Pediatric Potpourri:
Croup, Bronchiolitis and Fever

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Objectives

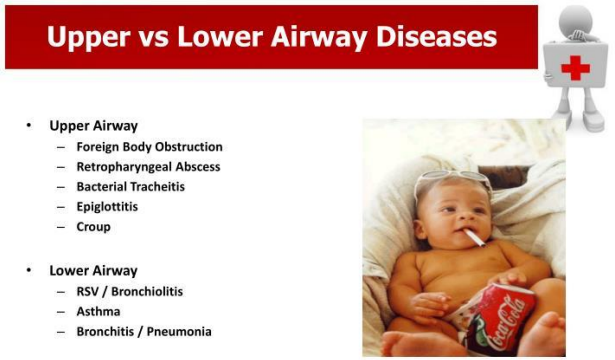
1. Recognize differences between the pediatric and adult airway

2. Recognize respiratory distress in the pediatric population

3. Recognition and management of croup in the pediatric patient

4. Recognize presentation and management and controversies associated with bronchiolitis in the pediatric population

5. Discuss management of the febrile infant and child



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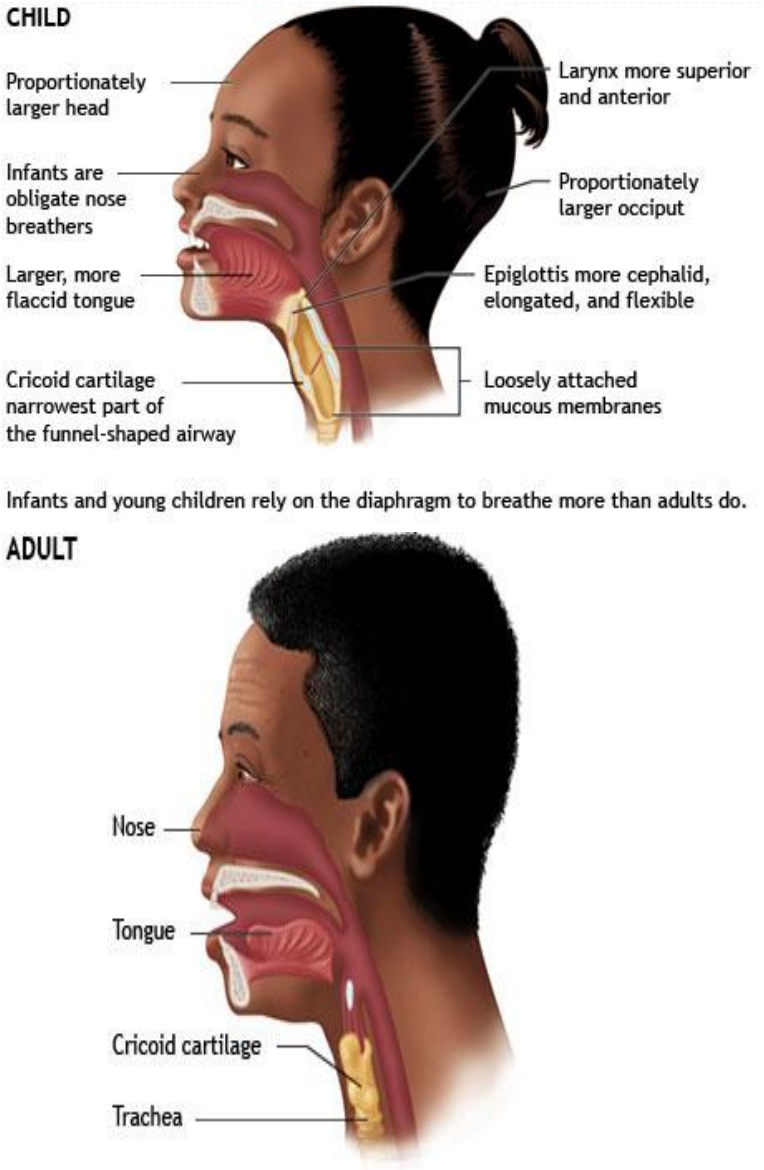
Introduction

- Infants and young kids have small airways compared to adults
- Can quickly develop clinically significant airway obstruction
- Acute airway obstruction- whatever the etiology- can be life threatening
- Complete obstruction will lead to respiratory failure →progress to cardiac arrest in minutes
- Prompt recognition and management of airway compromise is critical to good outcome

Pediatric vs Adult Airway

TABLE 3-1 Comparison of Infant and Adult Airways[1-3]

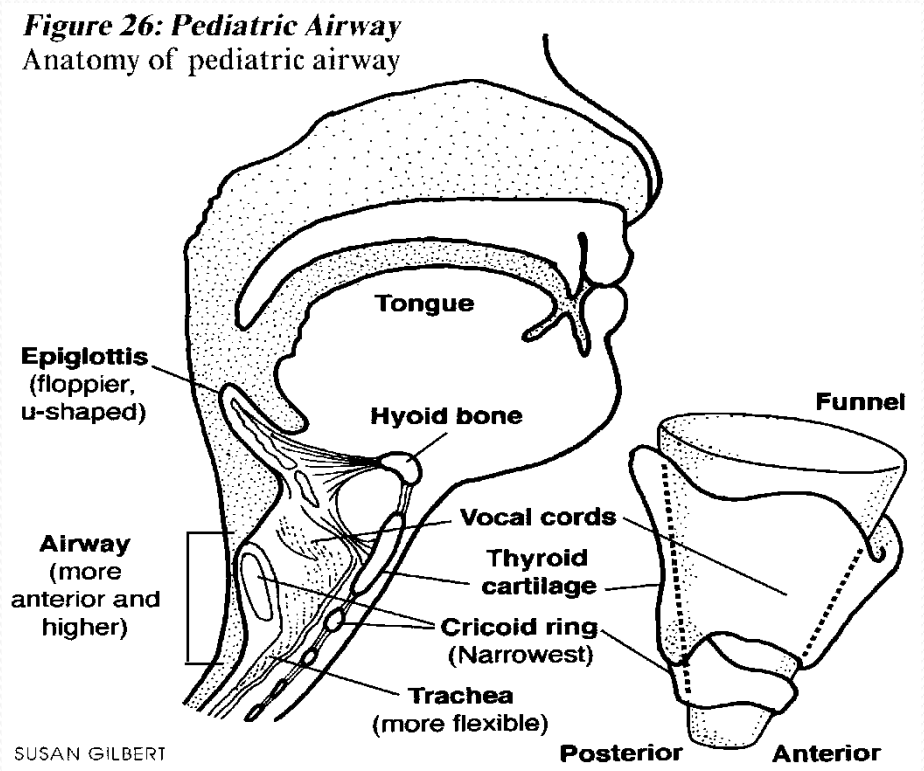
	Infant	Adult
Head	Large prominent occiput resulting in sniffing position	Flat occiput
Tongue	Relatively larger	Relatively smaller
Larynx	Cephalad position, opposite C2 and C3 vertebrae	Opposite C4 to C6
Epiglottis	Ω shaped, soft	Flat, flexible
Vocal cords	Short, concave	Horizontal
Smallest diameter	Cricoid ring, below cords	Vocal cords
Cartilage	Soft, less calcified	Firm, calcified
Lower airway	Smaller, less developed	Larger, more cartilage

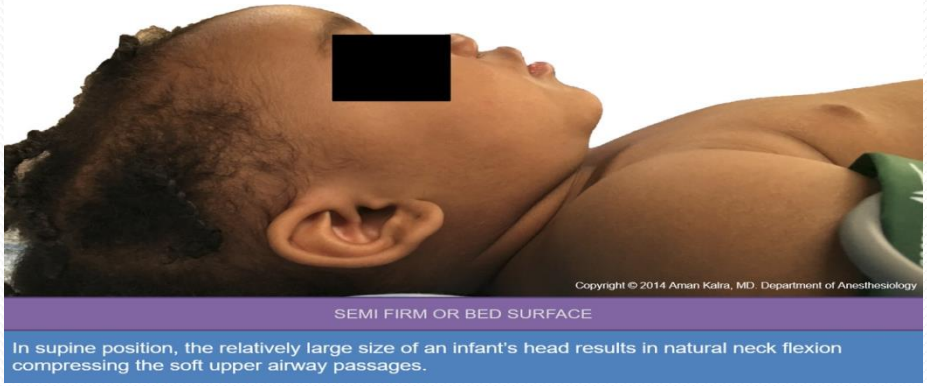


Anatomy

- Infant larynx:
  -More superior in neck
  -Epiglottis shorter, angled more over glottis
  -Vocal cords slanted: anterior commissure more inferior
  - Vocal process 50% of length
    -Larynx cone-shaped:
    narrowest at subglottic cricoid ring

  -Softer, more pliable: may be gently flexed or rotated anteriorly
- Infant tongue is larger
- Head is naturally flexed





Evaluation

- Begins with rapid assessment of respiratory status
- “Who needs resuscitation” ?
- Focus :

  upper airway patency

  degree respiratory effort

  efficiency of respiratory function
- History: onset of symptoms and presence of fever
- Context of Pediatric Assessment Triangle

Pediatric Assessment Triangle

- Observational assessment
- Formalizes the “general impression”
- Establishes the severity of illness or injury
- Determines the urgency of intervention
- Identifies general category of physiologic abnormality or state

SICK OR NOT SICK

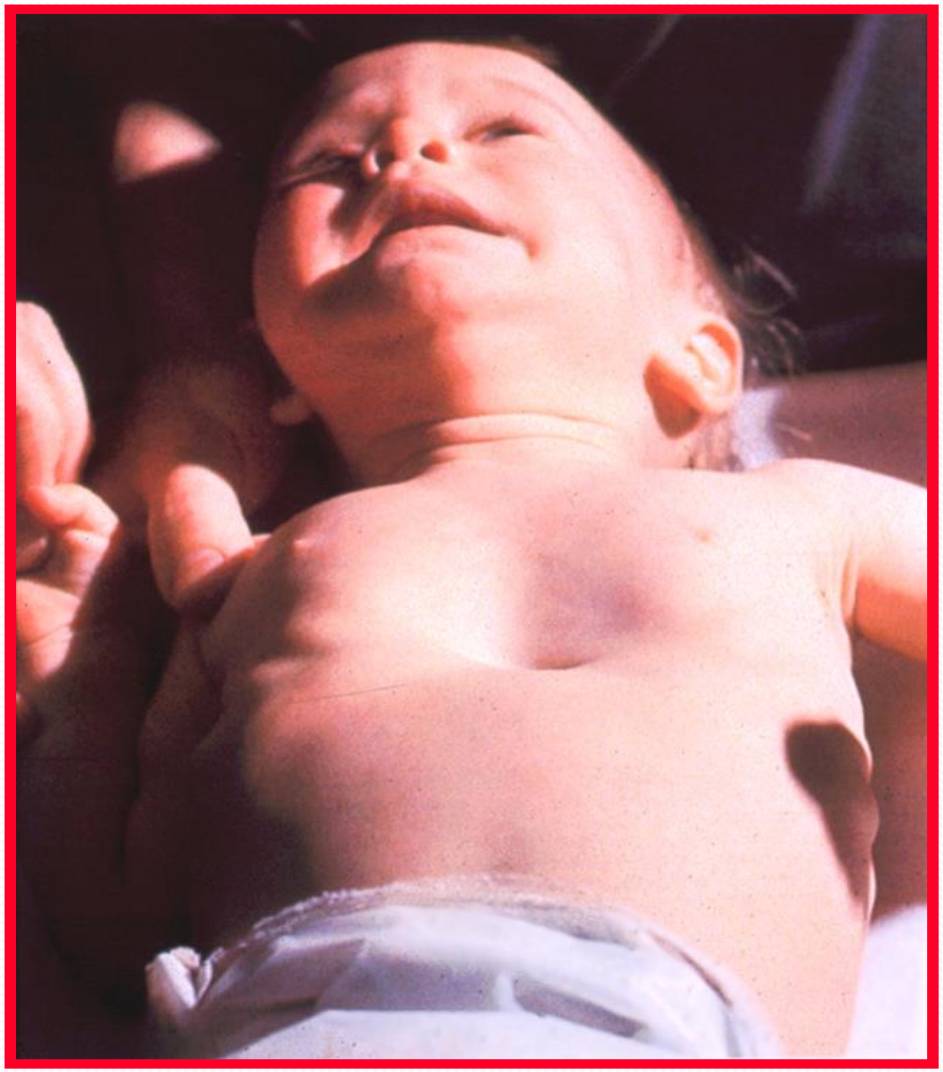
Appearance

Breathing

- Tachypnea
- Work of breathing
- Abnormal sounds
- Position of comfort

Retractions

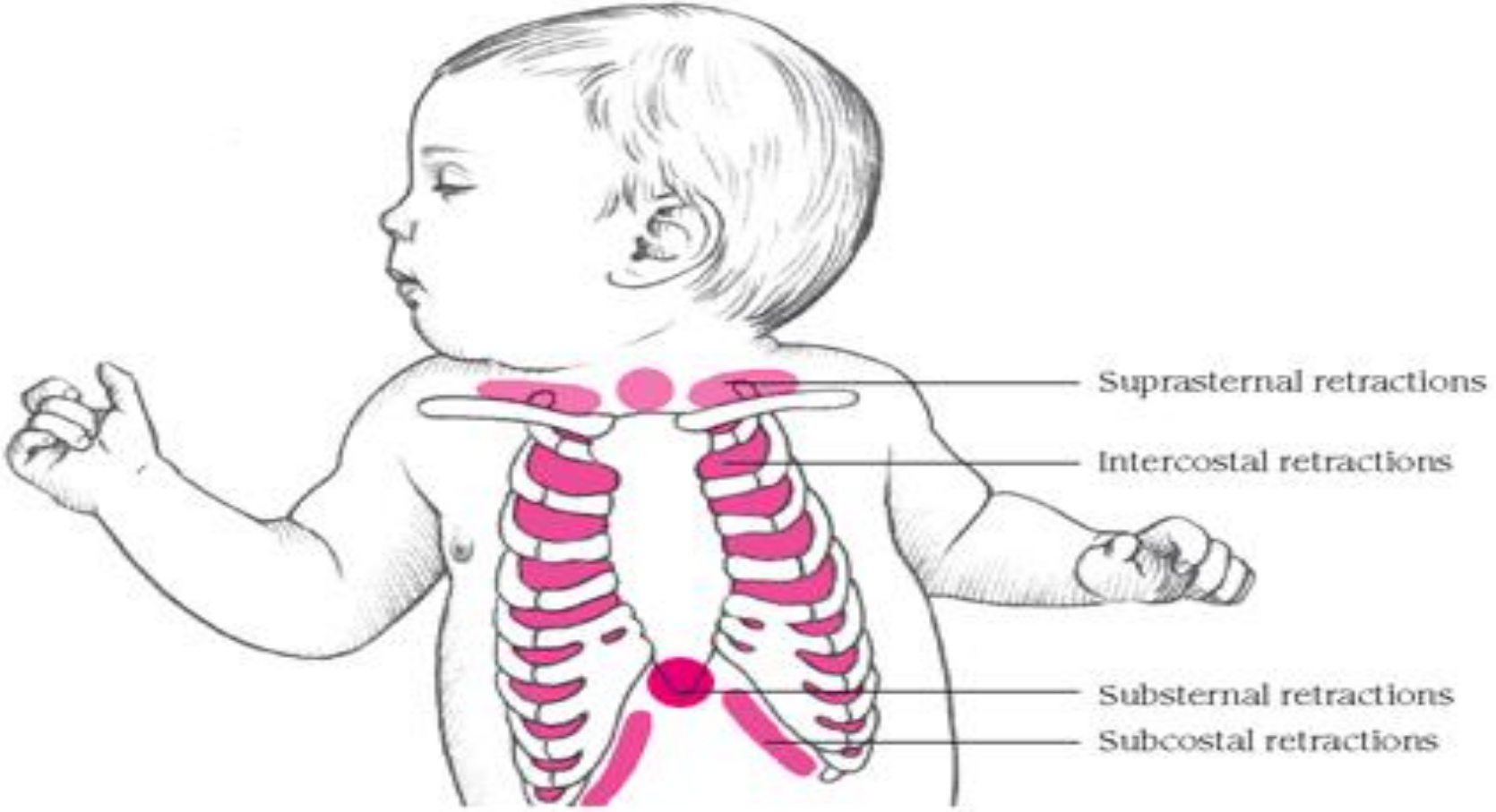
- Suprasternal
- Supraclavicular
- Intercostal
- Subcostal
- Nasal flaring



Observing retractions

When you observe retractions in infants and children, be sure to note their exact location—an important clue to the cause and severity of respiratory distress. For example, subcostal and substernal retractions usually result from lower respiratory tract disorders; suprasternal retractions, from upper respiratory tract disorders.

Mild intercostal retractions alone may be normal. However, intercostal retractions accompanied by subcostal and substernal retractions may indicate moderate respiratory distress. Deep suprasternal retractions typically indicate severe distress.



Abnormal Sounds

- **Grunting**
  - Noted at end expiration
  - Voluntary closure of glottis
  - Physiologically generates PEEP
  - Worrisome sign

- **Stridor**

  Age of pt important

  Infants- congenital problems

  Toddlers- foreign body

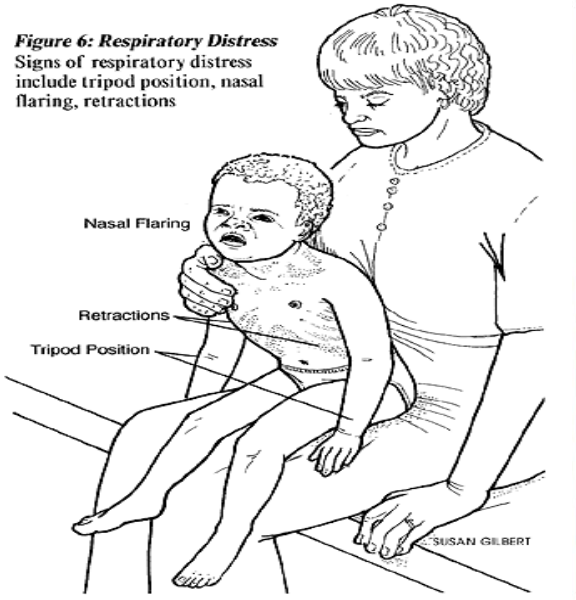
  Older child = bigger airway -> complete obstruction less likely

  Fever implies infectious etiology

- Audible wheezing
- Crackles and rales

Signs of Distress

- Retractions
- Tachypnea
- Grunting
- Position of comfort
- Color



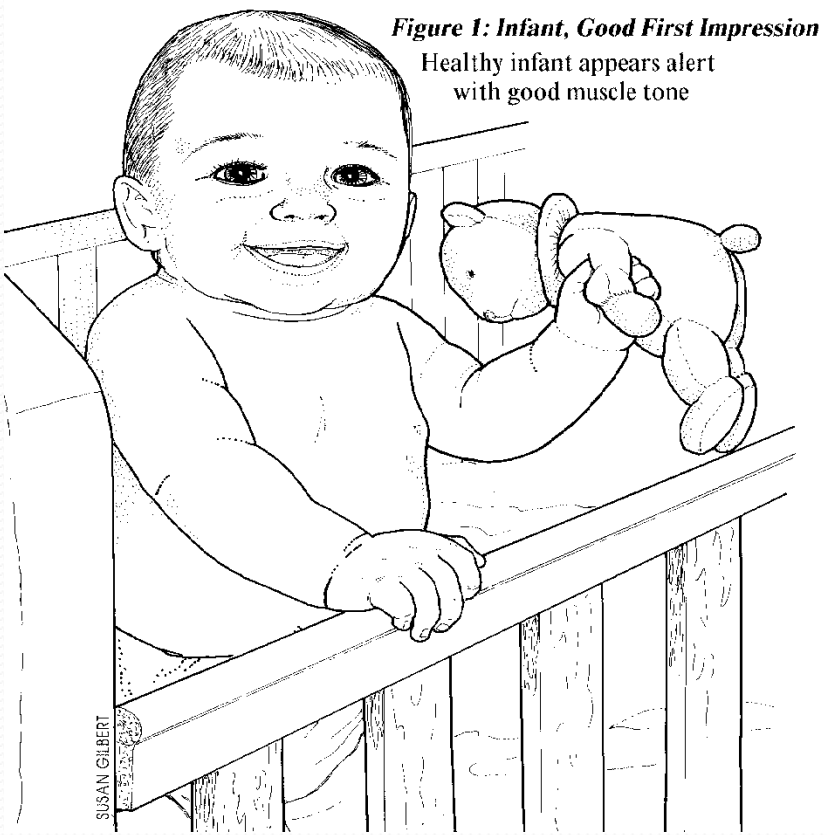
Position of Comfort

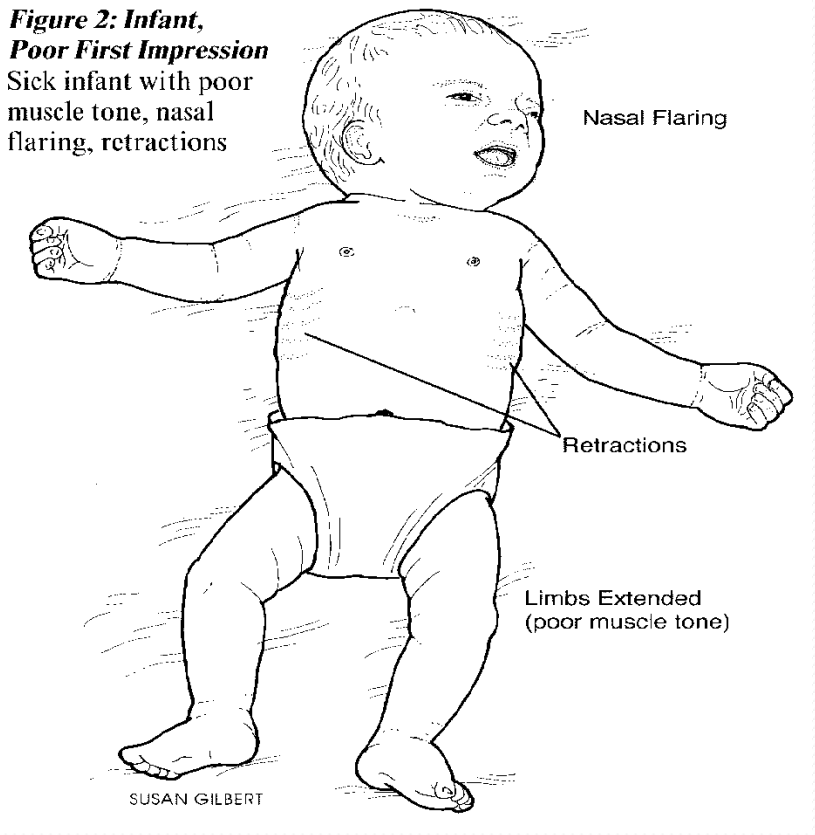
- **Lower airway disease**
  - Upright posture
  - leaning forward and support of upper thorax by arms
  - **Tripoding**

- **Upper airway disease**
  - Upright posture, leaning forward
  - self-generation of jaw thrust and chin lift
  - **“Sniffing” position**

Signs of impending respiratory failure

Increased respiratory rate or bradnypnea
Nasal flaring
Use of accessory muscles
Cyanosis





Circulation

- Capillary refill
- Distal vs central pulses
- Temperature of extremities
- Color
  - Pink
  - Pale
  - Blue (central cyanosis vs acrocyanosis)
  - Mottled

Capillary Refill

Respiratory Distress

Defined as inability to maintain gas exchange

- Multiple etiologies leading to distress
- Signs/symptoms varied- dependent on age
- Abnormal respirations
- Tachypnea
- Bradypnea
- Apnea

- Retractions/ accessory muscle use
- Head bobbing, position of comfort
- Nasal flaring
- Grunting
- Color change- pale or cyanotic
- Poor aeration
- Altered mental status

Impending Respiratory Failure

- Presence of acidosis
- $PCO_2 > 50$ mm Hg
- $PaO_2 < 50$ mm Hg
- “Normal “ blood gas in face of tachypnea and distress
- Diagnosis based primarily clinically
- Definitive airway should not be delayed waiting for labs or xray

Case 1

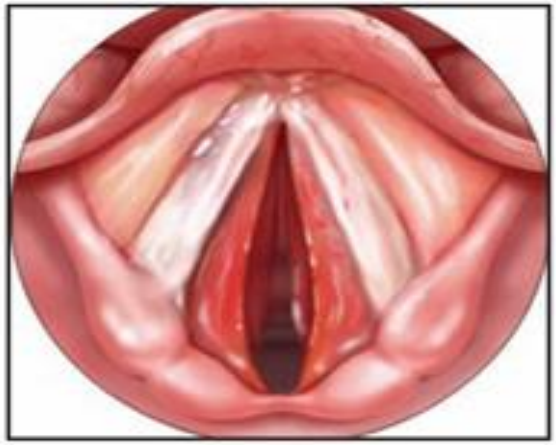
- 18 mo presents to ED w/ difficulty breathing
  - h/o rhinorrhea and fever for 3 days
  - Awoke in middle of the night w/ barking cough and noisy breathing
  - Symptoms worsen when agitated
- VS: T 102.5, HR 160, RR 40, O2 Sat 95%
  - Hoarse cry, Audible stridor, supraclavicular and suprasternal retractions

How sick is this child?

What is causing his symptoms?

Your First Clue: Croup

- Prodromal symptoms mimic upper respiratory infection.
- Fever is usually low grade (50%).
- Barky cough and stridor (90%) are common.
- Hoarseness and retractions may also occur.



Croup's distinctive barking cough is caused by swelling of the tissue around the voice box and wind-pipe. This swelling may affect the child's breathing also.

Croup

- **Accounts for 90% of stridor with fever**
- Children 1 to 3 years old
- Generally nontoxic presentation (38° to 40°C)
- Gradual onset of cough (barking) with varying degrees of stridor
- Viral pathogens
- Seasonal and temporal variations
- **Clinical diagnosis**

Croup/ Laryngotracheobronchitis

- **Most common cause for stridor in febrile infant**
- Mostly kids < 2 yrs of age
- Affects 6 mths – 6 yrs

  Incidence 3-5/100 children

  Male predominance 2:1

  Peak in second year of life- mean age 18 mths

  Seasonal: Occurs more late fall and early winter

  Viral etiology:

  Parainfluenza virus (60%)

  Influenza A- severe disease

  RSV (“ croupiolitis-” wheeze and stridor)

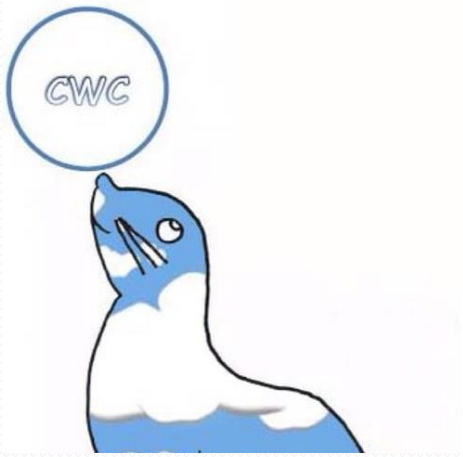
  Adenovirus

  Coxsackievirus

  Mycoplasma pneumoniae

Croup

- Acute viral infection
- Characterized by :
  - **Bark like cough**
  - Hoarseness
  - **Inspiratory stridor**
- Symptoms worse at night- typically last 4-7 days
- Spectrum of respiratory distress
- Mild to resp failure requiring intubation
- Disease most often self limited
- Rarely can lead to severe obstruction and death (< 2%)



Croup Score

- Westley croup score most common
- Tool to describe severity of obstruction
- Higher the score, the greater the risk for resp failure

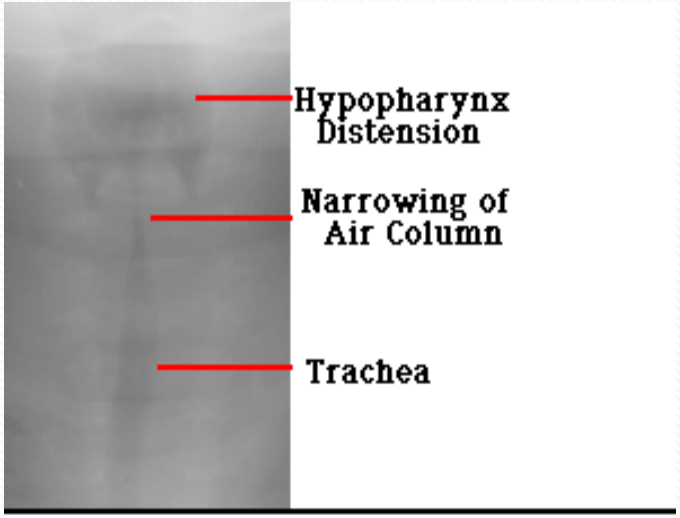
TABLE 3-5 Clinical Croup Score*

	0	1	2
Cyanosis	None	In room air	In 40% O_2
Inspiratory breath sounds	Normal	Harsh with rhonchi	Delayed
Stridor	None	Inspiratory	Inspiratory and expiratory or stridor at rest
Cough	None	Hoarse cry	Bark
Retractions and flaring	None	Flaring and suprasternal retractions	Flaring and suprasternal retractions plus subcostal and intercostal retractions

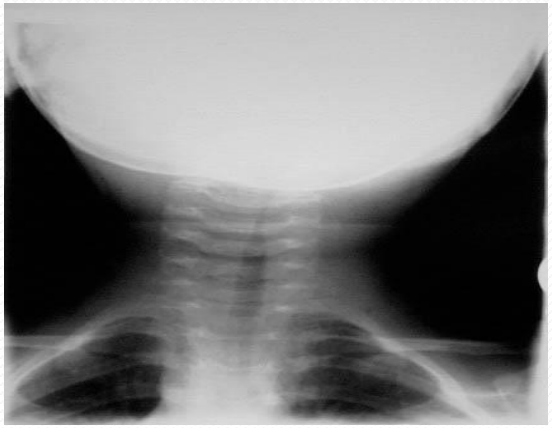
*A score of ≥4 indicates moderately severe airway obstruction. A score of ≥7, particularly when associated with $Paco_2$ of >45 and PaO_2 of <70 (in room air), indicates impending respiratory failure.

Diagnostic Studies

- **Croup is clinical diagnosis**.
- Routine laboratory / radiological studies are not necessary.
- **Films only if diagnosis uncertain**
- May see “ Steeple Sign”



Croup - Ant/Posterior X-ray shows classic steeple sign with narrowing of the tracheal air column at the larynx and distension of the hypopharynx.



Croup- Management

- Avoid agitation
- Position of comfort
- Provide cool mist – if tolerated
- Aerosolized epinephrine
  - Racemic EPI **0.5 ml in 3 ml NS**
  - When: **Stridor /retractions at rest**
- Steroids
  - **Dexamethasone 0.6 mg/kg IM/po**
  - Methylprednisolone 2 mg/kg PO
- Prepare airway equipment in severe cases
- Heliox may prevent intubation
- Airway radiographs not necessary

Management

- Minimize anxiety
- Oxygen
- Humidified mist:
  - anecdotally effective
  - literature shows no proven benefit
  - can use if tolerated
  - cool mist safer
  - just as effective as warm mist

Steroids

- Faster improvement croup score
- Decrease need for intubation and PICU
- Decrease hospitalization rates
- Shorter hospital stay if admitted
- Multiple studies have proven benefit- even mild cases (Bjornson, et al NEJM 2004)
- Dexamethasone or oral prednisolone both efficacious
- Dexamethasone- better compliance
  - usually only single dose required
  - cheap, easy to administer
  - IM = PO efficacy
  - **standard dose 0.6 mg/kg- max 10 mg**
  - recent studies show that lower dose may be ok (0.15- 0.3 mg/kg)
- Nebulized budesonide (Pulmicort):
  - better than placebo
  - not as good as Dex or prednisolone (Klassen, NEJM 1994)
  - no added benefit if added to Dexamethasone

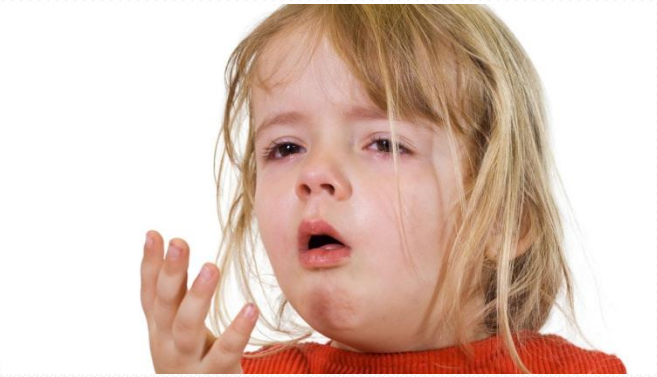
Racemic Epinephrine

- Indications:
  - stridor at rest
  - retractions
  - moderate – severe distress
- Duration 90-120 minutes
- “ Rebound effect”- myth only
- Must observe 2-4 hrs after treatment
- Dosing:

  0.5 mg in 2-3 cc NSS

Admission Criteria

- Inability to drink
- Cyanosis
- Hypoxia
- Stridor at rest
- Poor response to or multiple racemic epinephrine treatments
- Social concerns
- Lack of follow up
- Young age- consider for < 1 yr



Differential Diagnosis: What Else Could it Be?

- Epiglottitis (rare)
- Bacterial tracheitis
- Peritonsillar abscess
- Uvulitis
- Allergic reaction
- Foreign body aspiration
- Neoplasm

Differential Diagnosis for Croup

The pharmacist should be wary of assuming all stridor is croup-related. The patient may have *epiglottitis*—a serious condition without the barking cough but with abrupt onset of high fever, drooling, dysphagia, and protrusion of the tongue.[4] The child may have aspirated a foreign body that is causing acute stridor. Stridor may also be caused by psychological problems, hypocalcemia, or angioneurotic edema. With these serious conditions in mind, the pharmacist would be best advised to refer all cases of stridor to a physician for a full evaluation.

Tracheitis/ Pseudomembranous Croup

- Bacterial infection subglottic region
- Same age group as croup- average 3 yrs
- High fevers
- Look toxic
- Mortality 4-20%
- Characterized:
  subglottic edema
  inflammation larynx,
  trachea, bronchi, lungs
- Copious purulent secretions
- **Polymicrobial:**
  - Staph Aureus (most likely)
  - S. pneumoniae
  - H. influenzae
- Distress severe, not responsive to croup tx
- Complications- pneumonia, ARDS, Pulm edema, subglottic stenosis

Bacterial Tracheitis

- Complication of viral laryngotracheobronchitis
- Fever, white count, respiratory distress following a complicated course of croup
- Staphylococcus aureus- need appropriate antibiotic coverage
- Diagnosis usually made by direct visualization when intubating
- Require aggressive pulmonary toilet/ supportive care
- **Rare- but has emerged as most common potentially life threatening upper airway infection in children**
- Hopkins, et al, Pediatrics 2006:

  3 x as likely to cause resp failure than croup and epiglottitis combined

Peritonsillar Abscess

- **Most common deep infection of head and neck (30/100,000 people**)
- Occurs primarily teenagers and young adults
- Pediatrics- typically kids > 5 yrs of age
- Highest incidence Nov- Dec and April- May
- Coincides highest incidence Group A strep pharyngitis and tonsillitis
- Can occur after mononucleosis
- Polymicrobial- Group A strep predominate organism
- Symptoms: fever, malaise, sore throat
  dysphagia, otalgia
- Physical findings: trismus
  muffled voice/ **" hot potato voice"**
- Treatment: Drainage, antibiotics, pain control, hydration
- Steroids?- (Ozbek, et al J Laryngol Otol. 2004, Jun:118)- single high dose steroid
  prior to antibiotic more effective than antibiotic alone
  May be institutionally dependent- ENT here seems to use
- Children have lower recurrence rate-> tonsillectomy not always needed

Peritonsillar Abscess

Physical Findings

Deviation of tonsil
Dysphagia
Enlargement of tonsil
Fever
Fluctuance of soft tissue/palate
“Hot potato” voice
Severe pain
Trismus (60%)

Complications

Extension of abscess into neck
Hemorrhage due to erosion carotid artery
Septic thrombosis w/in internal jugular vein
Mediastinitis
Sepsis

Retropharyngeal Abscess

- Most common kids **2-4 yrs**
- Symptoms related to pressure and inflammation caused by abscess
- Intense dysphagia
- Drooling
- Respiratory distress- stridor, tachypnea
- Usually febrile and fussy
- **Unwilling to move neck**
  Extension > Flexion
- Pt holds neck stiffly
- **Mimic meningismus**
- Group A strep, S. aureus, anaerobes
- CT will help define abscess
- Medical management successful 50%
- May require surgical drainage- especially if airway compromise

Retropharyngeal Abscess

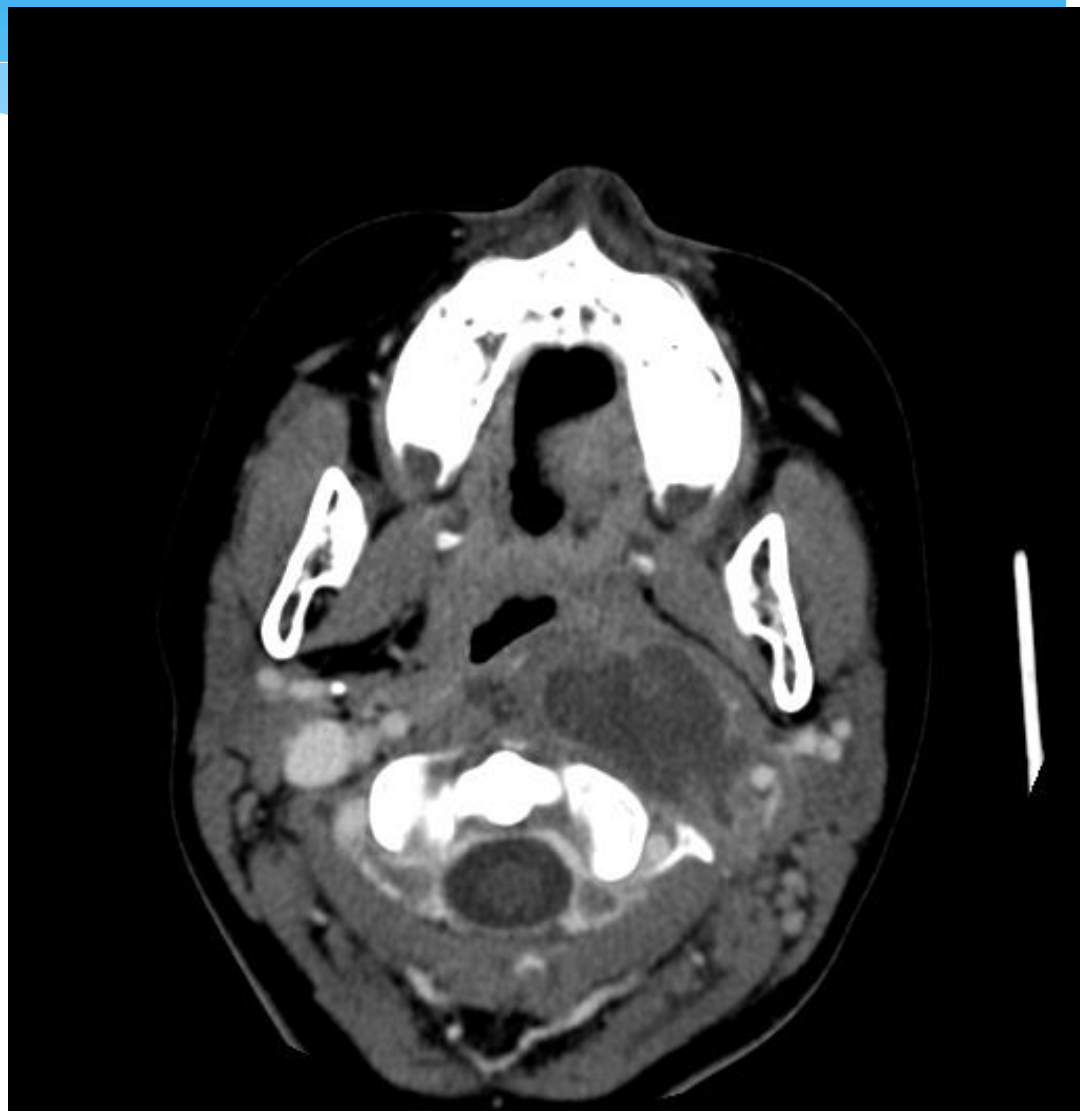
Predisposing Factors:

Recent infection

Penetrating trauma/ FB

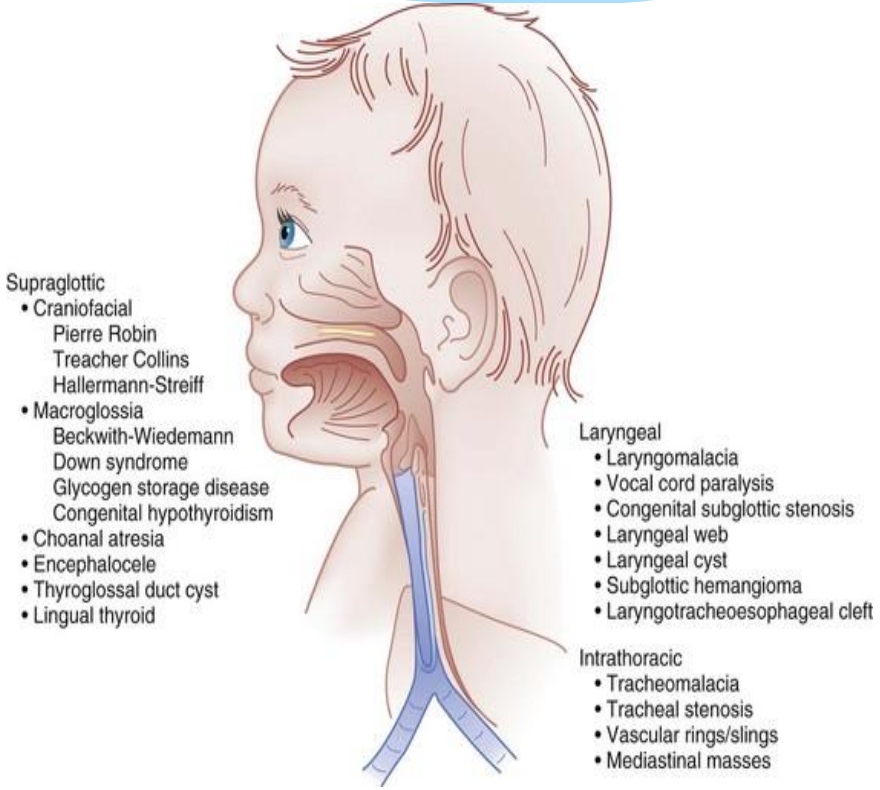
Crack cocaine use adults

Recent intubation

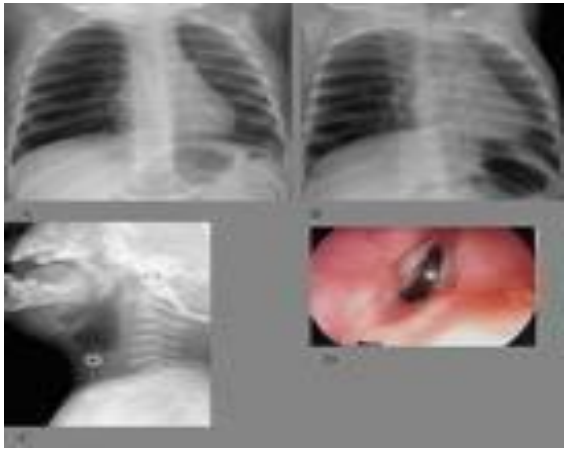


Non-infectious Etiologies for Upper Airway Obstruction

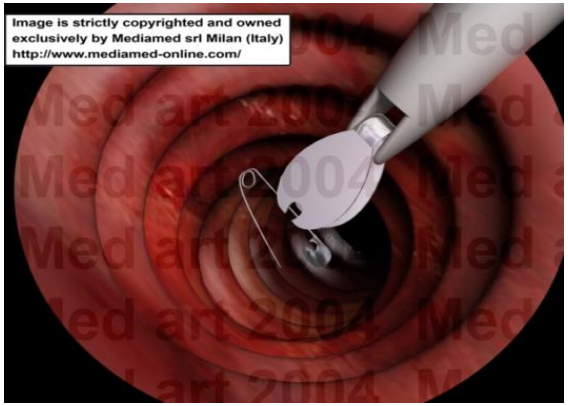
- Caustic Ingestion
- Burns
- Anatomical
- Foreign Bodies
- Trauma/ bleeding
- Anaphylaxis



Foreign Body Aspiration



- Foreign objects can be lodged in the upper or lower airway, or esophagus.
- Differences in the pediatric airway make evaluation and management of foreign body aspiration challenging.



Foreign Bodies

- 2-4year olds
- Acute episode of choking/gagging
- Triad of acute wheeze, cough and unilateral diminished sounds only in 50%
- 5-40% of patients manifest no obvious signs
- Think FB if persistent symptoms despite appropriate therapy
- Think FB if acute onset cough, gagging
- **Any child eating, running and acute onset distress = FOREIGN BODY**

Fatal Aspirations

- Require complete airway obstruction
- Hot dogs
- Candy
- Nuts
- Grapes
- Balloons
- Balls (< 3cm)
- Meat
- Carrot
- Hard cookies/bisquits

Epidemiology of Aspirations

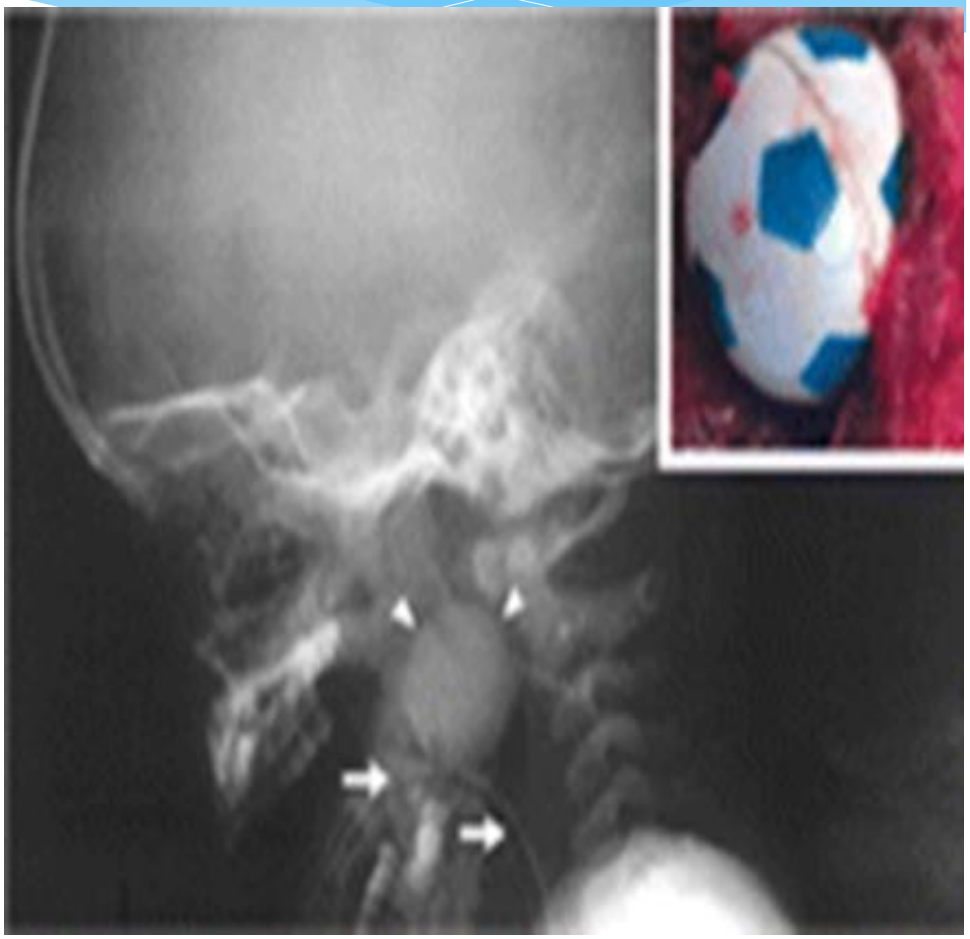
- Agent- usually food, round, < 3cm
- Objects that stay in mouth for prolonged time increase risk- gum, hard candy, sunflower seeds
- Age 6 mths- 5 years
- Underlying curiosity, oral phase of children
- Male: Female 2:1
- Environment-
  - poor supervision
  - availability small objects
  - not sitting when eating
  - inappropriate for age toys

“Classic Triad”

- Study by Oguz- 2000
- Findings associated with FB aspiration
- Cough (87%)
- Wheezing (45%)
- Asymmetrical breath sounds (53%)
- **Only 23% have all 3 components**

FB Aspiration Symptoms

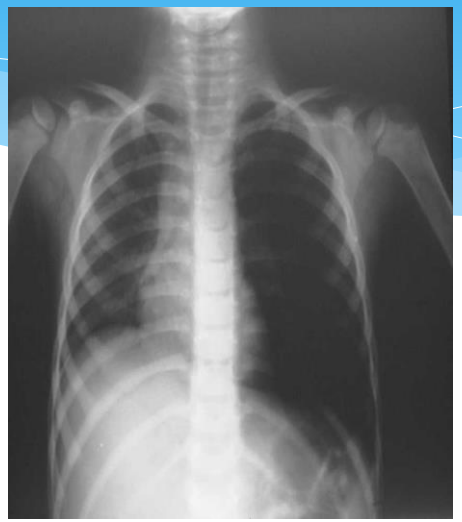
- Choking (22-86%)
- **Coughing (22-77%)**
- Dypsnea/ SOB (4-49%)
- Fever (12-37%)
- Wheezing (22-40%)
- **Stridor (1-61%)**
- Hemoptysis (1-11%)
- Asymptomatic (1-6%)

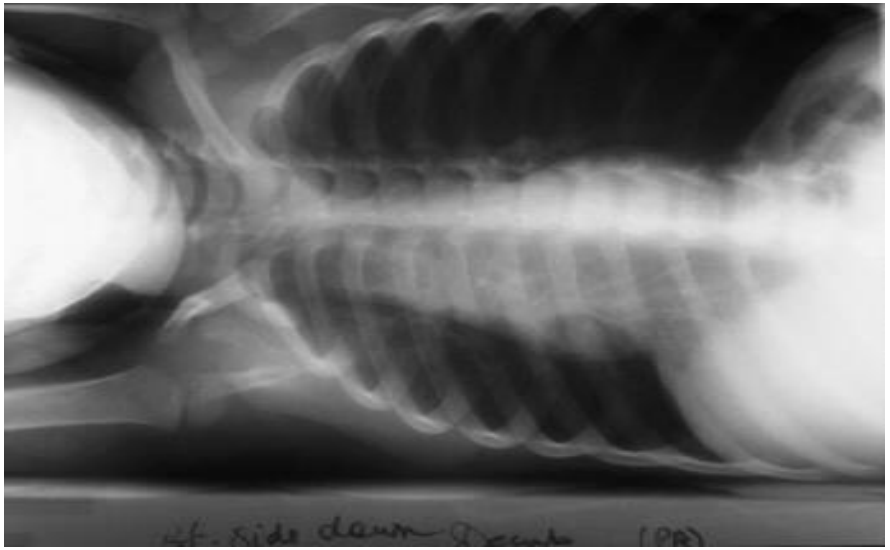


Radiologic Diagnosis

- **Xrays can not rule out non-radiopaque FB aspiration**
- Majority aspirated FB radiolucent
- AP, lateral chest films- normal 25% aspirated FB
- Inspiratory/Expiratory films require patient cooperation
- Decubitus views- “poor man’s” expiratory film
- Down side is expiratory
- **Most common findings :**

  hyperinflation/air trapping
  atelectasis
  pneumonia



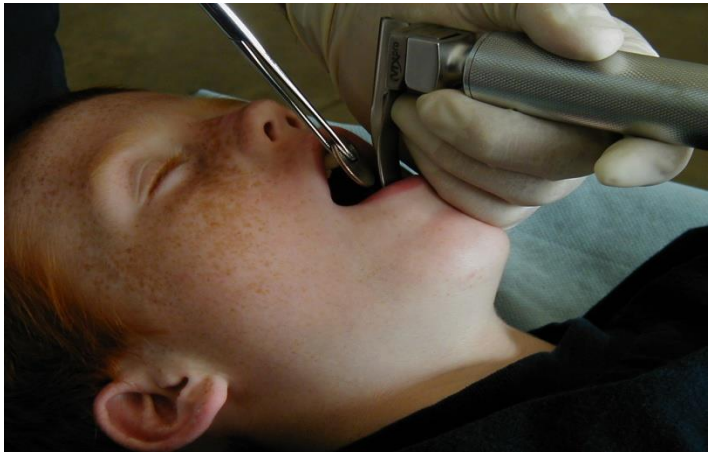



Hmmm, Doc, why don't we just make peanuts radio-opaque?
Then we won't worry about delayed diagnosis of FB as much.
This would be easy to see on Xray.

Management

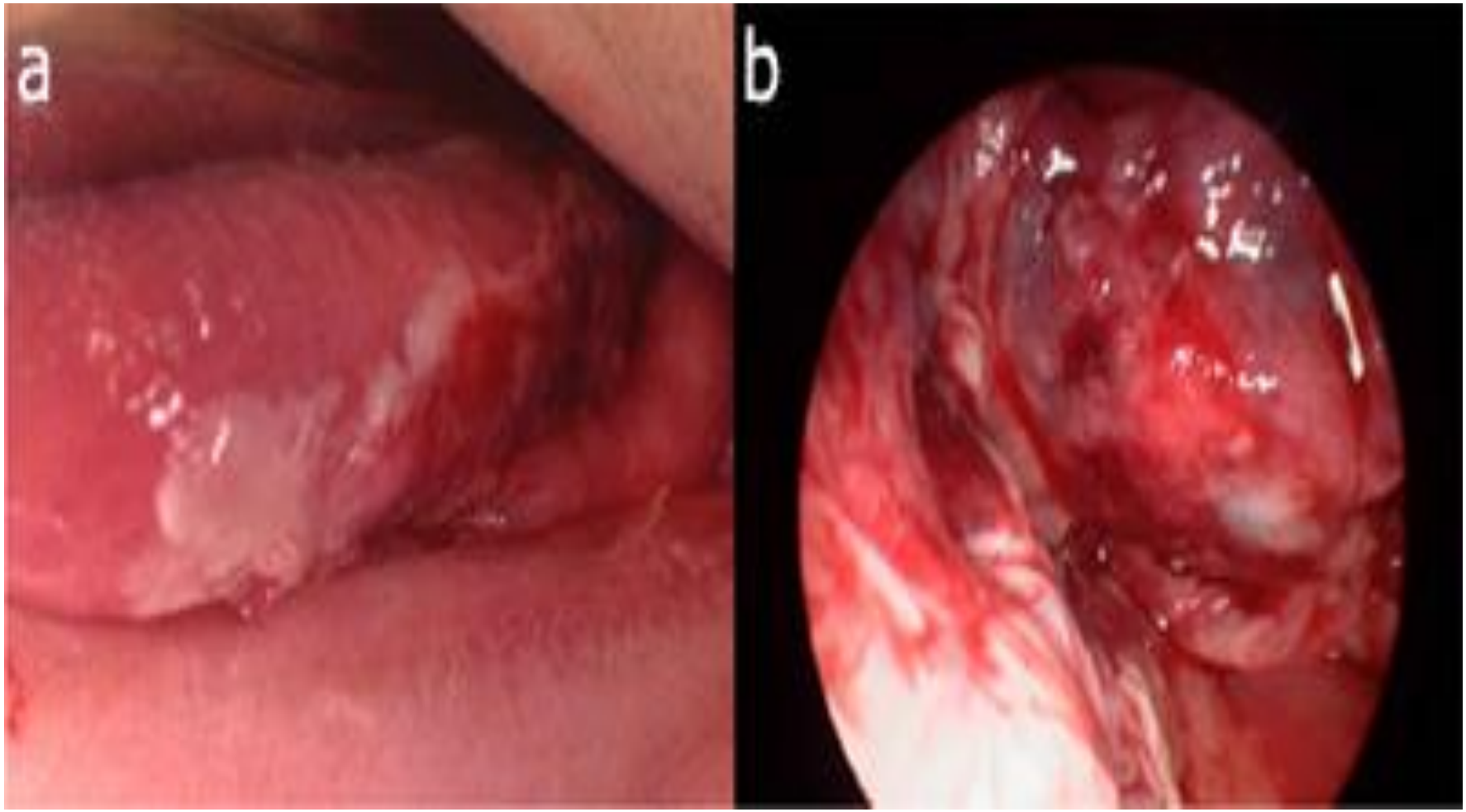
- Bronchoscopy- diagnostic/therapeutic treatment of choice
- Typically performed by Peds surgery, ENT, pulmonologist
- Unsuccessful bronchoscopy requires need for thoracotomy to remove FB
- Position of comfort
- Reduce agitation
- NPO
- **Be prepared if partial obstruction progresses to complete airway obstruction**

  - heimlich, back blows, Magill forceps, jet ventilation



Caustic Ingestion

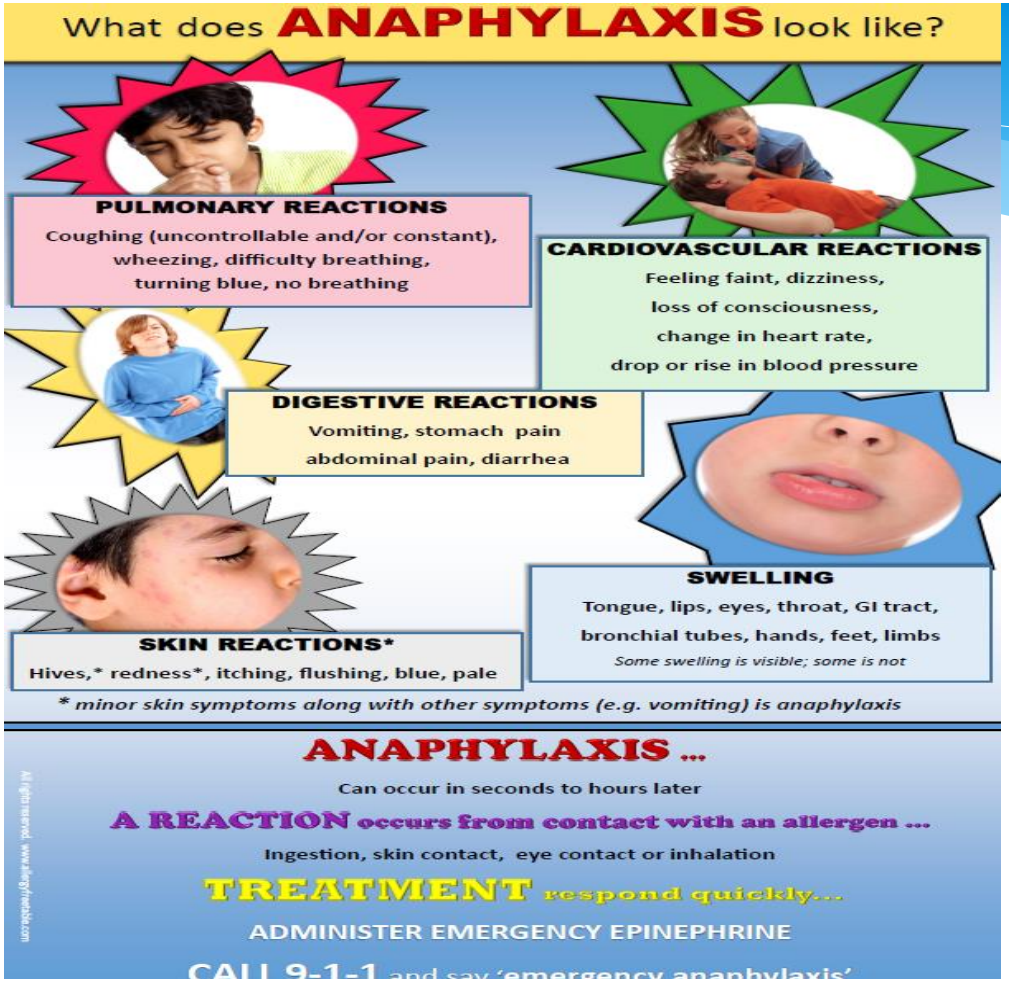
Pharyngeal lye ingestion



Goyal & Shaker
GI Motility online

Anaphylaxis

- Often under recognized
- Must treat aggressively
- Epinephrine is crucial
  (.01 cc/kg- 1: 1000 SQ or IM)
- Adjunctive meds-
  - steroids
  - fluids
  - albuterol
  - H1 and H2 blockers
- Must observe at least 8 hrs
- When d/c , do so with Epi pen x 2 and referral to allergy



Anaphylaxis is a **multi-systemic allergic** reaction characterized by:

At least one respiratory or cardiovascular feature

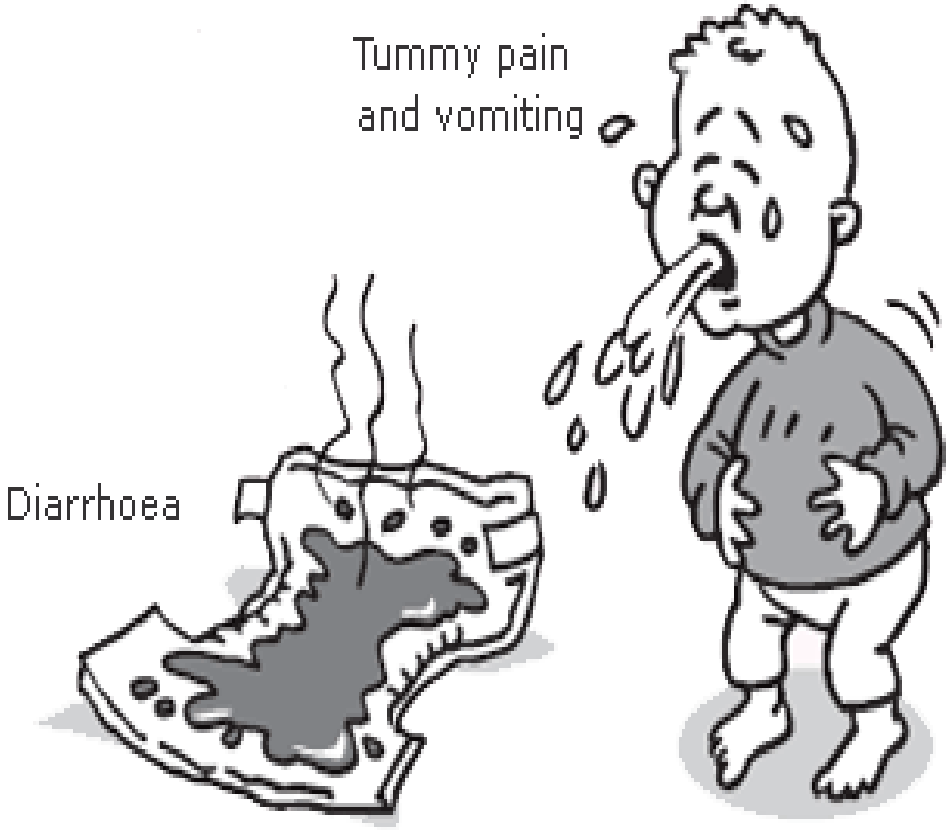
and

At least one gastrointestinal or skin feature.

Most reactions occur within **30 minutes of exposure** to a trigger.
Common causes of anaphylaxis in children include:
Foods (the most common cause) - Egg, nuts, cow milk, soy, shell-fish, fish and wheat
Bites/stings - Bee, wasp, jumper ants
Medications- Beta-lactams, monoclonal antibodies, anaesthetics
Others - including exercise induced anaphylaxis, idiopathic anaphylaxis, and latex anaphylaxis

Gastrointestinal Features

- Vomiting
- Diarrhea
- Abdominal pain



Skin Features- Anaphylaxis

- Angioedema
- Urticaria/erythema
- Generalized pruritus

Angioedema due to Anaphylaxis

Life-Threatening ALLERGIC REACTIONS

Could you save a life?

After eating, or being stung by a bee, a person who is known to have a potentially life-threatening allergy (anaphylaxis) might have any of these symptoms:

think F.A.S.T...

Face
Itchiness, redness, swelling of face and tongue

Airway
Trouble breathing, swallowing or speaking

Stomach
Stomach pain, vomiting, diarrhea

Total Body
Rash, itchiness, swelling, weakness, paleness, sense of doom, loss of consciousness

then ACT...

Give Epinephrine

- Give epinephrine (e.g. EpiPen®) at the first sign of a reaction.
- The first signs may be mild, but symptoms can get worse quickly.
- Repeat in 10-15 minutes *only* if reaction continues or gets worse.

Call 911

- Go by ambulance to the nearest hospital, even if symptoms are mild or have stopped.

Anaphylaxis Canada
Helping people live with deadly allergies

Safe
www.gosafe.ca

Health Canada | Santé Canada | MedicAlert

www.safe4kids.ca
to see how you can make your community safer for friends living with anaphylaxis.

Congenital Disorders

- Laryngomalacia- young infants
- Web
- Hemangioma and vascular rings
- Polyp
- Vocal cord paralysis
- All will present with “ noisy breathing”
- URI will worsen stridor and increase respiratory distress
- Think anatomy in young infant :

  especially < 6 mths age

  recurrent “ croup”- especially if no other infectious symptoms

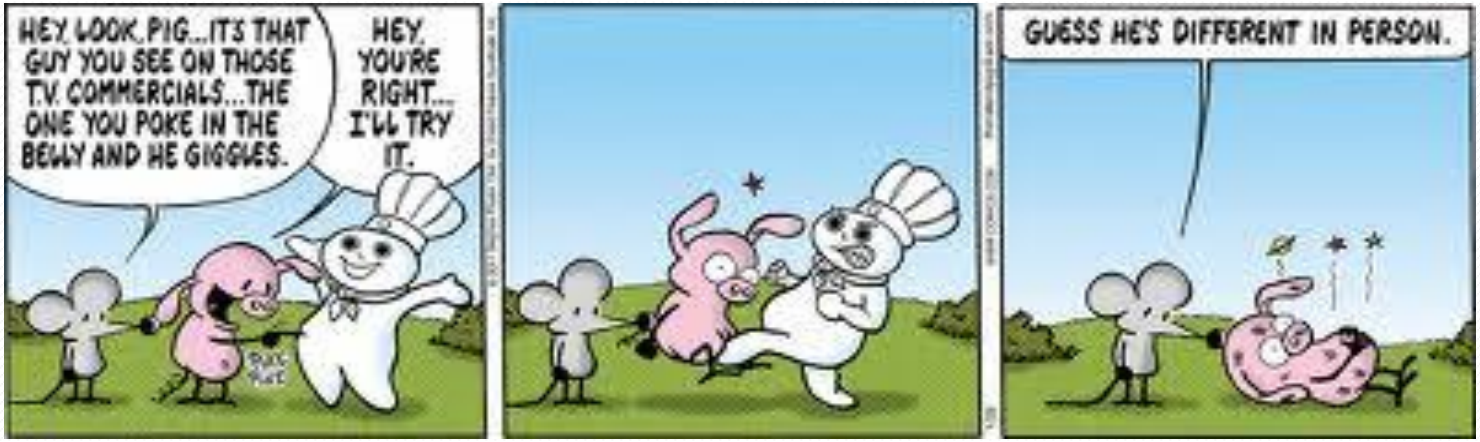
Conclusions

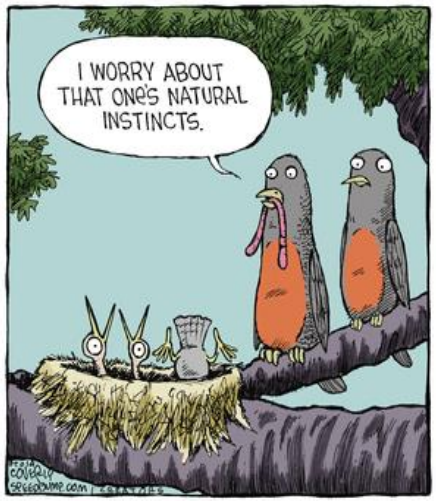
- Anatomic differences between pediatric and adult airway exist
- Make kids more susceptible to acute airway compromise
- Subglottic area is most narrow area in pediatric airway
- Any inflammation in child's subglottic area greatly reduces airway diameter
- Use pediatric assessment triangle to guide urgency of intervention
- Will quickly enable to recognize " sick" child
- Goal: prevent progression of resp distress to resp failure and cardiac arrest
- Multiple infectious and non infectious etiologies to upper airway obstruction
- Choose appropriate antibiotics – Staph, strep , H. flu
- Age of patient may guide your diagnosis
- Meningismus may accompany deep neck infections
- Need high index of suspicion!
- Tracheitis has supplanted epiglottitis and croup as etiology for acute life threatening upper airway infection

Conclusions

- Identification aspirated FB can be difficult
- Young kids most at risk
- Most aspirated FB radiolucent- won't be seen on film
- Peanuts consistently most common object aspirated
- High index of suspicion
- Think FB if acute onset symptoms:
  - wheeze/ cough in pt no prior RAD
  - recurrent pneumonias
  - no improvement w/ appropriate therapy- steroids, antibiotics
  - increased symptoms after eating→ especially if running/ jumping while eating
- Bronchoscopy test of choice
- Caustic ingestions/ thermal injuries may have immediate and progressive symptoms- control airway early
- Treat anaphylaxis aggressively- drug of choice is **EPINEPHRINE**

STILL WITH ME ?





Case 2

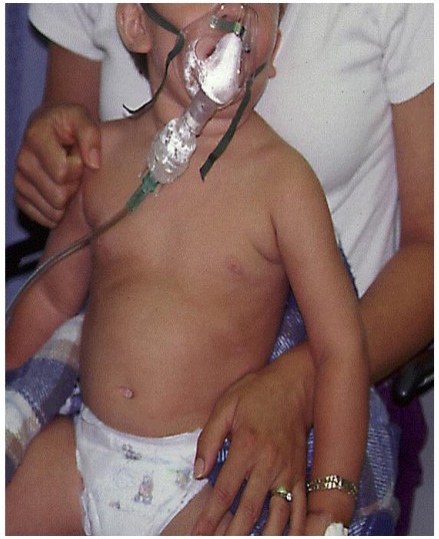
- 3 mth old
- Ex 31 week premie, short NICU stay
- 2 day hx cough, nasal congestion
- Breathing “ funny “ per mom
- Vitals hr 195 rr 80 T 38 Sat 93% r/a
- Wt 4 kg

Physical Exam

- Pale, small, ill appearing
- Slightly sunken eyes, dry mouth
- No stridor, thick rhinorrhea and congestion, and flaring
- Marked intercostal and subcostal retractions
- Diffuse wheeze, rhonchi, and crackles
- Good aeration
- No murmur , tachycardic
- Cap refill 3 sec, cool skin, mottled
- Crying, anxious, consolable

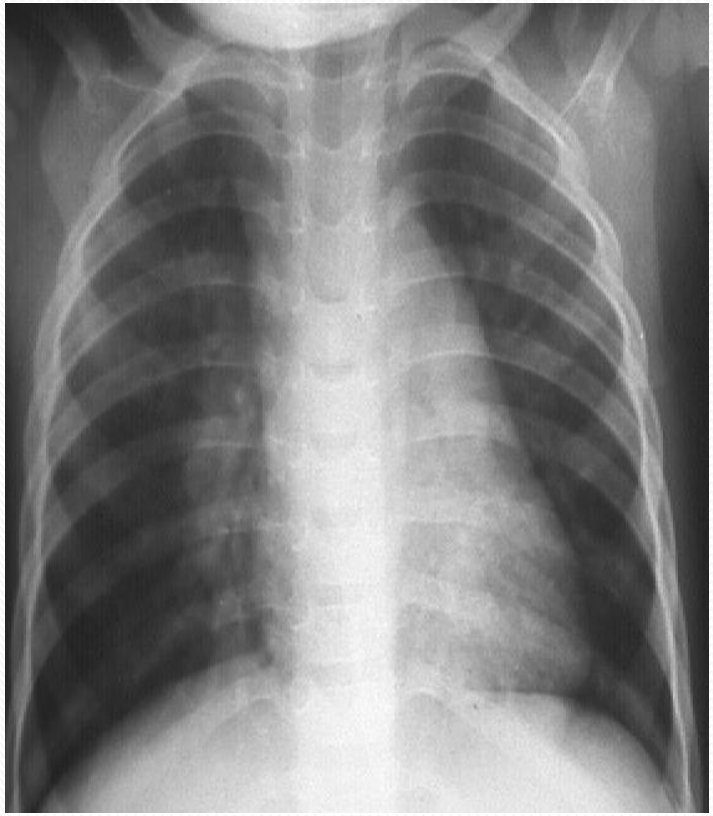
Further history- mom states “baby turned blue , stopped crying, stopped breathing” twice past 3 hrs
Lasted “ forever” but baby better after mom picked baby up and rubbed back
“Is this important? “ mom asks

Impression- sick or not sick?
What do you want to do?



Interventions and Actions

- **ABC's**
- Oxygen
- Suction
- IV access, lVFP, check blood sugar
- Initial trial albuterol?
- Consider Racemic Epinephrine?
- Call for chest film
- Prepare for intubation?



Case Progression

- Little change with albuterol
- Called stat into room, baby “ not breathing” and blue
- Apneic, HR 90, sats 74%
- Emergently intubated
- Transferred to PICU

Bronchiolitis

- Viral infection medium and small airways
- **RSV 85%**
- parainfluenza, adenovirus, influenza A, rhinovirus
- Seasonal disease
- Peak: winter and early spring
- Most children infected by 3 yrs age
- 10% of kids have clinical bronchiolitis w/in 1st year of life
- Peak incidence 2-6 mths
- Majority mild illness
- Cough may persist for weeks
- Highly contagious- WASH HANDS!

RSV

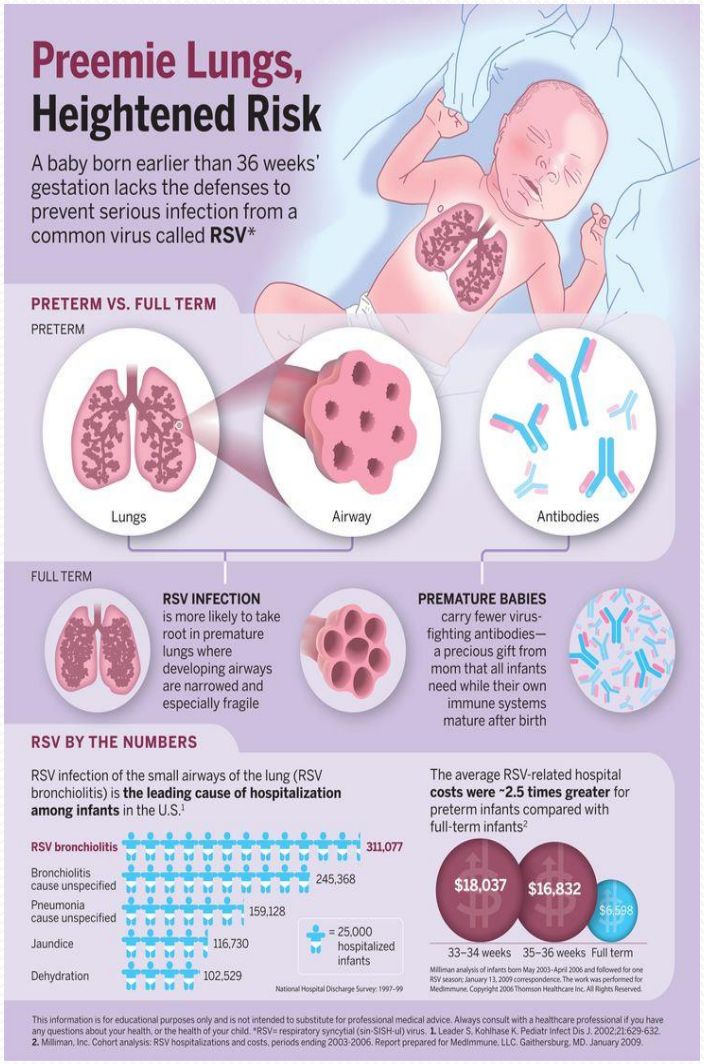
- Respiratory syncytial virus (RSV) = most common cause of lower respiratory tract infections among young children in the United States and worldwide
- Most infants are infected before 1 year of age
- Virtually everyone gets an RSV infection by 2 years of age
- Each year- in the United States- RSV leads to:
  - 57,527 hospitalizations among children < 5 yrs of age
  - 2.1 million outpatient visits among children < 5 yrs
  - 177,000 hospitalizations and 14,000 deaths among adults > than 65 years
- RSV infections occur primarily during fall, winter, and spring (US/ similar climates)

Clinical Manifestations

- URI symptoms
- Gradual progression over 3-4 days
- Fever
- Tachypnea
- Wheezing
- Retractions/flaring
- Dehydration, secondary otitiis media, pneumonia
- **Apnea- especially infants < 3 mths**

Risk Factors for Severe Disease

- Age
- Prematurity
- Underlying Disease
- **Most common complication = APNEA**
- Occurs early in illness, may be presenting symptom
- **Most at risk- very young, premature, chronically ill**
- Smaller, more easily obstructed airway
- Decreased ability to clear secretions



Bronchiolitis score

score 3 or more higher risk for severe disease

	0	1	2
age	< 3 mths	< 3 mths	
gestation	> 37 wks	34-36 wks	< 34 wks
appearance	well	ill	toxic
Resp rate	< 60	60-69	> 70
atelectasis	absent	present	
Pulse ox	> 97	95-96	< 95

Management

- Supportive care
- Fluids
- Oxygen
- Monitoring
- Pulmonary toilet
- Ventilatory support
- Prevention- Respigam, Synagis

Respiratory syncytial virus immunoprophylaxis for infants and young children with congenital heart disease*

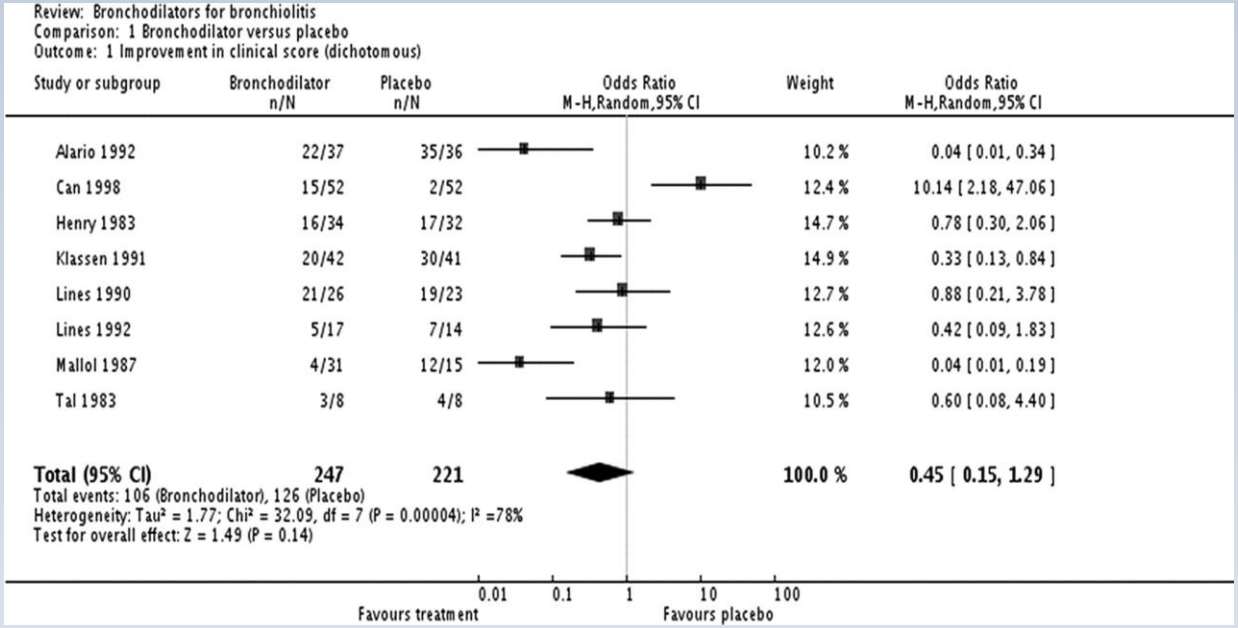
Most likely to benefit from immunoprophylaxis:
Infants receiving medication to control heart failure
Infants with moderate to severe pulmonary hypertension
Infants with cyanotic heart disease
Not indicated
Infants with hemodynamically insignificant heart disease:
Secundum atrial septal defect
Small ventricular septal defect
Pulmonic stenosis
Uncomplicated aortic stenosis
Mild coarctation of the aorta
Patent ductus arteriosus
Infants with lesions adequately corrected by surgery unless they continue to require medication
Infants with mild cardiomyopathy who are not receiving medical therapy

* Palivizumab is the only RSV immunoprophylactic agent approved for infants with congenital heart disease.
Adapted from Revised indications for the use of palivizumab and respiratory syncytial virus immune globulin intravenous for the prevention of respiratory syncytial virus infections. Pediatrics 2003; 112:1442.

Management Controversies

- Efficacy of bronchodilators
- Benefits of steroids
- Risk SBI in bronchiolitic with fever

Cochrane collaboration systematic review of studies that assessed the difference in rate of improvement after β2-agonist bronchodilators or placebo among children with bronchiolitis.



Zorc J J , Hall C B Pediatrics 2010;125:342-349

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PEDIATRICS®

Corticosteroids

- Again, studies inconclusive, unclear benefit in bronchiolitis
- Recent meta- analysis Garrison , et al 2000- suggest statistically significant improvement clinical symptoms, LOS, DOS hospitalized pts
- Schuh, et al 2002 – compared large dose Dex (1mg/kg) vs placebo in ED
- 4 hrs after med, improved clinical scores, decreased admit rates, no change sats/ rr
- Multicenter PECARN –Corneli, et al, N Engl J Med 2007; 357:331-339 July 26, 2007-

  infants with acute moderate-to-severe bronchiolitis who were treated in the emergency department, a single dose of 1 mg of oral dexamethasone per kilogram **did not** significantly alter the rate of hospital admission, the respiratory status after 4 hours of observation, or later outcomes.

STATE-OF-THE-ART REVIEWS

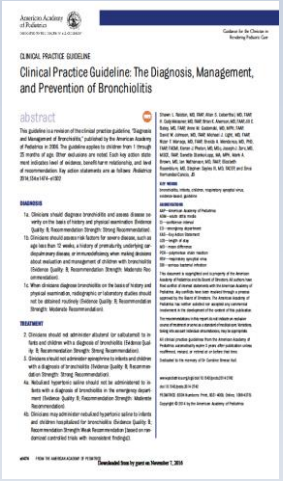
Bronchiolitis: Recent Evidence on Diagnosis and Management

Joseph J. Zorc, MD, MSCEa,b, Caroline Breese Hall, MDc

Pediatrics Vol. 125 No. 2 February 1, 2010
pp. 342 -349
(doi: 10.1542/peds.2009-2092)

Pediatrics
October 2014
From the American Academy of Pediatrics
Clinical Practice Guideline
Clinical Practice Guideline: The Diagnosis, Management, and Prevention of Bronchiolitis

Shawn L. Ralston, Allan S. Lieberthal, H. Cody Meissner, Brian K. Alverson, Jill E. Baley, Anne M. Gadomski, David W. Johnson, Michael J. Light, Nizar F. Maraqa, Eneida A. Mendonca, Kieran J. Phelan, Joseph J. Zorc, Danette Stanko-Lopp, Mark A. Brown, Ian Nathanson, Elizabeth Rosenblum, Stephen Sayles III, Sinsi Hernandez-Cancio



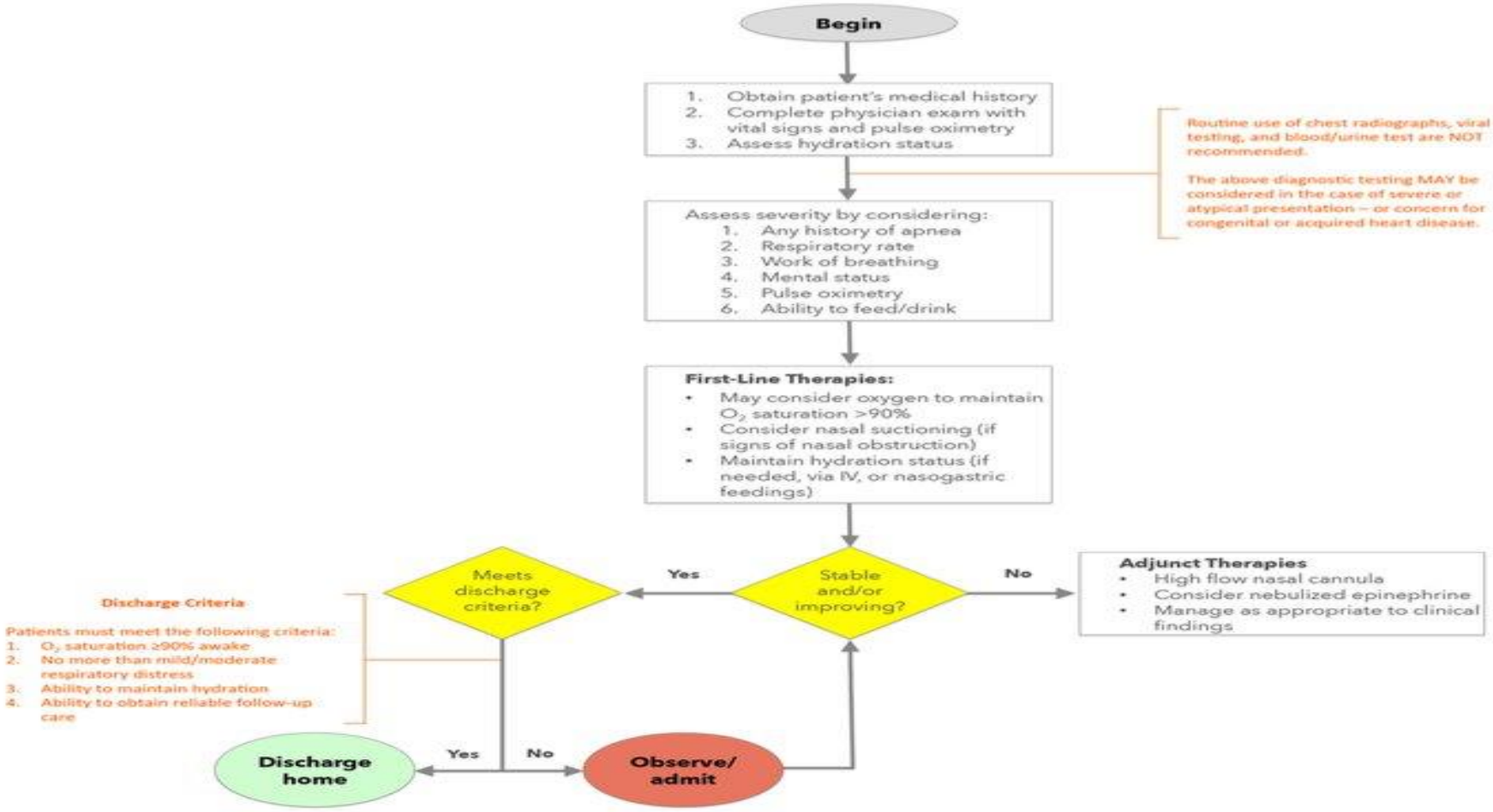
Recent multicenter research on therapy for bronchiolitis supports previous AAP recommendations against the routine use of bronchodilators or corticosteroids

Summary of Recent Evidence for Therapies Used for BronchiolitiS

(*Pediatrics February 1, 2010 vol. 125 no. 2 342-349)*

Therapy	Summary	Recommendation
Bronchodilators	No improvement in duration of illness or hospitalization[58,59]	No routine use
	May improve short-term clinical scores in a subset of children[58]	Use only after proven benefit in a trial of therapy, if chosen as an option
Corticosteroids	No improvement in duration of illness or hospitalization[7,63]	No routine use
Leukotriene receptor antagonists	No improvement in duration of illness[67,75]	Not recommended
Nebulized hypertonic saline	May reduce length of inpatient hospitalization[70]	None

Algorithm for Acute Bronchiolitis Management



Based on the "Clinical Algorithm for Bronchiolitis in the Emergency Department Setting" publication by the American Academy of Pediatrics' (AAP) Section on Emergency Medicine Committee on Quality Transformation (Ralston S et al. *Pediatrics* (2014). PMID 26430140)

ALiEM Academic Life in Emergency Medicine

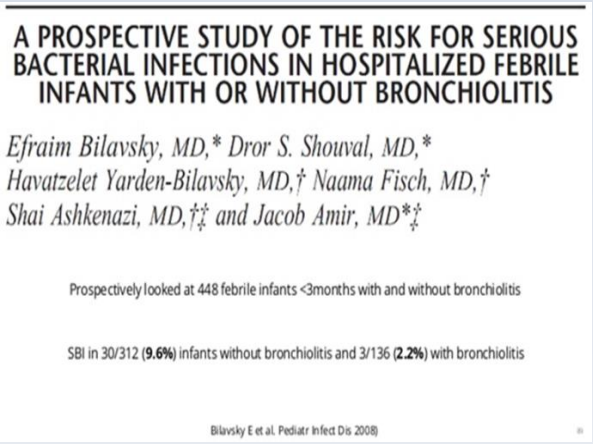
Updated 11-6-16

Serious Bacterial Infection

- Defined as bacteremia, UTI, meningitis
- What is risk for concurrent SBI in infant < 2 mths, febrile, with bronchiolitis?
- Kupperman, et al 1997 showed substantial risk for UTI in febrile infant- rate unchanged whether concurrent bronchiolitis
- Levin, et al 2004 PECARN study-

  risk SBI still high in neonate (<28 days) w/ bronchiolitis- need FSWU

  29-60 day- still high risk for UTI even with RSV



A PROSPECTIVE STUDY OF THE RISK FOR SERIOUS BACTERIAL INFECTIONS IN HOSPITALIZED FEBRILE INFANTS WITH OR WITHOUT BRONCHIOLITIS

Efraim Bilavsky, MD, Dror S. Shouval, MD,* Havatzelet Yarden-Bilavsky, MD,† Naama Fisch, MD,† Shai Ashkenazi, MD,†‡ and Jacob Amir, MD*‡*

Prospectively looked at 448 febrile infants <3months with and without bronchiolitis

SBI in 30/312 (**9.6%**) infants without bronchiolitis and 3/136 (**2.2%**) with bronchiolitis

Bilavsky E et al. Pediatr Infect Dis 2008)

Bronchiolitis and the Febrile Young Infant

Prevalence of Serious Bacterial Infections in Febrile Infants With Respiratory Syncytial Virus Infection

M. Olivia Titus, MD, and Seth W. Wright, MD, MPH

TABLE 2. Culture Results in Patients With and Without RSV Infection

	RSV-Positive (No. Positive/ No. Tested)	Controls (No. Positive/ No. Tested)
Bacteremia	0/170	5/171
Urinary tract infection	2/147	17/166
Meningitis	0/111	1/153
Overall serious bacterial illness	2/174	22/174*

* One patient had a positive culture from both blood and spinal fluid.

Titus MO et al. Pediatrics 2003

Risk of Serious Bacterial Infection in Young Febrile Infants With Respiratory Syncytial Virus Infections

Deborah A. Levine, MD*; Shari L. Platt, MD*; Peter S. Dayan, MD‡; Charles G. Macias, MD§; Joseph J. Zorc, MD‖; William Krief, MD¶; Jeffrey Schor, MD#; David Bank, MD**; Nancy Fefferman, MD‡‡; Kathy N. Shaw, MD, MSCE‖; and Nathan Kuppermann, MD, MPH§§, for the Multicenter RSV-SBI Study Group of the Pediatric Emergency Medicine Collaborative Research Committee of the American Academy of Pediatrics

1248 febrile patients ≤60 days enrolled into prospective cross-sectional study

7% SBI rate for RSV+ infants vs. **12.5%** SBI rate for RSV- infants

Levine DA et al. Pediatrics 2004

TABLE 3. SBI by RSV Status

Variable	RSV Positive (N = 269)	RSV Negative (N = 979)	RR (95% CI)
Any SBI	17/244 7% (4.1%–10.9%)	116/925 12.5% (10.3%–14.8%)	0.6 (0.3%–0.9%)
UTI	14/261 5.4% (3.0%–8.8%)	98/966 10.1% (8.3%–12.2%)	0.5 (0.3%–0.9%)
Bacteremia	3/265 1.1% (0.2%–3.2%)	22/968 2.3% (1.4%–3.4%)	0.5 (0.1%–1.6%)
Meningitis	0/251 (0%–1.2%)	8/938 0.9% (0.4%–1.7%)	0

5.5% of RSV+ infants had UTI

Febrile infants with RSV are less likely to have SBIs but its probably wise to get a urine culture on these kids

Levine DA et al. Pediatrics 2004

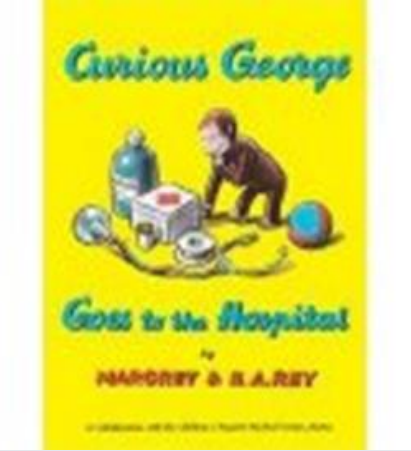
Serious Bacterial Infection

- Febrile infants with bronchiolitis may be at lower risk for SBI
- However, reduced risk for bacteremia and meningitis is not zero- especially neonate
- Rate for UTI, predominant SBI, remains significant despite having bronchiolitis

Still check for UTI in febrile infant with bronchiolitis

Admission

- High risk pts more disposed to severe disease
- Chronic lung disease
- Congenital heart disease
- Immunocompromised
- Infants < 3 mths age, especially if < 37 gestation
- Resp distress- rr > 70, Sats < 95%
- Any history of apnea
- Poor po/ decreased urine output/ concerns hydration status
- Concerns re : follow up or compliance
- Parental anxiety/ fear



Prevention of RSV

- Research development RSV vaccines, but **none is available** yet
- Steps can be taken to help prevent the spread of RSV :

  Cover coughs and sneezes

  Wash hands frequently and correctly (with soap and water for 20 seconds)

  Avoid sharing cups and eating utensils with others

  Refrain from kissing others
- Cleaning contaminated surfaces (such as doorknobs) may help stop the spread of RSV
- Protect high risk kids- **premature infants, children younger than 2 years of age with chronic lung or heart conditions, and children with weakened immune systems**- most likely to develop severe disease
- **Palivizumab (Synagis**) is available to prevent severe RSV illness in specific group of infants/ children at high risk :

  prophylaxis may be administered to infants born before 29 weeks

  prophylaxis may be considered during the RSV season during the first year of life for preterm infants who develop CLD of prematurity defined as gestational age <32 weeks and a requirement for >21% oxygen for at least the first 28 days after birth

  12 months or younger with hemodynamically significant CHD may benefit from prophylaxis

  Prophylaxis for Alaska Native and American Indian Infants

  Can help prevent development of serious RSV disease

Can not cure or treat children already with RSV

PROTECT YOUR CHILD from RSV

Avoid close contact with **sick people**

Wash your hands often

Cover your coughs & sneezes

Avoid touching your face with unwashed hands

Clean & disinfect surfaces

Stay home when you're **sick**

CDC

www.cdc.gov/rsv

Conclusions

- Apnea may be 1st and only symptom bronchiolitis
- More likely early in course, < 3 mths age
- Admit kids at risk for more severe disease
- **Treatment is supportive**
- May be small subset that benefit from steroids and bronchodilators
- Neonate with bronchiolitis- still consider FSWU
- Febrile infant with bronchiolitis -risk UTI