediately by a physician?***

Epidemiology

- Febrile illness accounts for about 15-30% of all ED visits
- Typical infant has 4-6 febrile illnesses in first 2 years of life

A & P Review

- Hypothalamus acts as the body's thermostat
  - Specifically, thermostat is located in the preoptic region of the anterior hypothalamus, near the floor of the third ventricle

A & P Review

- Fluctuations in body temperature detected by thermosensitive neurons in the preoptic nucleus
- Prostaglandin E_2 produced
- Directs autonomic changes in sweat glands, skeletal muscle, peripheral vasculature to cause fever

A & P Review

- Elevation of body temperature occurs via:
  - Increased cell metabolism
  - Increased muscle activity
  - Shivering
  - Peripheral vasoconstriction

A & P Review

- Reduction of body temperature occurs via:
  - Peripheral vasodilation
    - Increased convection, conduction, and radiation of heat
  - Sweating

Pathophysiology

- Causes of fever:
  - Exogenous pyrogens
    - Bacteria, bacterial endotoxins
    - Yeasts, fungi
    - Antigen-antibody complexes
  - Endogenous pyrogens
    - Neutrophiles, monocytes
    - Kupffer cells, alveolar macrophages, spleen cells
    - Increase synthesis of prostaglandins

Pathophysiology

- Peripheral vasoconstriction, shivering, central venous pooling, and behavior (putting on of layers, swaddling) contribute to increased temperature

Pathophysiology

- Is fever beneficial or harmful?
- Pros include:
  - Cellular and humoral response enhancement
  - Direct antimicrobial activity
  - Valuable diagnostic aid
- Cons include:
  - Makes child uncomfortable
  - Increases in metabolic activity
    - Increased O_2 consumption, CO_2 production, water loss

Pathophysiology

- Changes in vital signs with fever
- For each 1.8°F rise in temperature:
  - Increases metabolism about 10%
  - Increases HR 10-15 bpm
  - Increases RR 3-5 bpm

Pathophysiology

- What degree of temperature elevation represents a fever?
  - A study of 18 pediatric residency programs asked the question, “What temperature constitutes a fever in infant < 2 months?”
    - Answers ranged from 100.4ºF – 103ºF
  - Most current practice guidelines recommend 100.4ºF
    - Rectal determination

Pathophysiology

- Infants younger than 3 months with fever are special!
  - Immature immune system may not be able to control infection
  - Risk of serious bacterial illness (SBI) relatively high (up to 10%)
  - Clinical appearance difficult to interpret

Pathophysiology

- Immature immune system may not be able to control infection
  - In utero, infant benefited from maternal antibodies
  - Up to 3 months, has not developed adequate antibodies to effectively fight infectious organisms
- All infants < 3 months with a fever will get a sepsis workup in the ED, regardless of how well they appear

Pathophysiology

- Risk of SBI relatively high (up to 10%)
  - Urinary tract infection, meningitis, bacteremia, bacterial enteritis
- About 20% of infants < 3 months old with a fever will have a fever without an identifiable source (FWS)
  - About 10%-18.5% of these infants with a temp of 100.4ºF or higher will have a SBI

Pathophysiology

- Clinical appearance difficult to interpret
  - No verbal communication
  - Infant has not developed habits, routines to deviate from
  - Infants < 3 months old not alert to surroundings, recognize parents, not social (can recognize parents), cannot interact with environment

Pathophysiology

- **Infants between 3 and 36 months at higher risk of occult bacteremia**
  - **Child febrile but appears well**
  - **No obvious focus of infection**
  - ***S. pneumoniae* (85-90% of cases), *H. influenzae, N. meningitis***
- **Infants with occult bacteremia who do not receive antibiotics**
  - **10-25% develop complications**
    - **Sepsis, pneumonia**
  - **3-6% develop meningitis**

Take-home points for prehospital care providers:

Pathophysiology

If a patient less than 3 years old has a fever he or she should receive an immediate evaluation by a physician.

The risk of serious infection, bacteremia, and DEATH are too significant in this population.

Clinical Assessment

- History important, especially with younger infants
  - For neonate:
    - Explore birth history
      - Risk factors
    - Prematurity
    - Maternal infections
    - Congenital or chronic disease
    - Use of antibiotics by mom or infant

Clinical Assessment

- History
  - Vomiting, diarrhea, frequency of urination
  - Coughing, rhinorrhea, pulling ears?
  - Feeding habits
    - Tolerating fluids?
    - Less feeding?
  - Patient activity
    - Changed significantly?
  - Immunization status?

Clinical Assessment

- History
  - When did the fever start?
    - Are there related symptoms?
    - What has been done at home to control fever?
    - Correct dose of antipyretic administered?
  - Rash present?

Clinical Assessment

- Physical assessment
  - Does the child appear:
    - Unwilling or unable to interact with family/you?
      - When age appropriate
    - Listless, lethargic, or with poor muscle tone?
    - Unalert, or with decreased level of consciousness?
  - All ominous signs in infant with fever

Clinical Assessment

- Physical assessment
  - Head to toe exam to identify source of fever
    - Respiratory: lung sounds, nares, ears
    - Skin: cellulitis, rash, petechiae, jaundice, cyanosis
    - Meningitis: nuchal rigidity
  - Evaluate hydration status
    - Capillary refill
    - Fontanelles, mucus membranes
    - Absence of tears when crying

Clinical Assessment

- SaO_2 determination
  - Identify hypoxia
- Blood glucose determination
  - Fever = increased metabolism and metabolic demand, hypoglycemia possible
- Cardiac rhythm determination
  - Especially if child listless, lethargic, altered level of consciousness, etc.

Treatment

- Assure that the airway is open and that breathing and oxygenation are adequate
  - Supplemental O_2
  - BVM assist, intubation if necessary
- Circulation
  - IV access, need for volume replacement based on history and clinical exam

Treatment

- Antipyretics
  - Acetaminophen (Tylenol)
    - 10-15 mg/kg PO every 4-6h as needed
  - Ibuprofen (Advil, Motrin)
    - 5-10 mg/kg PO every 6-8h as needed

Treatment: Hospital

- General treatment
  - Airway management, ventilation, and oxygenation
  - Aggressive fluid replacement if hypotension present
  - Use of vasopressor agents if hypotension refractory to fluid replacement
    - Sepsis
  - Antimicrobial therapy

Treatment: Hospital

- Almost every infant < 1 month old with fever will get a sepsis workup
  - CBC
  - Urinalysis
  - Lumbar puncture
  - Cultures of blood, urine, spinal fluid
- Inpatient treatment
  - Combination aminopenicillin and cephalosporin therapy

Treatment: Hospital

- Infants aged 1-3 months with fever will get an evaluation based on appearance
  - High-risk, toxic-appearing infants will get the full sepsis workup
    - "Toxic-appearing" = poor feeding, lethargic, irritable behavior
  - Third-generation cephalosporin therapy

Treatment: Hospital

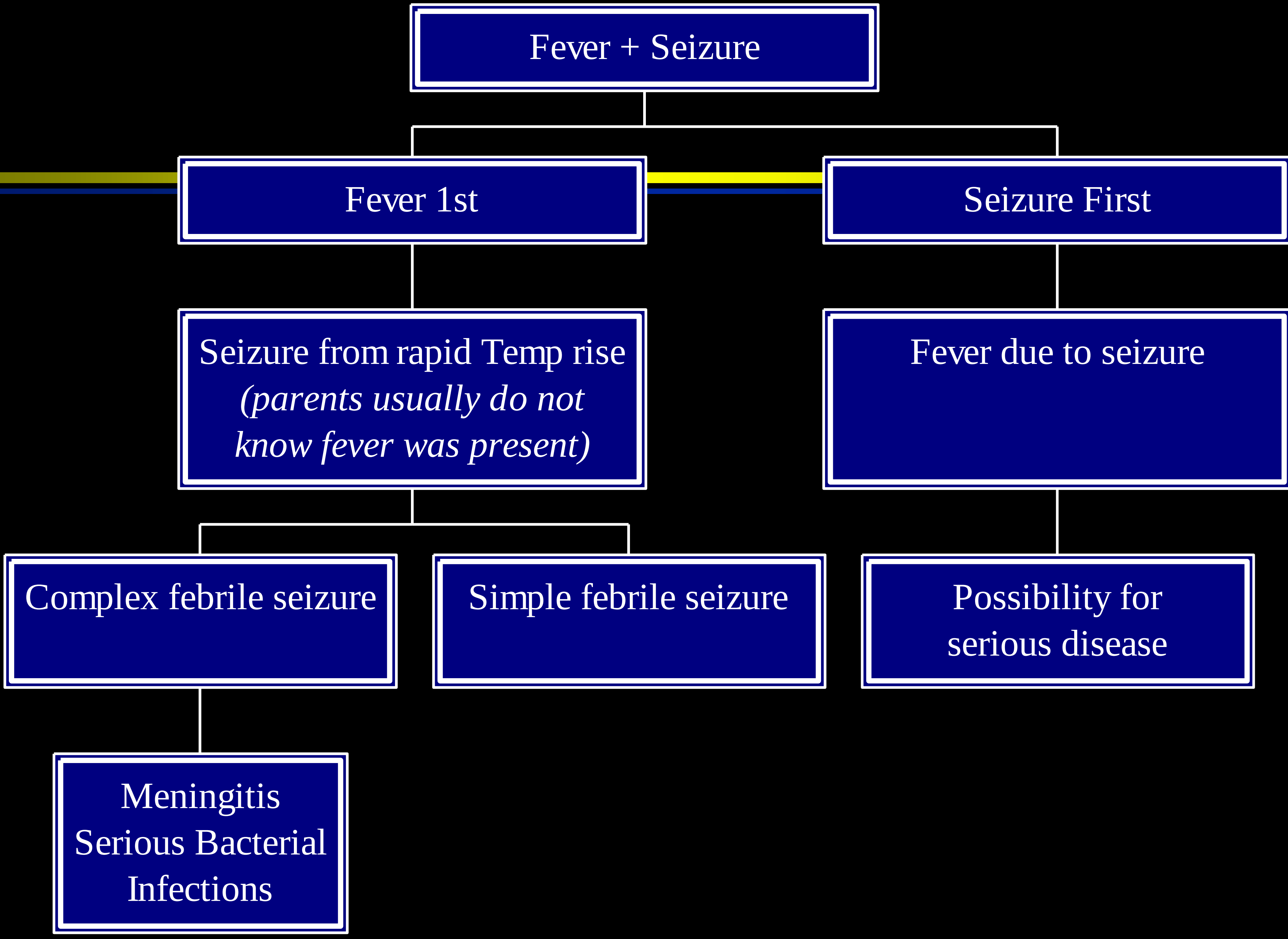
- **Infants aged 1-3 months with fever will get an evaluation based on appearance**
  - **Low-risk, well-appearing infant** may **receive outpatient management**
    - **Reliable caregiver and guarantee of follow-up**
    - **May get a lumbar puncture and culture of CSF, prophylactic antimicrobials**

Treatment: Hospital

- Infants aged 3 months to 3 years stand a better chance of receiving outpatient treatment
  - Normal lifespan development lends itself to a more accurate clinical assessment
- Sepsis workup based on clinical assessment findings
  - "Toxic appearance" = sepsis workup
- Prophylactic antimicrobial therapy likely

Seizures

- Fever can cause seizure
- Seizure can cause a fever
- Non-prehospital diagnoses


Fever + Seizure
Fever 1st
Seizure First
Seizure from rapid Temp rise *(parents usually do not know fever was present)*
Fever due to seizure
Complex febrile seizure
Simple febrile seizure
Possibility for serious disease
Meningitis Serious Bacterial Infections

Why is this important?

- Need to Manage as seizure
  - not febrile seizure
- What are possible causes
  - toxin ingestion/exposure
    - Sympathomimetics
    - Nicotine ingestion
    - Anticholinergics
    - Seratonin Reuptake Inhibitors
  - serious infections
  - hypoglycemia
  - hypoxic seizure

Dispatch Information

- It's 12:30 a.m., and you, a paramedic, and your 2 EMT partners are dispatched to a child having a seizure

Initial Impression

- The patient's father meets you at the front door and brings you upstairs to his daughter's room
- He tells you that he and his wife were awakened by the sounds of their daughter having a seizure

Initial Assessment

- 5 y/o female
- Supine in bed
- Diaphoretic
- Lethargic
- Alert to pain only

Discussion

- *How would you rate the patient's status?*
- *What are your immediate concerns?*
- *What are your immediate actions?*

Assessment

- You perform a physical exam while your partner takes a verbal report from the parents

Assessment

- Physical exam reveals:
  - Airway is open, patient is breathing adequately, equal lung sounds bilaterally
  - Pupils dilated bilaterally, sluggish to light
  - No obvious trauma noted on body
  - Skin warm, pink, diaphoretic
  - Patient responds to verbal stimuli with confused answers
  - Lethargic, seems “tired”

Assessment

- You overhear your partner getting a history from the parents
  - Patient went to bed about 10 p.m.; Mom said she felt like she had a fever
    - Mom said she was warm to touch
  - Patient had a seizure around 12:20 a.m.
  - Full-body seizure activity witnessed
  - Lasted about 2 minutes
  - Patient did not become cyanotic

Assessment

- No past medical history, no medications
- No recent trauma
- No reason to suspect alcohol or drug use

Assessment

- Vital signs:
  - HR = 100 regular
  - RR = 20 regular
  - BP = 92/68
    - 80 + age x 2
  - SpO_2 = 99% room air
  - Capillary refill: Good at 3 seconds

Discussion

- *Is there any additional information you would like?*
- *How would you begin to manage this patient?*

Assessment

- You use a tympanic thermometer to take the patient’s temperature
  - 102°F
- Blood glucose check
  - BG = 112 mg/dL

Assessment

- You note that the patient's mental status has improved, and though she is answering questions appropriately, she is still groggy and a bit lethargic
- Vital signs:
  - HR = 92 regular
  - RR = 18 regular
  - BP = 94/60
  - SpO_2 = 99% room air

Assessment

- The patient's father asks if you think the patient needs to go to the ED for treatment

Discussion

- *What do you tell the father?*
- *Does a patient who experiences a febrile seizure need to go to the ED?*
- *What are the risks involved?*

Treatment

- You and your partner explain to the parents that the seizure was most likely a result of the fever
- You recommend that the patient stay home, get some sleep, and advise the parents to call EMS again should another seizure occur

Treatment

- The father agrees and signs a release form

Dispatch

- It's 3 a.m., and your ambulance is dispatched back to the same address for a child seizing

Initial Impression

- As you are walking back to the patient's room, you can hear the distinct sound of someone breathing through liquid

Initial Impression

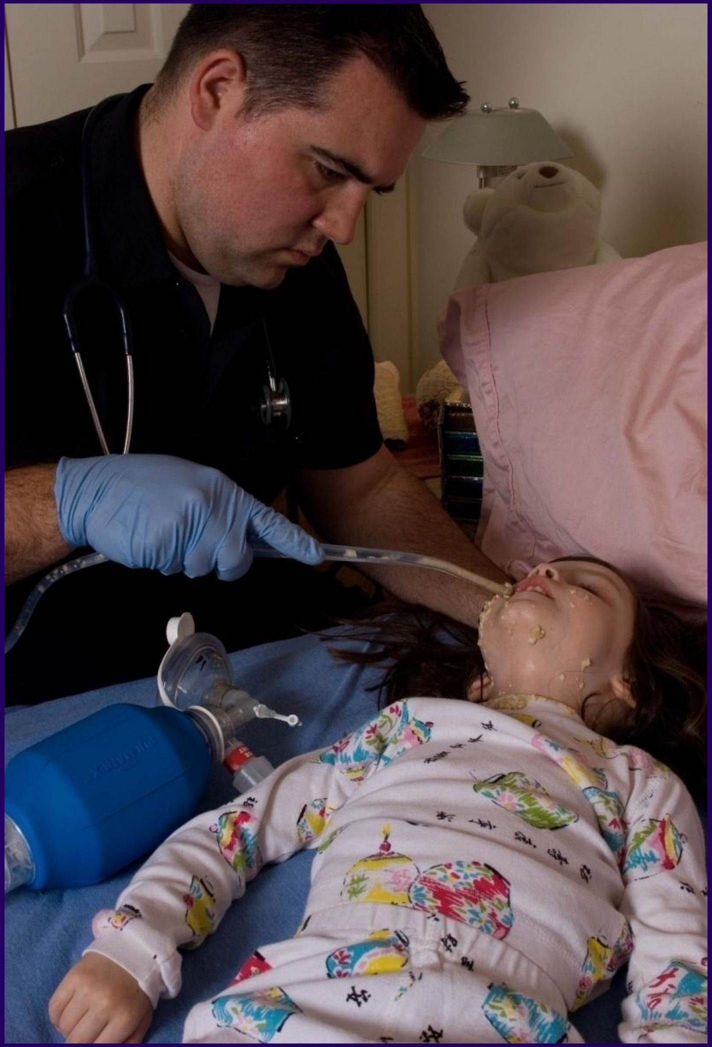
- Patient is actively seizing
- Cyanotic
- Secretions and vomit in airway
- Clenched jaw

Discussion

- *How would you describe the patient's status?*
- *What are your immediate management priorities?*
- *Do you wish you had done anything different earlier?*

Assessment/Treatment

- Your partner tries to suction the patient's airway and attempts to assist ventilations with a BVM and 100% O_2
  - HR = 68 regular
  - SpO_2 = 69%

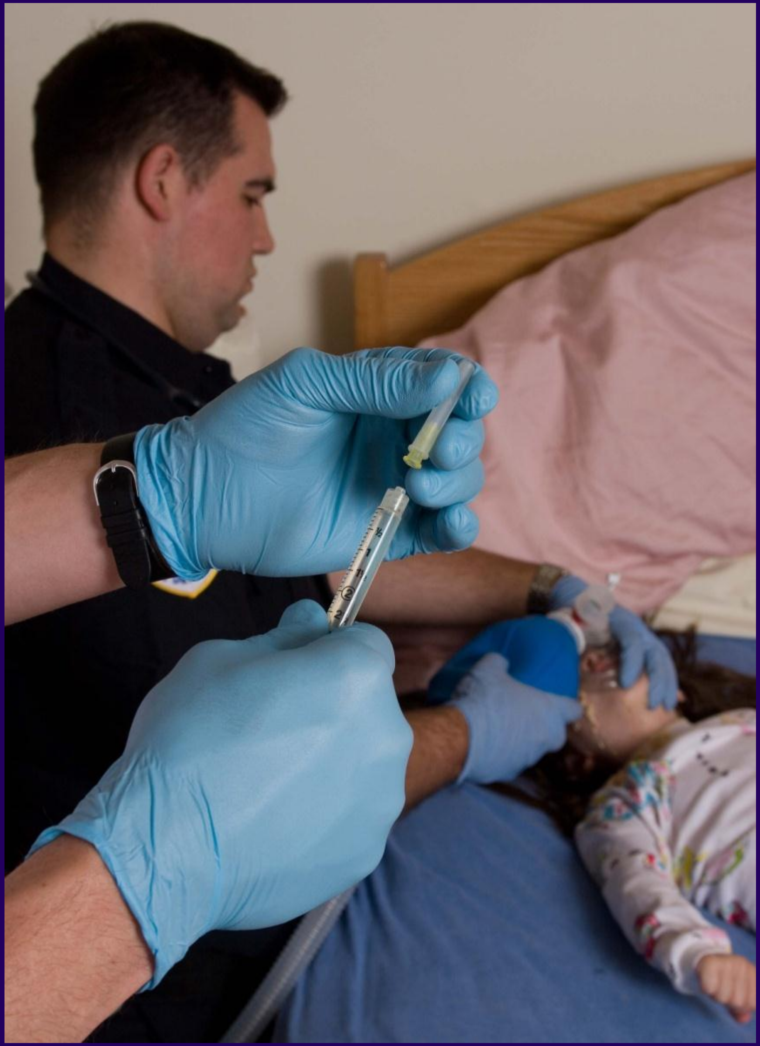


Assessment

- You again explore the patient's history, this time asking if there is a family history of seizures
- The father states that she has a seizure history and takes phenobarbital

Treatment

- You prepare a syringe for rectal diazepam administration



Assessment/Treatment

- The valium is administered, and the patient stops seizing within a minute
- Your partner is able to open the patient's airway and suctions a significant amount of vomit and secretions
- The patient's weak respiration efforts are assisted with the BVM and 100% O_2

Assessment

- You repeat your initial assessment
  - Airway requires a jaw thrust to remain open, though slight snoring noted
  - Auscultation of lung sounds reveals rhonchi to the upper lobes bilaterally
  - Shallow respiratory effort at a rate of 8/min
  - Strong radial pulse is increasing with BVM ventilations, is presently 90 bpm

Discussion

- *How would you classify the patient's status?*
- *What are your management priorities?*

Assessment/Treatment

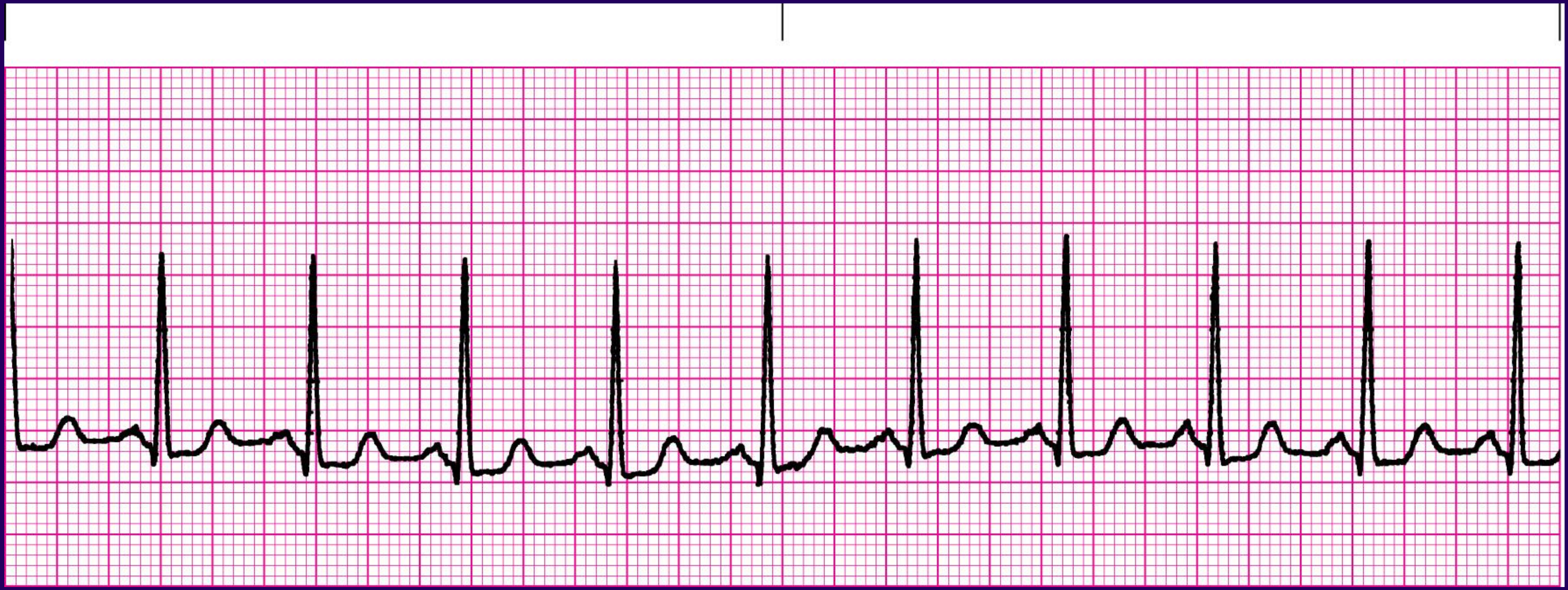
- You insert a nasal airway and note that the snoring stops
  - Equal chest rise and fall noted with BVM ventilations
  - Lung sounds equal bilaterally with rhonchi in the upper lobes

Assessment/Treatment

- Vital signs
  - HR = 104 regular
  - RR = 8 & shallow
  - BP = 92/50
  - SpO_2 = 96% with BVM assist
- IV access
  - 20 g angiocath
  - Microdrip set, 500 mL bag of saline

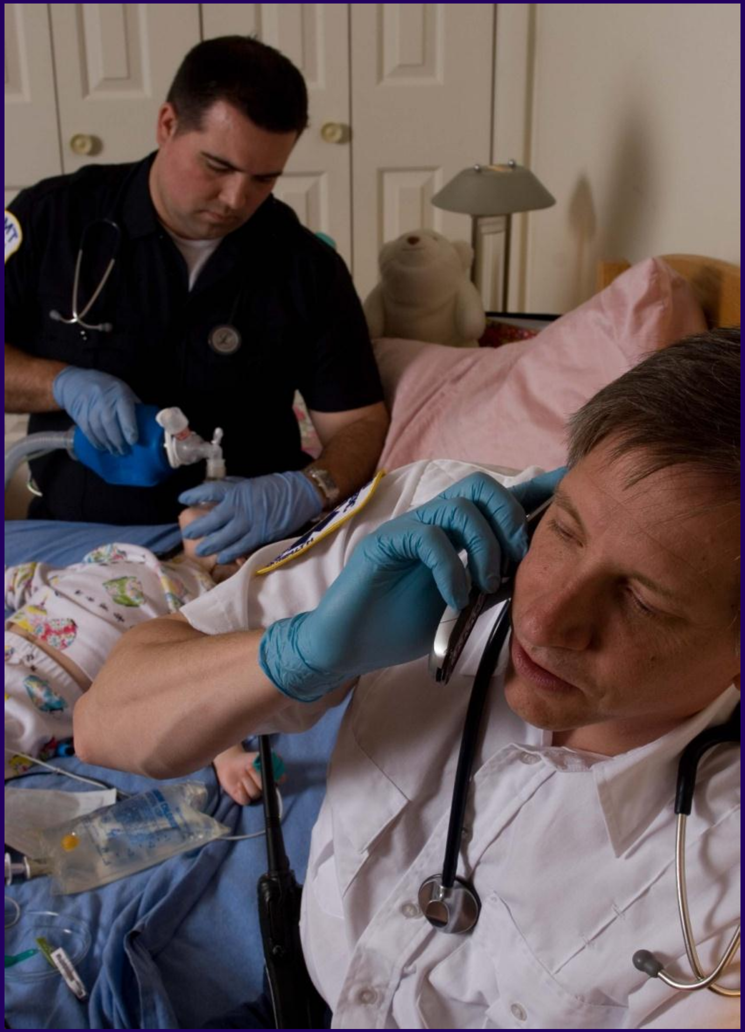
Assessment/Treatment

- **Cardiac monitor:**



Assessment/Treatment

- You contact the ED attending at the receiving facility and give a report



Treatment

- You and your partner package and move the patient to the ambulance
- Transport to the ED is initiated

Assessment/Treatment

- **At time of arrival at the ED, the patient is still responsive to pain only and requires the nasal airway and BVM assist**

ED Treatment and Beyond

- The patient is promptly intubated
- Chest X-ray reveals significant aspiration and atelectasis to the upper lobes bilaterally
- The patient is transferred to the PICU where she is found to have an undiagnosed seizure disorder
- Bad News: Aspiration pneumonia develops and the patient expires 12 days later, never having regained consciousness
- Further Bad News: You and your partners, along with your agency and physician medical director are held liable for not transporting the child following the initial response. An undiscolosed amount was rewarded to the family

Epidemiology

- Febrile seizures occur in 2-5% of children aged 6 months to 5 years
  - 70-75% have simple febrile seizures
  - 20-25% have complex febrile seizures
- Males have slightly higher incidence than females

Epidemiology

- Children who experience a simple seizure are at increased risk of recurrence
  - 1/3 will have another simple seizure
  - Children aged < 12 months at time of first simple seizure have 50% risk
  - Children aged > 12 months at time of first simple seizure have 30% risk

Epidemiology

- Slight relationship between febrile seizures and epilepsy
  - Risk of epilepsy 2-4% in children with febrile seizures
    - 0.5% in general population
  - Appears that children with epilepsy more likely to have a febrile seizure

Pathophysiology

- Seizure
  - Aberrant electrical discharge of brain neurons resulting in abnormal neurologic function
- Status epilepticus
  - State of continuous seizures lasting > 30 minutes or 2 or more generalized seizures without a lucid period between
- Epilepsy
  - Condition in which an individual is subject to recurrent seizures

Pathophysiology

- Ideopathic or primary seizures
  - Occur in otherwise normal individuals
  - No cause identified
- Symptomatic or primary seizures
  - Occur secondary to an identifiable neurologic condition
    - Metabolic, structural, inflammatory, systemic

Pathophysiology

- Types of seizures
  - Simple febrile seizures
    - Generalized (tonic-clonic)
      - Aka grand mal seizure
    - Tonic-clonic movement
      - Tonic: tense, contracted muscles
      - Clonic: rhythmic jerking of extremities
    - Last < 15 minutes
    - Postictal period after

Pathophysiology

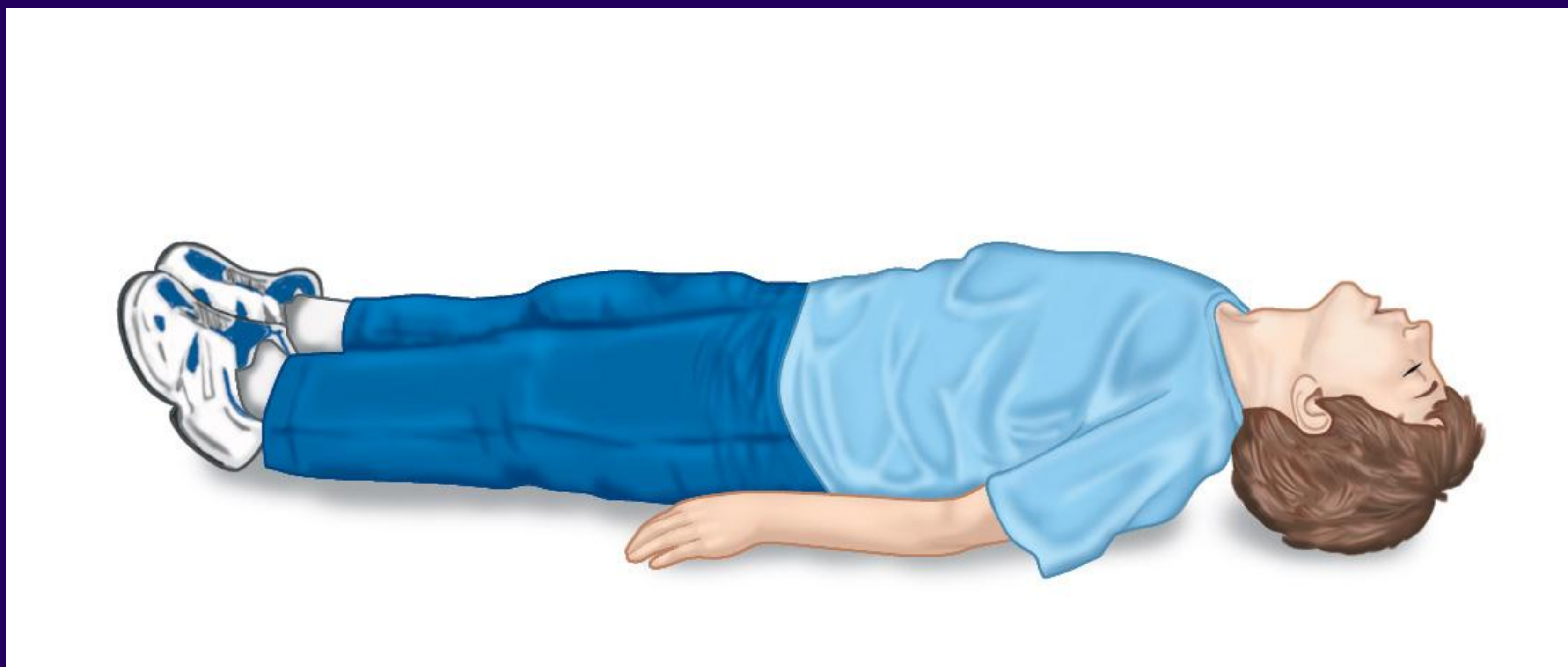
Progression of a seizure

Pathophysiology

Progression of a seizure

Pathophysiology

Progression of a seizure



Pathophysiology

Progression of a seizure

Pathophysiology

- Types of seizures
  - Complex febrile seizures
    - Prolonged
    - Last > 15 minutes
    - Occur more than once in 24 hrs
    - Focal
  - Simple Febrile Seizure
    - Generalized, lasts < 15 min
    - Fever and seizure not secondary to meningitis, encephalitis, or other neurologic illness
  - Symptomatic febrile seizure
    - Generalized, lasts < 15 min
    - Child has preexisting neurologic abnormality or disease

Pathophysiology

- Complex febrile seizure
  - Seizure focal or > 15 min or multiple seizures in close succession
  - Fever and seizure not secondary to meningitis, encephalitis, or other neurologic illness

Pathophysiology

- A febrile seizure:
  - Is associated with fever
    - Specifically, febrile seizures are associated with a rapid rise in temperature above about 101.8ºF
    - Occurs early in most illnesses, may recur
  - Occurs in children aged 6 months to 5 years
  - Occurs without evidence of neurologic abnormality or illness

Pathophysiology

- Febrile seizures are difficult for the paramedic to diagnose in the field!
  - Especially in children < 18 months old
- Plus, the cause of fever should be a concern
- The risk of missing a mass lesion, bacterial infection, or other underlying pathology is too great
  - Transport to the ED for evaluation!

Clinical Assessment

- History
  - Past medical history
    - Children with febrile seizures are neurologically and developmentally healthy before and after seizure
  - History of fever
    - Sudden onset, rapid rise in temperature
    - Lack of temperature < 101.8ºF suggests event was not simple febrile seizure

Clinical Assessment

- History
  - Seizure
    - Signs of partial (focal) seizures rules out simple febrile seizure
    - Seizure > 15 minutes rules out simple febrile seizure

BRADY

Clinical Assessment

- Physical exam
  - Ensure adequate airway and breathing
    - Suction if needed
    - Examine for signs of hypoxia
  - Patient may be postictal at time of your arrival
    - Decreased LOC, altered mental status, dilated and sluggish pupils
    - Should resolve within 15 minutes of end of seizure

Clinical Assessment

- Physical exam
  - Attempt to identify cause of fever
    - Respiratory or urinary tract infection, gastroenteritis
    - Meningitis, encephalitis, sepsis,
    - Cellulitis
  - Presence of rash, petechiae
    - Can indicate serious bacterial infection

Clinical Assessment

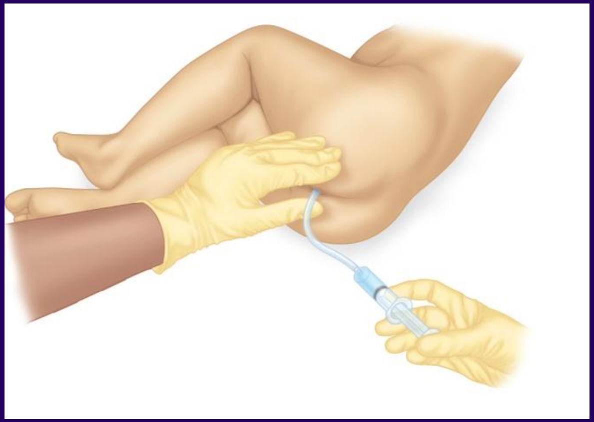
- Physical exam
  - Exam should reveal a developmentally and neurologically healthy child
  - Skin: warm to touch, possibly diaphoretic
    - Determine temp if possible
  - Rule out cardiac dysrhythmia
  - Blood glucose determination
    - Fever and seizure can both contribute to hypoglycemia

Treatment

- Assure open airway and adequate breathing and ventilation
  - Suction
  - Supplemental O_2
  - BVM assist if patient in status, attempt intubation
- Consider need for IV access
  - Medications if child seizing?
  - Fluid volume replacement needed?

Treatment

- Anticonvulsants
  - For prolonged or recurrent seizures
  - Diazepam: 0.2mg/kg IV (Max. individual dose 5mg) OR
    - Diazepam: 0.5mg/kg rectal (Max. individual dose 10mg) if no IV
  - Ativan : .05mg/kg (max individual dose of 2mg)
  - Midazolam (Versed): 0.15mg/kg IV or IM (Max. individual dose 3mg)



Treatment

- Antipyretics
  - Acetaminophen (Tylenol)
    - 10-15 mg/kg PO every 4-6h as needed
  - Ibuprofen (Advil, Motrin)
    - 5-10 mg/kg PO every 6-8h as needed

Treatment

- Determine blood glucose levels and treat if glucose < 70mg/dl
  - D10W IV or IO at 5ml/kg for neonates (< 1month old)
  - D25W IV or IO at 2ml/kg for children < or equal to 2 years (1month to 2 years)
  - D50W IV or IO at 1ml/kg for children > 2 years
  - Glucagon 0.1mg/kg IM (Max. 1.0mg) if no IV available
    - Repeat dextrose x 1 if blood glucose remains < 70mg/dl after treatment

Treatment: Hospital

- Continued support of airway, ventilation, and oxygenation, if necessary
- Anticonvulsant therapy if patient actively seizing
  - Benzodiazeines
  - Phenobarbital
  - Propofol
  - Lidocaine

Treatment: Hospital

- Determination of fever origin
  - Lumbar puncture
  - Full sepsis workup if child appears toxic
  - Radiographic studies
- If febrile seizure diagnosed, patient will not be admitted

Respiratory Emergencies

- Infections
- Upper airway distress
  - Croup
  - Epiglottitis
- Lower airway distress
  - Asthma
  - Bronchiolitis
    - RSV virus

Croup versus Epiglottitis

Table 2-12 Symptoms of Croup and Epiglottitis

Croup	Epiglottitis
Slow onset	Rapid onset
Generally wants to sit up	Prefers to sit up
Barking cough	No barking cough
No drooling	Drooling; painful to swallow
Fever approx. 100–101° F	Fever approx. 102–104° F
	Occasional stridor

Epiglottitis

- Posturing of the child with epiglottitis
- Often there will be excessive drooling

Epiglottitis

- The child with epiglottitis should be administered humidified oxygen and transported in a comfortable position

Asthma

- The young asthma patient may be making use of prescribed inhalers to relieve symptoms.

Dispatch Information

- It's 3 a.m., and you and your partner, both paramedics, are dispatched to a "child with difficulty breathing"

Initial Impression

- You arrive on scene, get your equipment, and walk up to the open front door
- The patient's father calls you to the back of the house
- While walking back to the patient, you can hear stridorous respirations

Discussion

- ***Based on the dispatch, what equipment did you bring with you into the house?***
- ***What is the differential diagnosis for stridor?***
- ***Are you concerned?***
  - ***Why or why not?***

Initial Impression

- 8 y/o male
- Sitting on bed, tripoding and drooling
- Good color
- Breathing about 22 X a minute
- Pt distressed, has been crying

Discussion

- *How would you describe the patient's status?*
- *What would be your immediate actions?*

Treatment/Assessment

- Your partner places the patient on a nonrebreather mask and takes vital signs while you get a history from the father

Assessment

- Dad states that the patient went to bed at 9 p.m. with a sore throat
- Patient could not sleep, developed stridor about 1/2 hour ago
- No significant medical history
- No medications
- No known allergies

Assessment

- Your partner states that the patient's lungs are clear and reports vital signs of:
  - HR = 102 regular
  - RR = 22 regular
  - BP = 122/72
  - SpO_2 =
    - 99% room air
    - 100% on 15 lpm

Discussion

- ***What are you suspecting is the cause of the patient's stridor?***
- ***Is there any additional information you would like to narrow the possibilities?***

Assessment

- The patient indicates that he has not suffered a foreign body aspiration or ingestion
- Patient has not had a productive cough, no pus or mucus from airway
- Only complaint is of a very sore throat and pain with swallowing

Detailed Assessment

- **Physical exam:**
  - **Skin hot, dry, slightly pale**
  - **Lung clear all fields bilaterally**
  - **Auscultation of larynx reveals it to be the source of the stridor**
  - **Inspection of oral cavity unremarkable**

Discussion

- ***Considering the information provided, what do you think is the cause of the stridor?***

- ***How would you treat this patient?***

Treatment

- IV access
  - 18 gauge, left anticubital area, microdrip set, and a 500 mL bag of saline
- Cardiac monitor

Treatment

- Cardiac rhythm interpretation:

Ongoing Assessment

- Your partner notes that the patient seems a little more agitated and that the stridor is a bit worse
- Vital signs:
  - HR = 110 regular
  - RR = 26 regular
  - BP = 120/78
  - SpO_2 = 100%

Ongoing Assessment

- You promptly load the patient on the stretcher and begin the 25-minute transport to the pediatric ED at the regional trauma center.

Ongoing Assessment

- Once in the ambulance, you note that the stridor is definitely worse and vital signs of:
  - HR = 114 regular
  - RR = 28 slightly labored
  - SpO_2 = 100%

Discussion

- *What are your options at this point?*
- *Given the information provided, how would you manage the situation?*

Ongoing Assessment/Treatment

- Realizing that the patient's airway may be occluding, you decide to divert to a Level II trauma center that is 5 minutes away
- You make contact with the ED attending and give your report, making clear that:
  - You suspect epiglottitis
  - The patient's airway has been deteriorating
  - Endotracheal intubation may be necessary

Ongoing Assessment/Treatment

- You prepare a BVM and your intubation equipment in case it is needed

Ongoing Assessment/Treatment

- You also tell the patient that he is doing a great job and that he will be in the ED in a few minutes
- He nods his head and tries to smile

Ongoing Assessment

- You are 3 minutes from the ED with the following vital signs:
  - HR = 116 regular
  - RR = 28 regular
  - BP = 122/78
  - SpO_2 = 100%
- You note:
  - Patient is alert but very anxious
  - Slight accessory muscle use
  - Skin warm, pale, slightly diaphoretic

Discussion

- ***Would you:***
  - ***Assist with a BVM?***
  - ***Attempt endotracheal intubation?***
  - ***Continue supplemental oxygen administration only?***
- ***What are the benefits and risks of each?***

Ongoing Assessment

- You decide not to assist BVM ventilations or attempt intubation because:
  - The patient still "looks strong," does not appear to be near failure
  - SpO_2 is 100%
  - BVM assist might agitate him
  - Endotracheal intubation attempt may worsen the periglottic edema
  - You are now 2 minutes from an ED that is expecting you

Ongoing Assessment

- There are no changes by the time you arrive at the ED
- You bring the patient into the ED, where a team is awaiting your arrival

ED Treatment and Beyond

- The ED attending and an anesthesiologist both agree that endotracheal intubation is necessary
- RSI is performed, and the anesthesiologist is able to intubate the trachea on the first attempt
  - You hear her remark that “it was a tough tube, lots of swelling in there!”

ED Treatment and Beyond

- Blood cultures are obtained
- Lab specimens are obtained
- Cefuroxime administered
  - Effective against *H. influenzae*
- Radiograph confirms ET tube depth
- Critical care transport to University Hospital's PICU is arranged

Epidemiology

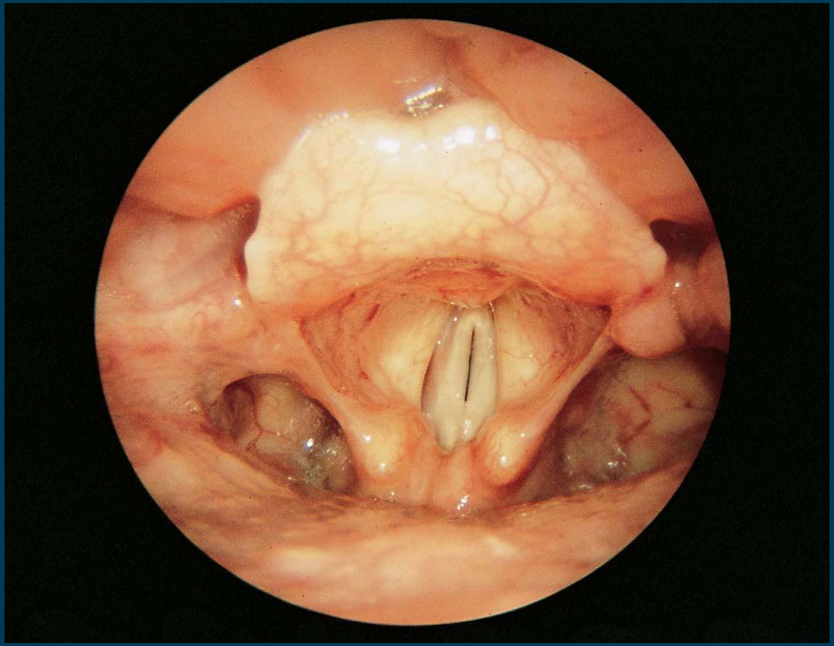
- Epiglottitis on the decline
  - 11 per 10,000 hospital admissions prior to 1990
  - < 2 per 10,000 hospital admissions since 1990
- Mortality as high as 10% in severe cases where airway not protected with intubation
  - Mortality close to 0 in pediatric centers
  - Delay in diagnosis associated with a 9-18% mortality

Epidemiology

- Median age about 6 years; can occur at any age
  - Traditionally, has been most frequent in children aged 3-7 years
  - *H. influenzae* vaccinations have changed the demographics significantly
- 60% male predominance

A & P Review

- **Airway anatomy**
  - **Corniculate cartilage**
  - **Cuneiform cartilage**
  - **Vocal cords**
  - **False vocal cords**
  - **Epiglottis**



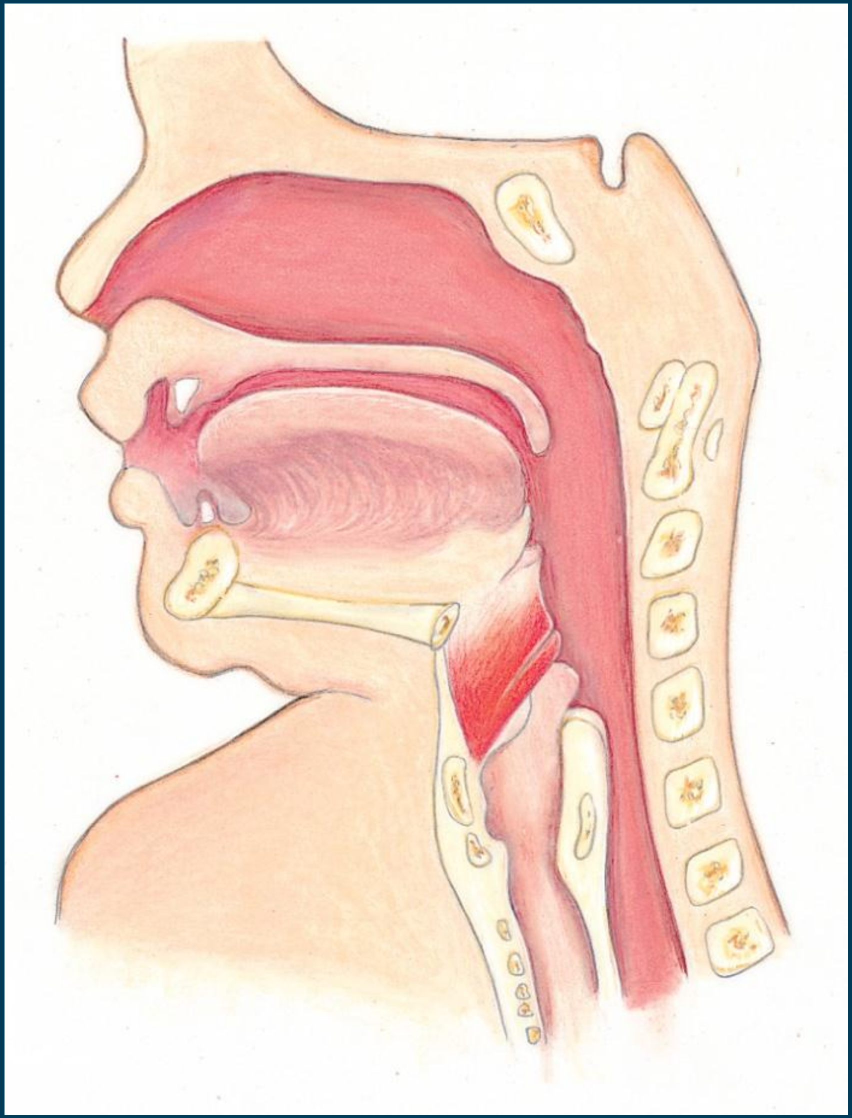
Pathophysiology

- Causes of stridor:
  - Epiglottitis
  - Croup
  - Retropharyngeal abscess
  - Foreign body
    - Foreign bodies in trachea and esophagus can cause stridor
  - Bacterial tracheitis

Pathophysiology

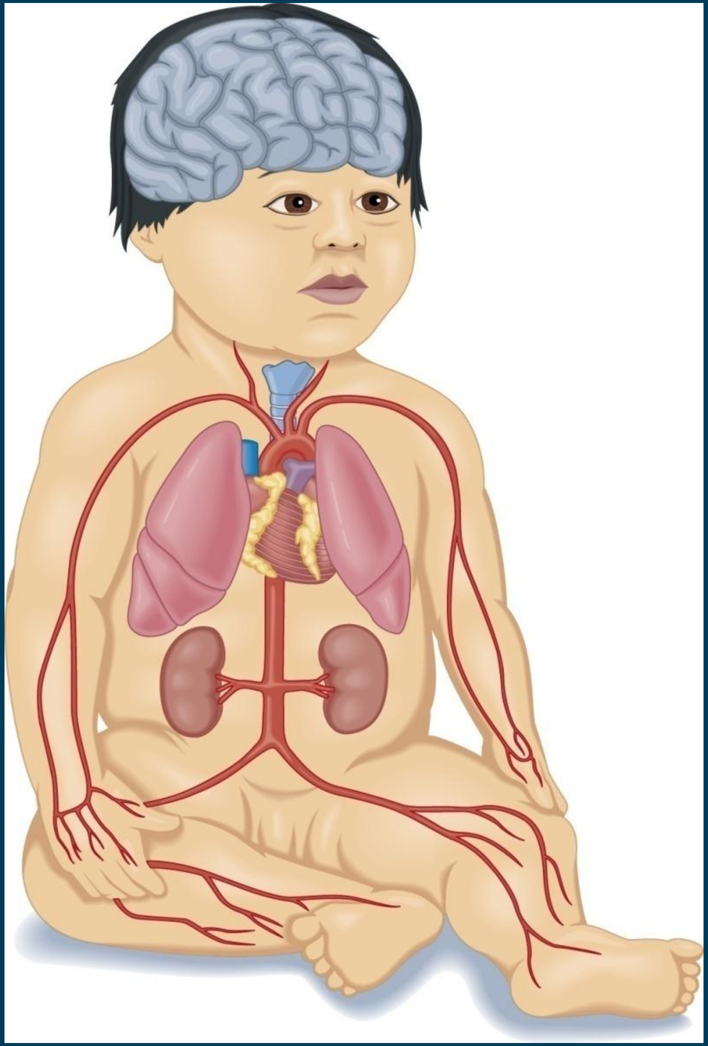
- **Local invasion of the tissue around and including the epiglottis**
  - ***H. influenzae*** **most common cause**
- **Epiglottis, supraglottic structures, aryepiglottic folds, false vocal cords become inflamed, edematous**
  - **Narrowed airway: stridor**
  - **Possible respiratory compromise**

Pathophysiology



Pathophysiology

- Organism invasion of bloodstream can lead to bacteremia
- Bacteremia can lead to infection of tissues and organs



Clinical Assessment

- History important to determine etiology of stridor
  - Chance of foreign body ingestion/aspiration?
  - Recent illness?
  - Interaction with other sick children?
  - Acute or slow onset?

Clinical Assessment

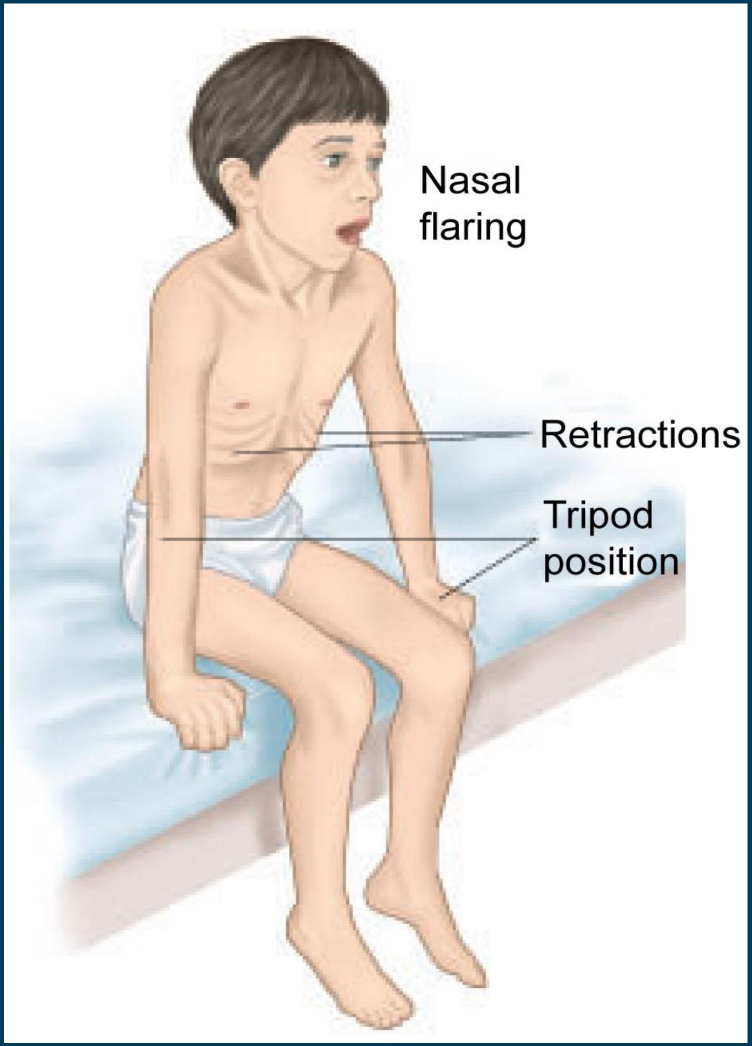
- History: epiglottitis characterized by:
  - Acute onset of severe symptoms
    - Older children may have prolonged onset, more subtle symptoms
  - Fever followed rapidly by stridor and difficulty breathing

Clinical Assessment

- Physical exam
  - "3 Ds"
    - Classic clinical triad of drooling, dysphagia, and distress (restlessness, anxiety)
  - Tripoding or sniffing position
    - Maximize air entry
  - Fever
  - Stridor, muffled or hoarse voice, sore throat

Clinical Assessment

- Physical exam
  - Indicators of severe distress, poor prognosis:
    - Suprasternal, intercostal retractions
    - Nasal flaring
    - Panic, severe anxiety
    - Lethargy, altered mental status, stupor
    - Cyanosis, decreased SpO_2



Clinical Assessment

- Physical exam
  - Cardiac rhythm determination
  - Pulse oximetry
    - Rule out hypoxia

Treatment

- Treatment for epiglottitis centers around:
  - Airway maintenance
  - Oxygenation
  - Making the patient comfortable

Treatment

- Assure patent airway and ventilation
  - If patient in severe distress, endotracheal intubation may be necessary
  - Attempt intubation *only* if you are convinced that the patient is in respiratory failure or is at risk of complete airway occlusion from edema
  - Needle cricothyrotomy may be necessary in cases of total occlusion
    - Extremely rare

Treatment

- Assure oxygenation
  - High-flow, humidified, 100% O_2
  - Nonrebreather mask, blow-by for younger children who will not tolerate mask

Treatment

- IV access if patient will require meds, fluid administration
  - Agitation can make already labored breathing worse
- Reduce anxiety
  - Have caregiver accompany patient, administer blow-by O_2

Treatment

- Cardiac monitor
  - Monitor cardiac rhythm
- Position of comfort
  - Tripod, sniffing position

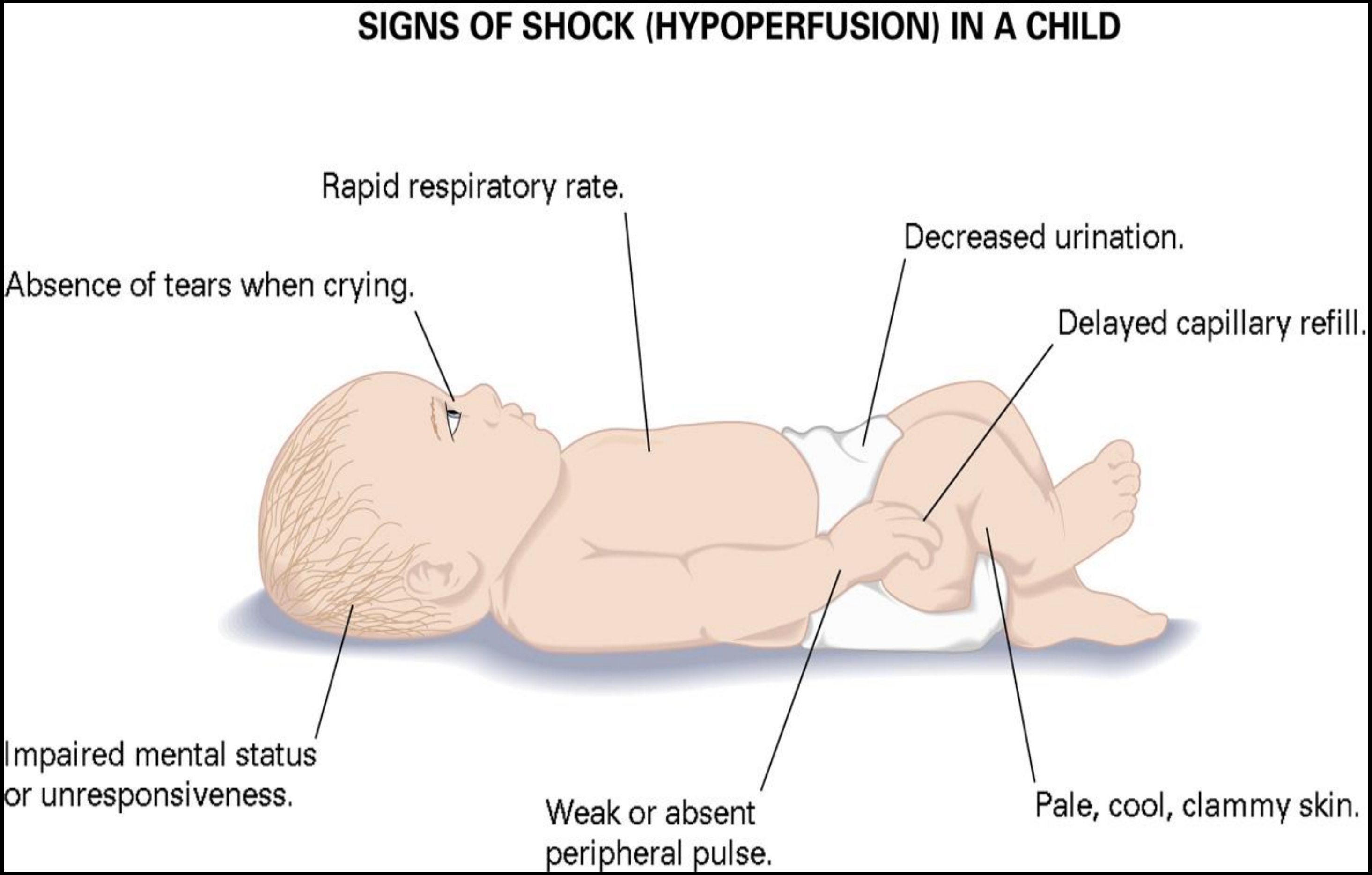
ED Treatment and Beyond

- Continue supportive airway care and oxygenation
- Establish IV access if not already done
- X-ray
  - Thumb sign: lateral view of swollen epiglottis
- Obtaining of blood cultures
- Antibiotic administration

Vomiting/Diarrhea

Shock

Signs and Symptoms of Shock (hypoperfusion) in a Child



General Management

- Graded approach to treatment
- Airway – Trauma (C-spine)
- Ventilation and oxygenation
- Monitor with pulse oximetry or capnography
- Circulation
- Non-cardiogenic: Fluid (NS, LR)
- Cardiogenic: Dysrhythmia management as necessary

Noncardiogenic

- **Incidence: common**
- **Pathophysiology**
  - **Intravascular volume depletion**
- **Severe dehydration**
  - **Vomiting, diarrhea**
- **Blood loss**
  - **Trauma**
  - **Other, e.g., GI bleed**

Dehydration

Table 2-13 SIGNS AND SYMPTOMS OF DEHYDRATION

Signs/Symptoms	Mild	Moderate	Severe
Vital Signs			
Pulse	normal	increased	markedly increased
Respirations	normal	increased	tachypneic
Blood pressure	normal	normal	hypotensive
Capillary refill	normal	2–3 seconds	> 2 seconds
Mental Status	alert	irritable	lethargic
Skin	normal	dry and ashen	dry, cool, mottled
Mucous Membranes	dry	very dry	very dry/no tears

Distributive Shock

- Epidemiology
  - Uncommon
- Etiology
  - Septic
  - Neurogenic
  - Anaphylaxis
- Pathophysiology
  - Peripheral pooling due to loss of vasomotor tone
- Management: Fluid/Vasopressor

Allergic Reaction/Anaphylactic Shock

- **Management**
  - Bronchospasm present
  - Albuterol 2.5mg/3ml via nebulizer (repeat every 15 minutes as necessary)
  - Ipratropium Bromide 0.5mg via nebulizer
  - Shock: Epinephrine 1:1000 solution at 0.01mg/kg via subcutaneous injection
  - IV NS and fluid bolus at 20ml/kg x 2 to a total of 60ml/kg
  - Diphenhydramine: 1.0mg/kg IV or deep IM (maximum individual dose of 50mg)
  - Methylprednisolone: 1.0mg/kg
  - Severe shock: Cimetidine (Tagamet) 5-10mg/kg IV piggyback over 5-10 minutes or IM

Hypoglycemia

- Pathophysiology
  - Children have limited glucose storage
  - In severe cases and not promptly treated, can cause brain damage
  - Blood glucose < 70mg/dl

Hypoglycemia

Table 2-14 Signs and Symptoms of Hypoglycemia

Mild	Moderate	Severe
Hunger	Sweating	Decreased level of consciousness
Weakness	Tremors	Seizure
Tachypnea	Irritability	Tachycardia
Tachycardia	Vomiting	Hypoperfusion
Shakiness	Mood swings	
Yawning	Blurred vision	
Pale skin	Stomach ache	
Dizziness	Headache	
	Dizziness	
	Slurred speech	

Management

- Assist airway and ventilation as necessary
  - Monitor delivery with pulse oximetry or end tidal C02
- Initiate cardiac monitoring
- IV NS, if unable to obtain in child proceed with IO
- Determine blood glucose and < 70mg/dl

Pharmacological Management

- D10W at 5ml/kg for neonates
- D25W at 2ml/kg for children < or equal to 2 years
- D50W at 1ml/kg for children > 2 years
- IV or IO access not available
  - Glucagon 0.1mg/kg IM (Maximum dose 1.0mg)
- Repeat Dextrose x 1 if
  - Blood glucose remains < 70mg/dl after treatment
- Altered Mental Status
  - Naloxone at 0.1mg/kg (maximum individual dose 2.0mg) via IV or IO

Hyperglycemia

Table 2-15 Signs and Symptoms of Hyperglycemia

Early	Late	Ketoacidosis
Increased thirst Increased urination Weight loss	Weakness Abdominal pain Generalized aches Loss of appetite Nausea Vomiting Signs of dehydration, except increased urinary output Fruity breath odor Tachypnea Hyperventilation Tachycardia	Continued decreased level of consciousness progressing to coma Kussmaul respirations (deep and slow) Signs of dehydration

Hyperglycemia

- Leads to dehydration and ketoacidosis
- Management
  - Airway and circulation
  - Cardiac monitoring
  - Measure blood glucose
  - NS or LR bolus of 20ml/kg to 60ml/kg

Meningitis

- Infection of the brain and spinal cord lining
- Bacterial, viral, and on occasion fungal causes
- Primary airborne transmission
- Often begins as cold, sinus infection, or middle ear infection and infiltrates brain

Signs and Symptoms

- Vary with age
  - Infants: poor feeding, irritability, fever
  - Children: Fever, malaise, headache, stiff sore neck, nausea and vomiting, rash, acute confusion, seizures
  - Treatment: Supportive and treat for shock

Poisoning and Toxic Exposure

- Incidence
  - Children account for the majority of poisoning
  - Major cause of preventable death in children under five years of age
- Pathophysiology
  - Depends upon type of poison or toxin and the extent of exposure

Some of the poisons commonly ingested by children

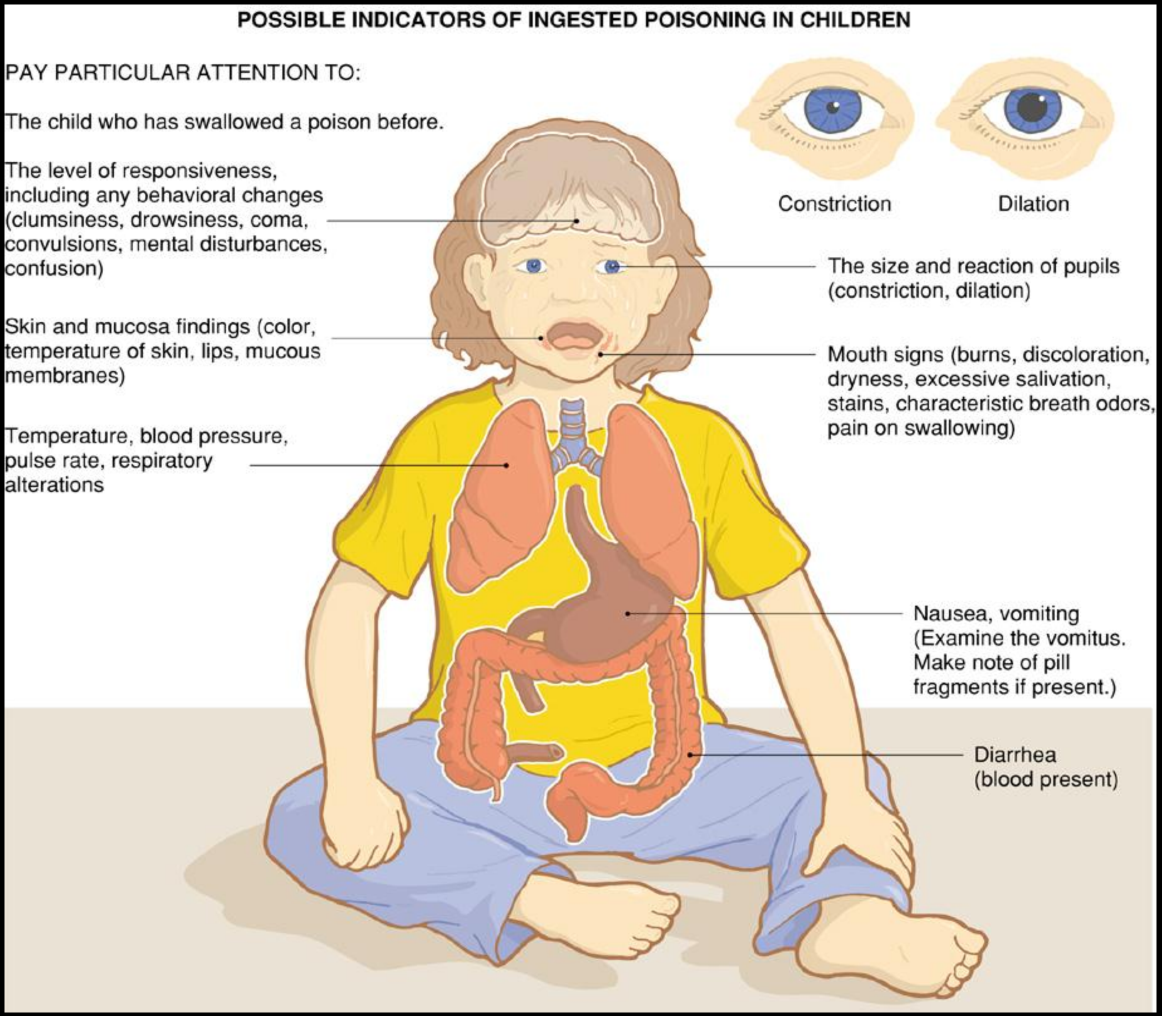
Common Substances of Pediatric Poisonings

- Alcohol, barbiturates, sedatives
- Amphetamines, cocaine, hallucinogens
- Anticholinergic
- Aspirin
- Corrosives
- Digitalis, beta-blockers
- Hydrocarbons
- Narcotics
- Organic solvents (inhaled)
- Organophosphates

Signs and Symptoms

- Vary depending upon both the poisoning/toxic substance and the time since the child was exposed
  - Respiratory system depression
  - Circulatory system depression
  - CNS stimulation or depression
  - Mind-altering ability
  - Gastrointestinal system irritation

Possible indicators of ingested poisoning in children



Management

- Airway, breathing, oxygenation
- Initiate cardiac monitoring and determine rhythm
- IV NS or LR
- Respiratory depression is present and a narcotic overdose is suspected
  - Administer Naloxone at 0.1mg/kg (maximum dose 2.0mg) via IV, IO, or IM route

Management

- Organophosphates
  - High dose atropine (goal is to improve respiratory difficulty and decrease secretions)
  - Atropine 0.02mg/kg IV (minimum dose 0.1mg)
- Tricyclic Overdose
  - With hypotension or wide complex arrhythmia
  - Sodium bicarbonate 1mEq/kg IV
  - May repeat every 10 minutes

Management

- Calcium channel and beta-blocker overdose
  - Glucagon 0.1mg/kg IM or IV (maximum dose 1.0mg), if inadequate response
  - Atopine 0.02mg/kg (minimum dose 0.1mg) for symptomatic bradycardia, if inadequate response
  - Calcium chloride 0.3ml/kg slow IV over 2 minutes for calcium channel blocker toxicity

Management

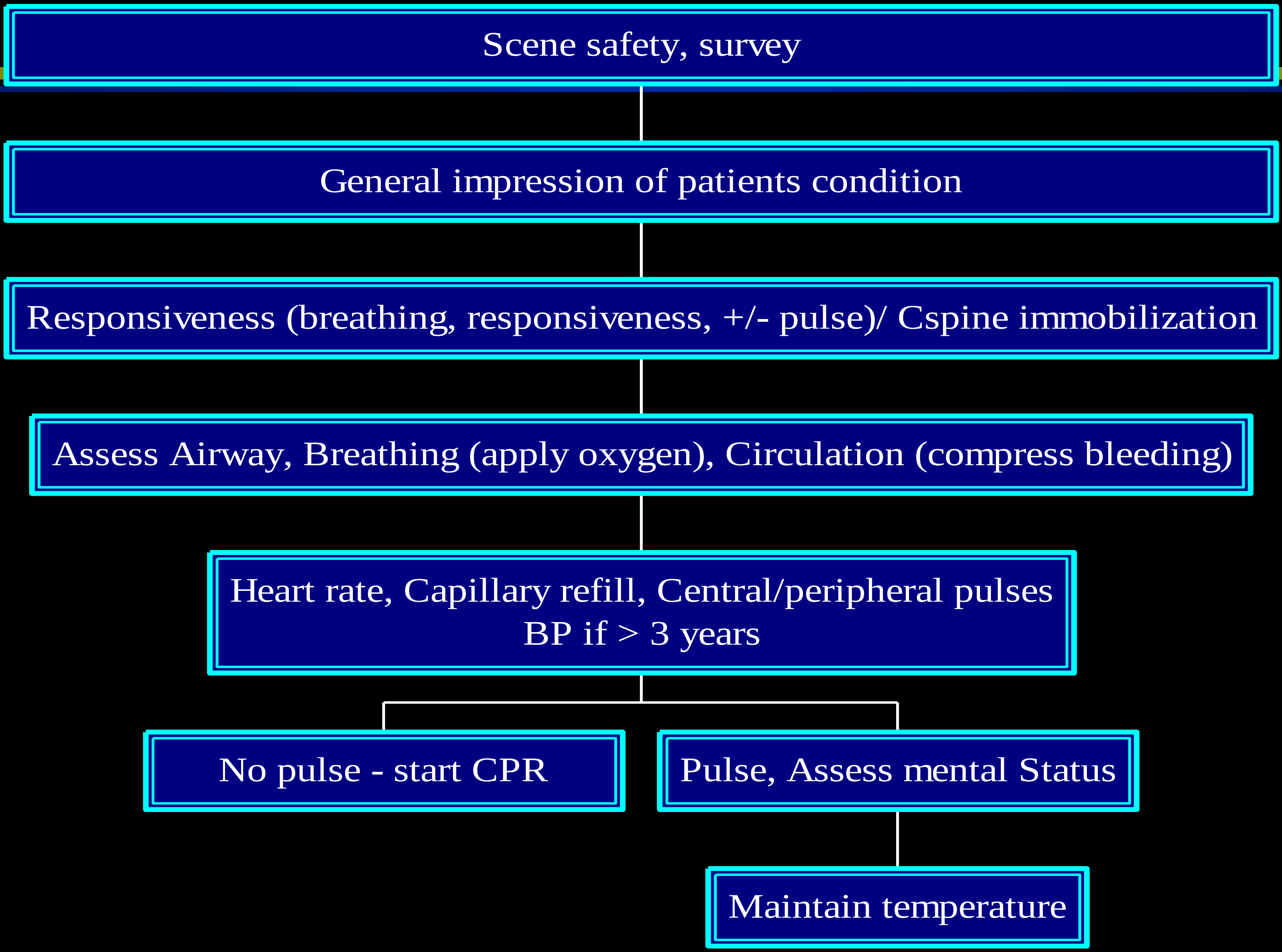
- Dystonic reactions: acute uncontrollable muscle contractions
- Diphenhydramine (Benadryl) 1mg/kg IV or deep IM (maximum dose 50mg)
- Treat glucose < 70mg/dl
- Non-pharmacological
  - Take pills, substances, containers to hospital

General Illness Protocols

Protocols

- Source
  - National Association EMSPhysicians - 2000
  - American Heart Association new guidelines
- Definitions
  - AHA/Pediatric Advanced Life Support ≤ 8 years
    - Airway becomes adult like
    - Shockable rhythms
    - Cspine/head shape/stresses
    - PALS algorithms/American Heart
  - General definition ≤ 12 years
    - Broeslow tape
    - 40 kilograms or less
  - Trauma alert ≤ 15 years

BLS Protocol



ALS Protocol (Assuming BLS functions complete)

Suction Airway/Open/secure airway
Pulse oximetry check
Assist Breathing/Ventilation

Initiate Cardiac Monitoring

If shock, vascular access **[ACCUCHEK on all who Need IV/IO]**

IO if cannot start IV < or = 5 years
Fluid bolus 20 ml/kg IV up to 3 times, reassessing between bolus

If unstable, critical initiate transport
Focused History and Examination en route

Broeslow for all meds, equipment sizes
See Specific Protocols for management of Specific Complaints

Thank you!