Pediatric Respiratory Distress:

Croup, Asthma and Bronchiolitis

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Disclosures

I have nothing to disclose

Objectives

1. Recognize differences between the pediatric and adult airway

2. Recognize respiratory distress in the pediatric population

3. Recognize presentation and manage croup in the pediatric population

3. Recognition of and management of pediatric asthma

4. Recognize and treatment of bronchiolitis in the pediatric population

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

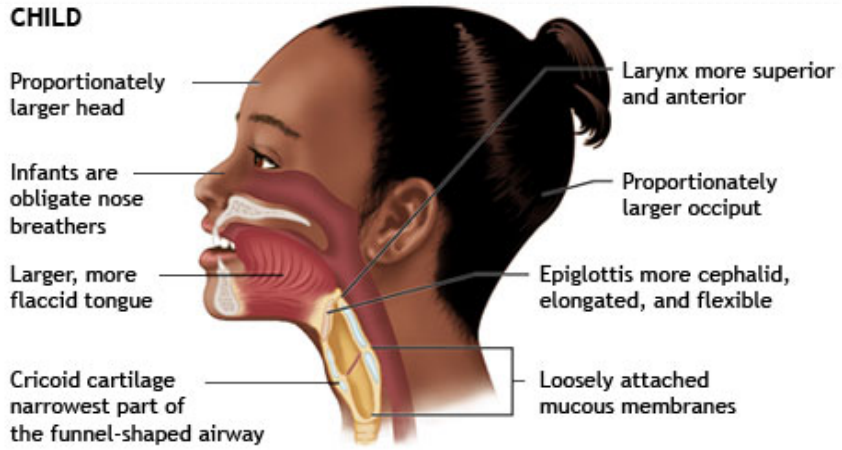
Pathophysiology

- Small caliber of airway makes it vulnerable for occlusion
- **Exponential rise in airway resistance** and **WOB** with **any process that narrows airway**
- Infant is nasal breather- any obstruction of nasopharynx significantly increases WOB
- Large tongue can occlude airway
  especially increased ICP
  loss muscle tone due to decreased GCS
- **Cricoid ring is narrowest part upper airway- often site occlusion in FB**

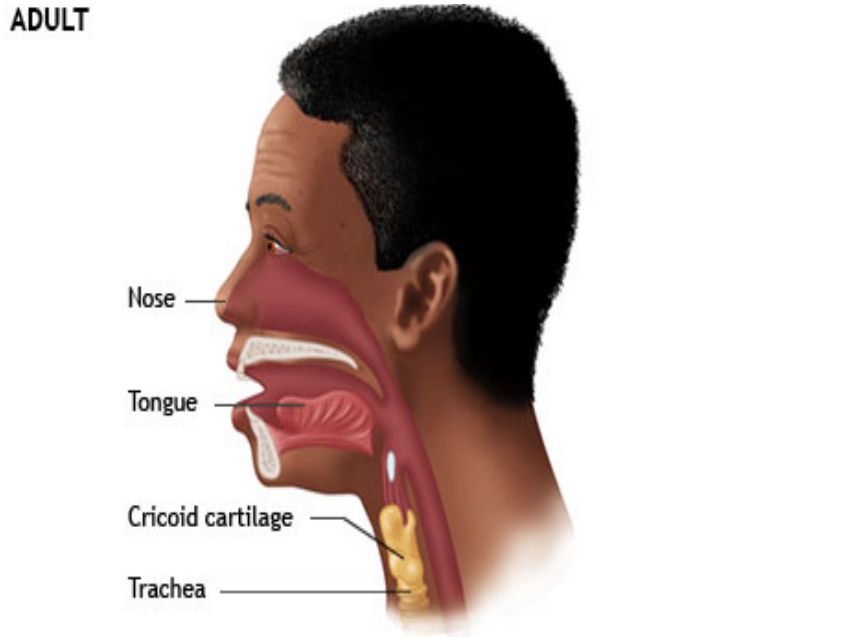
Pediatric vs Adult Airway

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

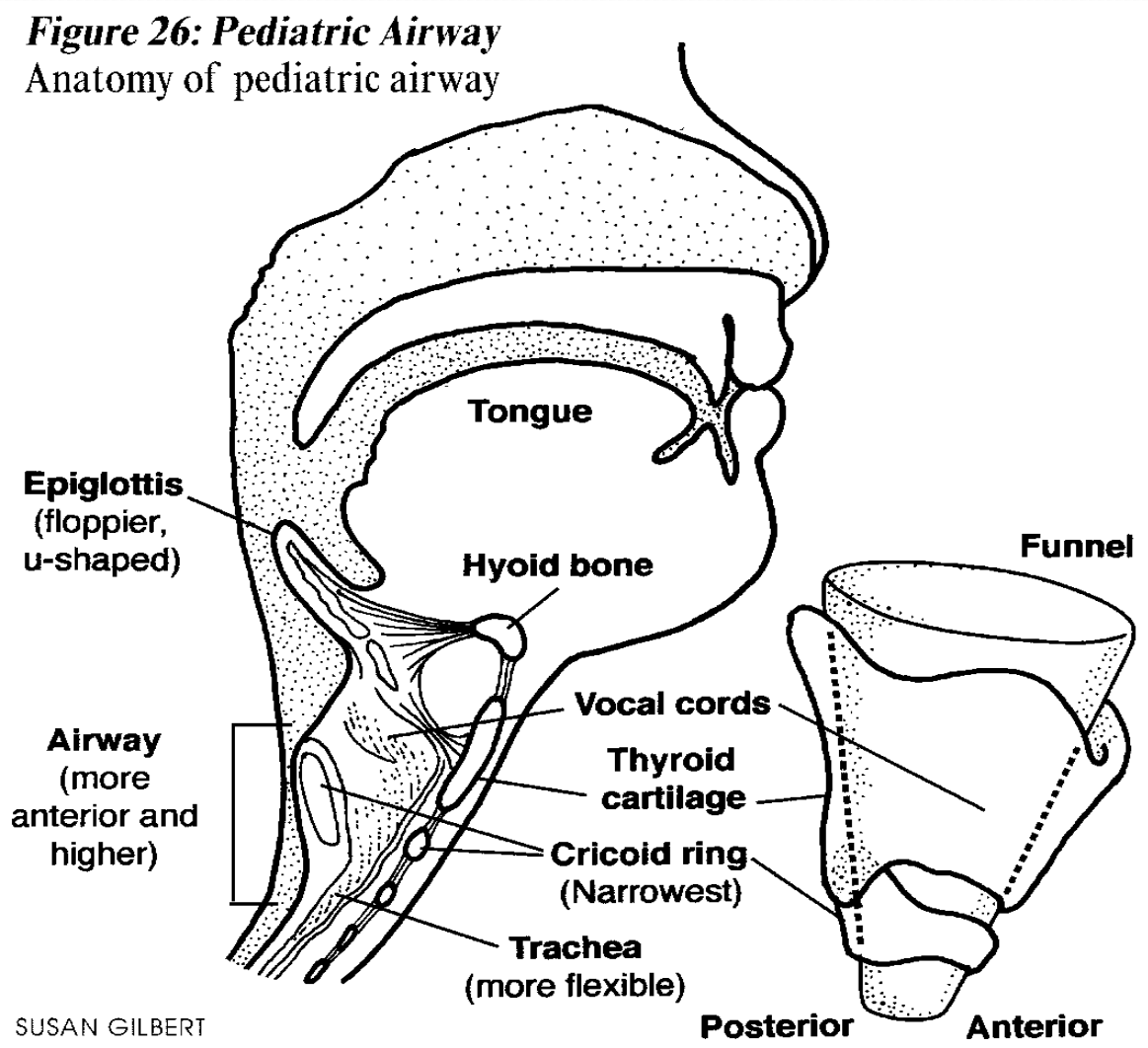


Infants and young children rely on the diaphragm to breathe more than adults do.



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



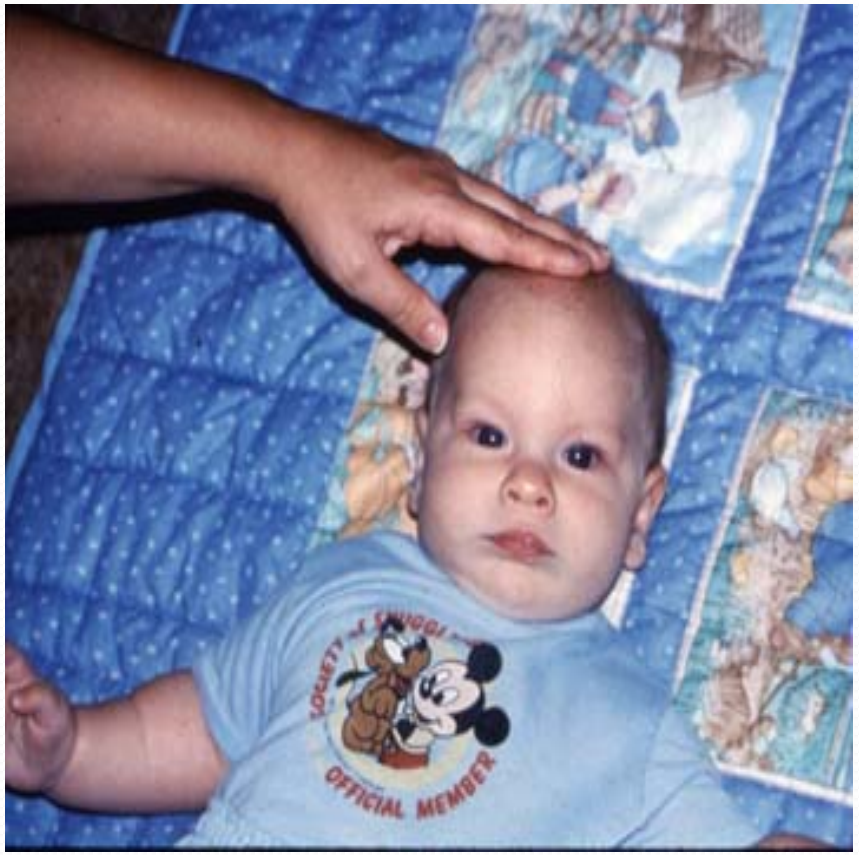
Evaluation

- 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

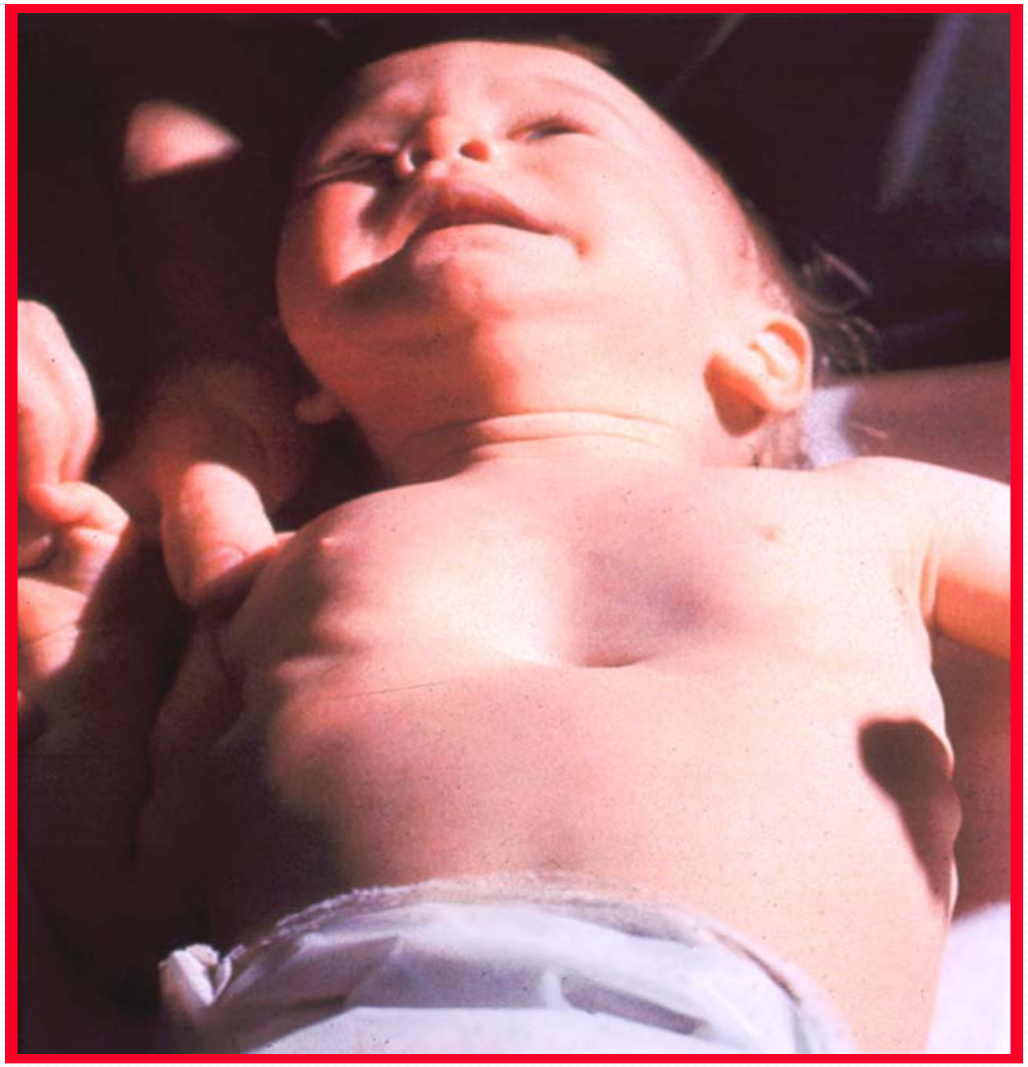


Breathing

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

Retractions

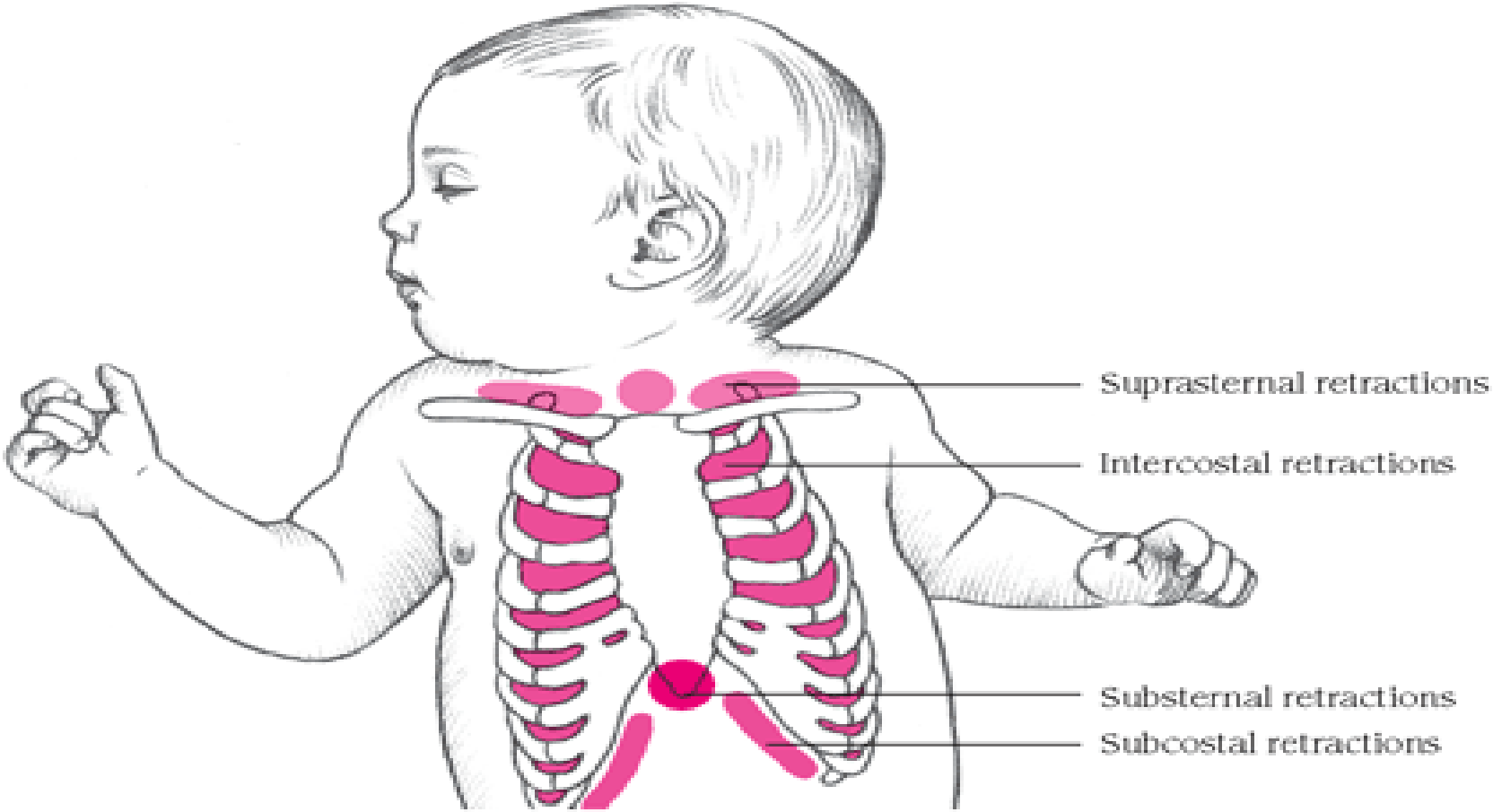
- Suprasternal
- Supraclavicular
- Intercostal
- Subcostal
- Nasal flaring



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


?Grunting baby?? - YouTube.url

- Stridor


?Stridor & Respiratory Distress in an Infant?? - YouTube.url


?Inspiratory stridor at rest - severe croup?? - YouTube.url


2-50Add tobaby with Croup Stridor Barking Cough visual & ...by babyinformation12,655 views.url

- Audible wheezing


?asthma wheezing (sound)?? - YouTube.url

Stridor

- Musical , high pitched inspiratory sound
- Hallmark of partial airway obstruction
- Pattern can localize the lesion

- **Supraglottic disease** = **inspiratory stridor**
  lesion at or above the cords
  Inspiration: loose tissues collapse inward
  Expiration: airway enlarges, tissues move

- **Subglottic disease** = **biphasic stridor**
  lesion at or below vocal cords
  Inspiration: loose tissues move inward
  Expiration : fixed lumen size impedes air flow

Stridor

- **Age of pt important**
  Infants- congenital problems
  Toddlers- foreign body
- Older child = bigger airway → complete obstruction less likely

- **Fever** implies **infectious** etiology

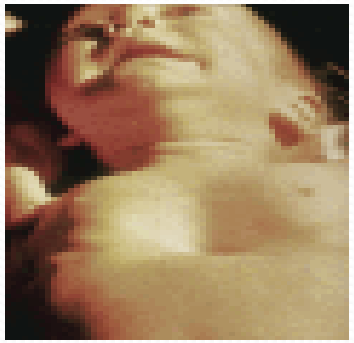
- **Sudden onset** suggests :
  some infections
  foreign body
  anaphylaxis/ allergic rxn

- Other non infectious causes:
  anaphylaxis
  trauma/ caustic ingestion
  burn/ thermal injury

Position of Comfort

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

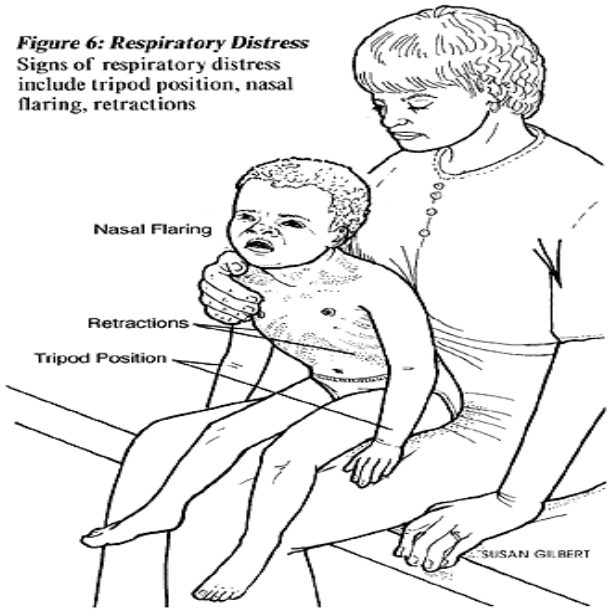
- **Upper airway disease**
  - Upright posture, leaning forward
  - self-generation of jaw thrust and chin lift
  - **“Sniffing” position**



Signs of Distress

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

https://www.youtube.com/watch?v=Zkau4yHsLLM&list=PL7EA9354BC2DD8B67&index=2



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

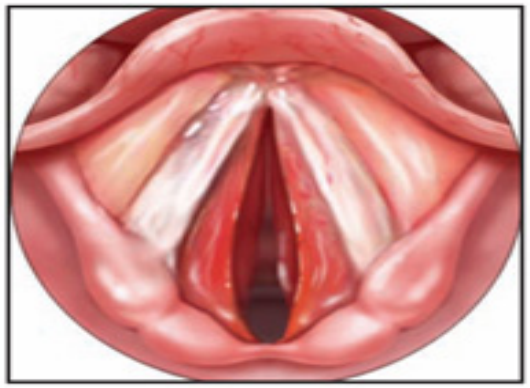
- Presence of acidosis
- PCO_2 > 50 mm Hg
- PaO_2 < 50 mm Hg
- “Normal “ blood gas in face of tachypnea and distress
- Diagnosis based primarily clinically
- Definitive airway should not be delayed waiting for labs or xray

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/ Laryngeotracheobronchitis

- 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

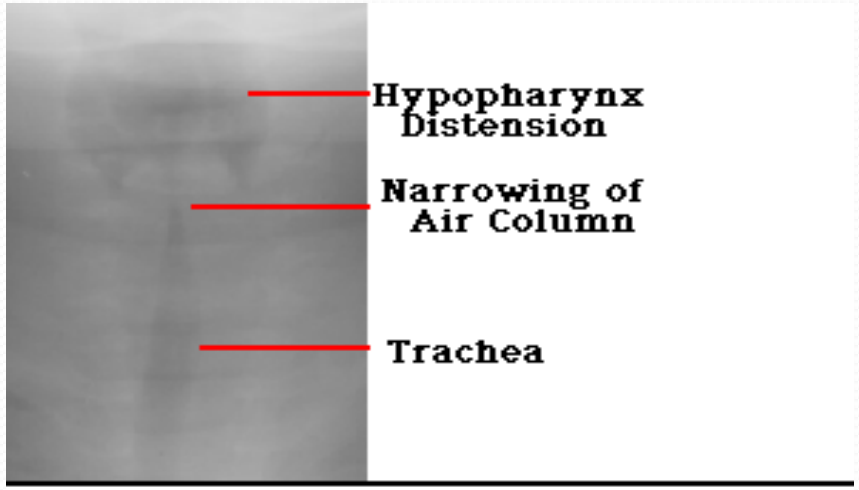
TABLE 3-5 Clinical Croup Score*

	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

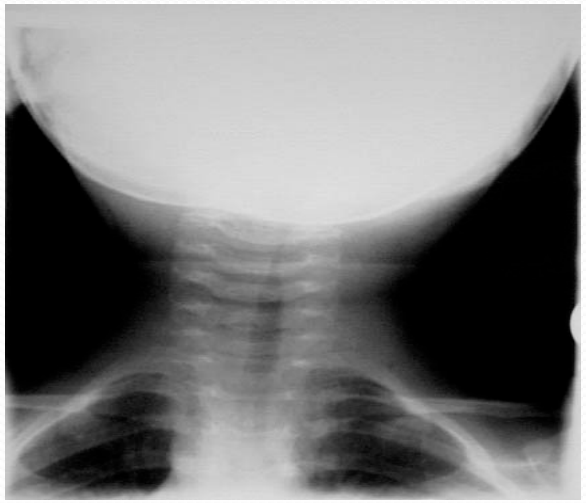
*A score of ≥4 indicates moderately severe airway obstruction. A score of ≥7, particularly when associated with $Paco_2$ of >45 and PaO_2 of <70 (in room air), indicates impending respiratory failure.

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

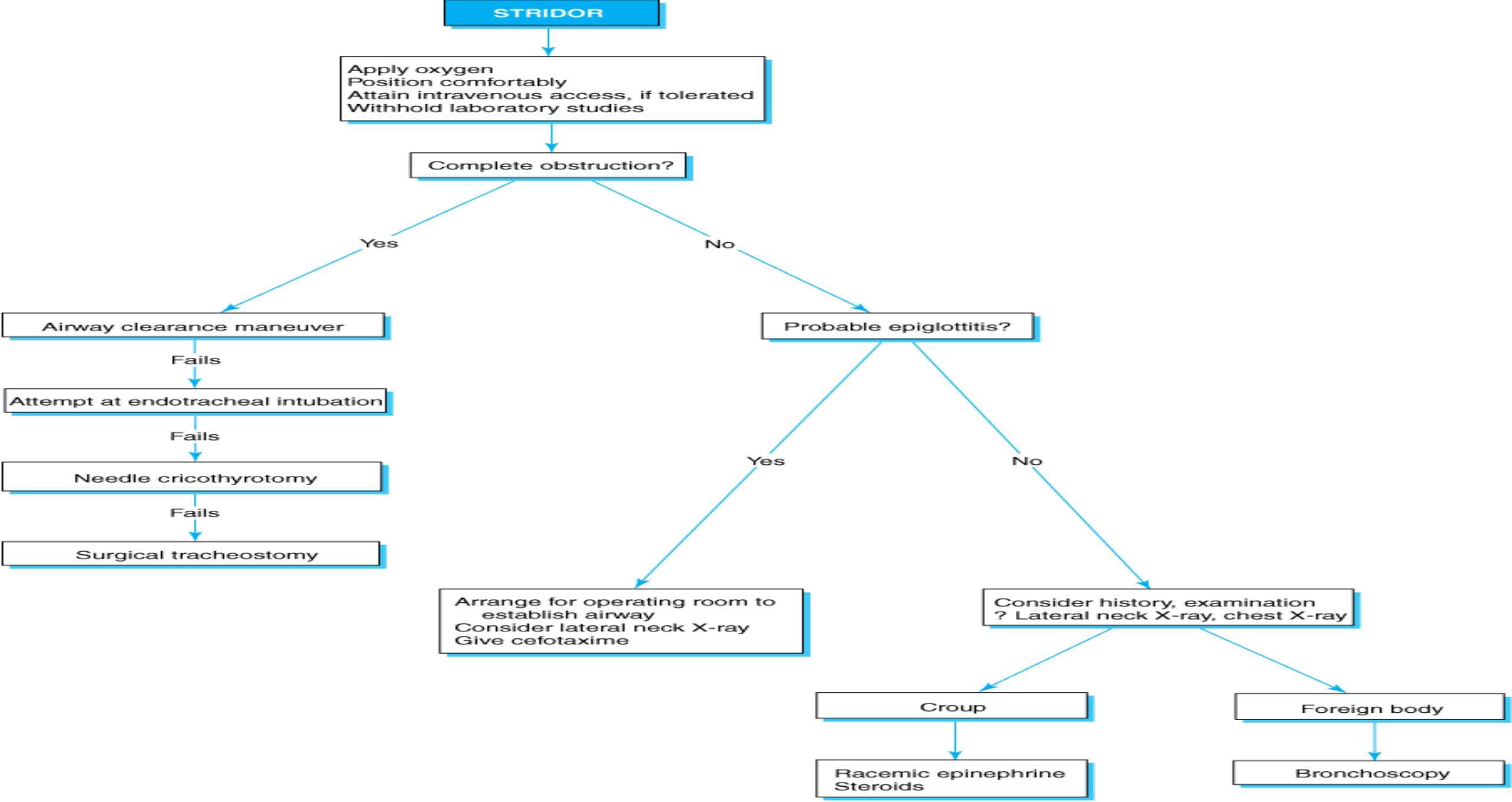
- Inability to drink
- Cyanosis
- Hypoxia
- Stridor at rest
- Poor response to or multiple racemic epinephrine treatments
- Social concerns
- Lack of follow up
- Young age- consider for < 1 yr

Differential Diagnosis: What Else Could it Be?

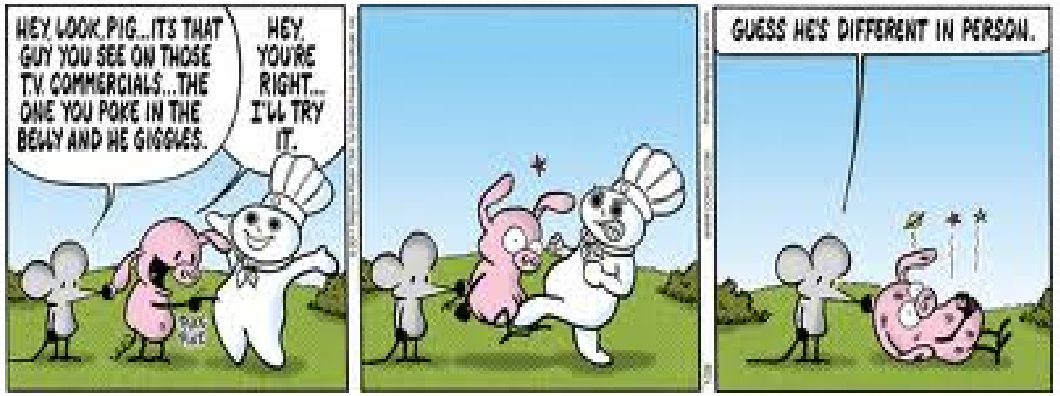
- Epiglottitis (rare)
- Bacterial tracheitis
- Peritonsillar abscess
- Uvulitis
- Allergic reaction
- Foreign body aspiration
- Neoplasm

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.



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

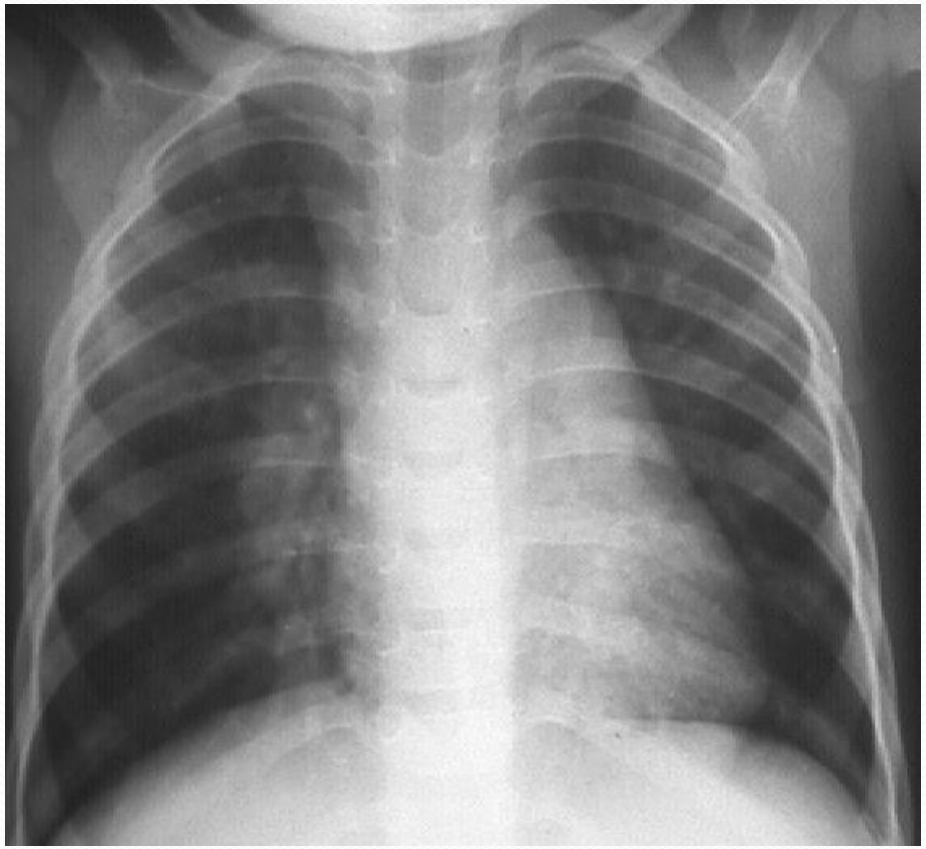
Physical Exam

- 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, IVFP, 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!

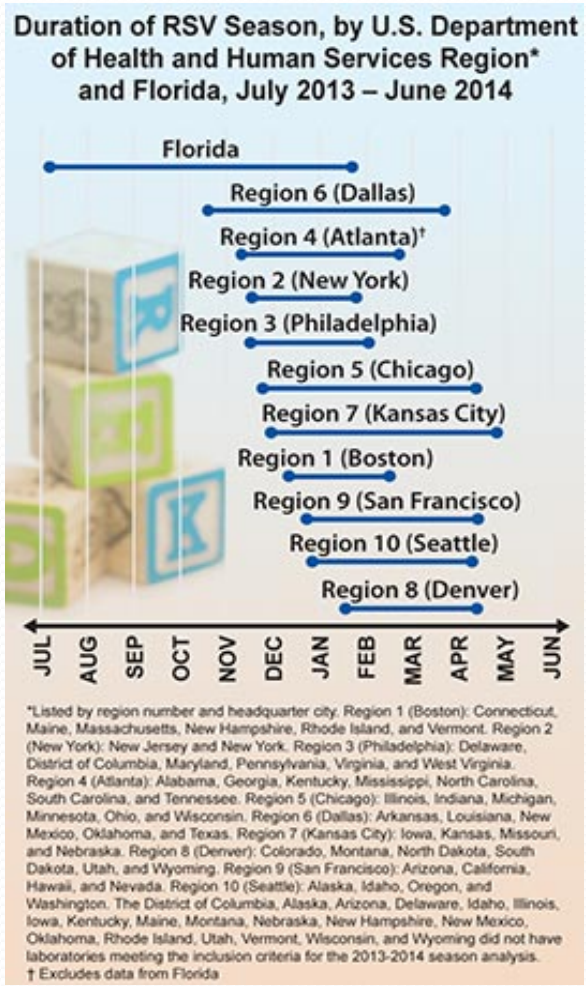
RSV

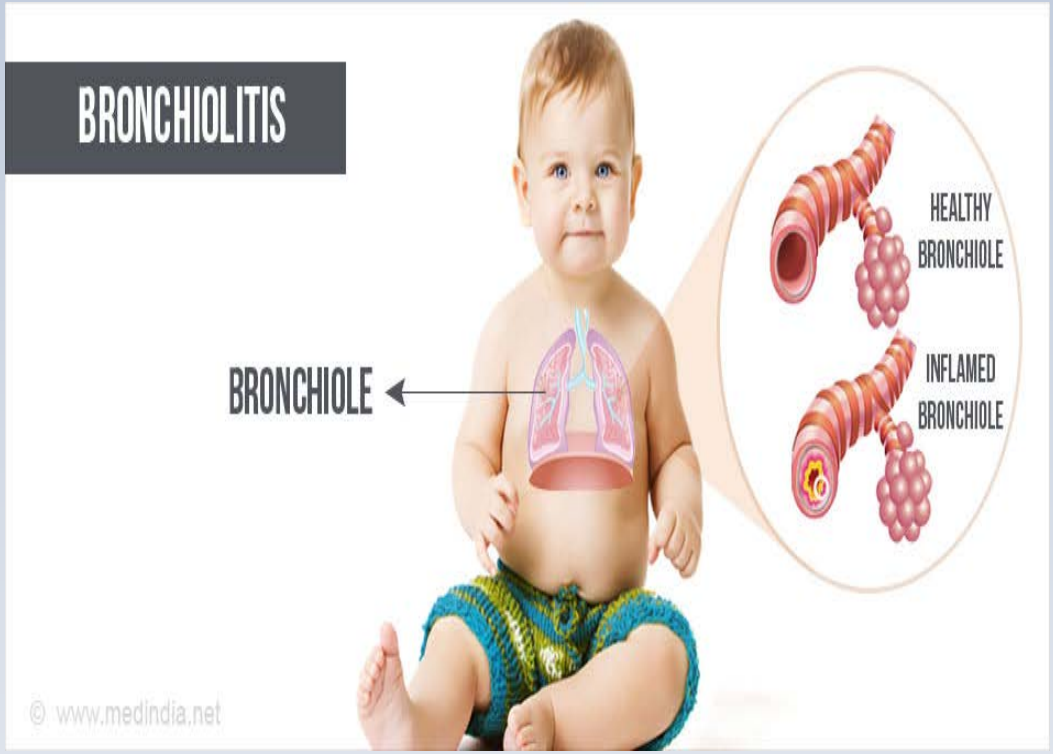
- Respiratory syncytial virus (RSV) is the most common cause of lower respiratory tract infections among young children in the United States and worldwide
- Most infants are infected before 1 year of age
- Virtually everyone gets an RSV infection by 2 years of age
- Each year- in the United States- RSV 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 older than 65 years
- RSV infections occur primarily during fall, winter, and spring (US/ similar climates)




BRONCHIOLITIS
BRONCHIOLE
HEALTHY BRONCHIOLE
INFLAMED BRONCHIOLE
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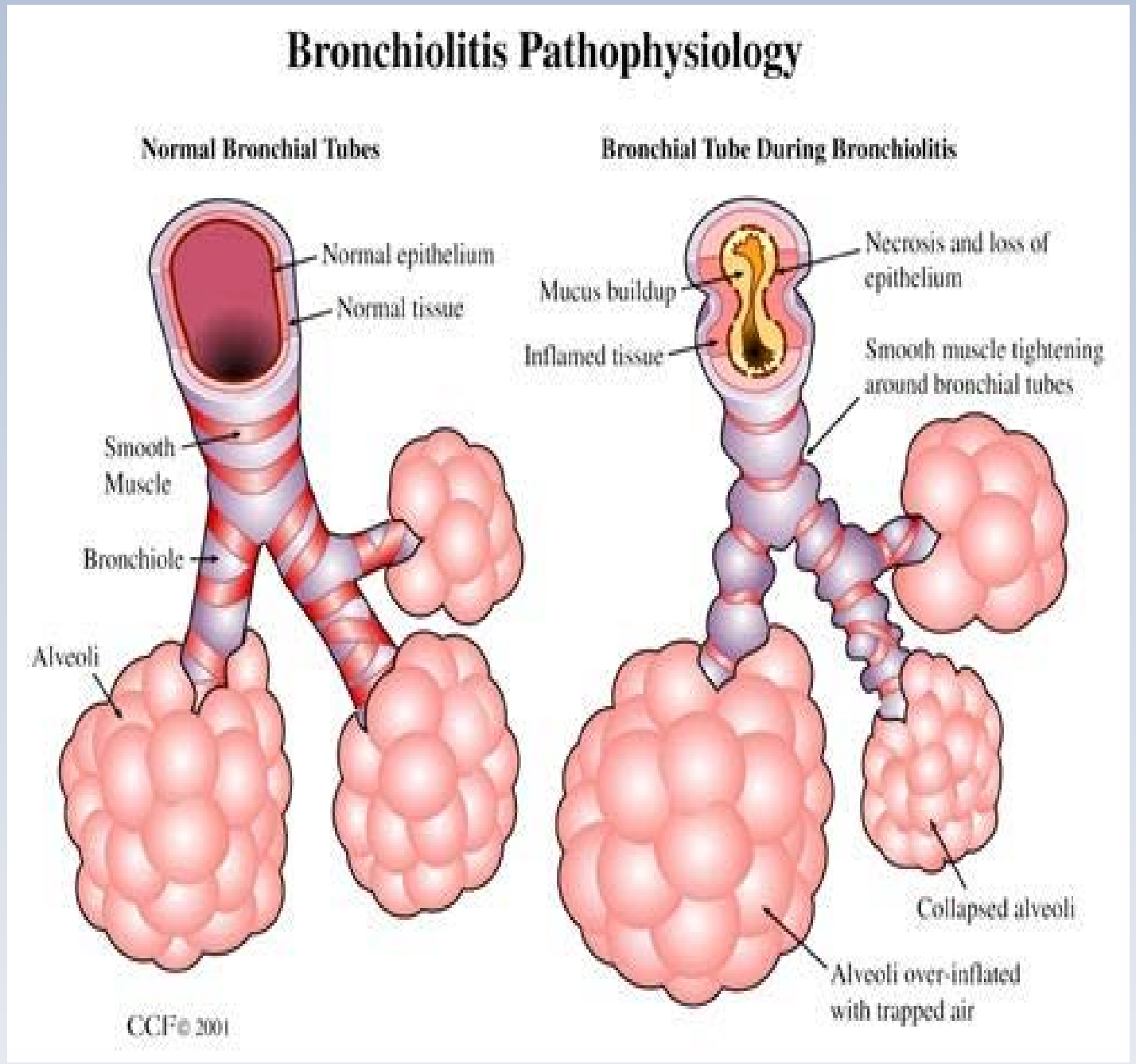
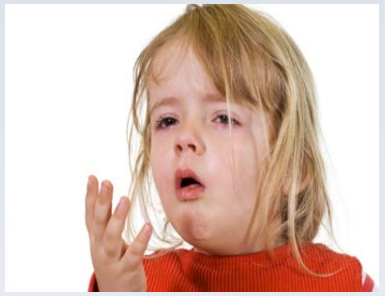

Bronchiolitis Pathophysiology
Normal Bronchial Tubes
Bronchial Tube During Bronchiolitis
Normal epithelium
Normal tissue
Smooth Muscle
Bronchiole
Alveoli
Mucus buildup
Inflamed tissue
Necrosis and loss of epithelium
Smooth muscle tightening around bronchial tubes
Collapsed alveoli
Alveoli over-inflated with trapped air
CCF© 2001

Clinical Description and Diagnosis- Infants

- RSV infection can cause a variety of respiratory illnesses
- These illnesses sometimes cause fever
- RSV infection most commonly causes a cold-like illness
- Can also cause croup and lower respiratory infections like bronchiolitis and pneumonia
- Of every 100 infants and young children with RSV infection, 25 to 40 (25% to 40%) will show signs of pneumonia or bronchiolitis
- Premature infants, very young infants, and those with chronic lung or heart disease or with suppressed (weakened) immune systems have greater chance of having amore severe infection
- Infants typically have runny nose and decreased appetite prior to other symptoms
- Cough develops 1 to 3 days later
- Subsequent sneezing, fever, and wheezing may occur after cough develops
- In very young infants, irritability, decreased activity, and **apnea** may be the only symptoms of infection.
- Most healthy infants infected with RSV do not need hospitalization
- Those who are hospitalized may require oxygen, intubation, and/or mechanical ventilation
- Most improve with supportive care and discharged in a few days

There is no specific treatment for RSV infection

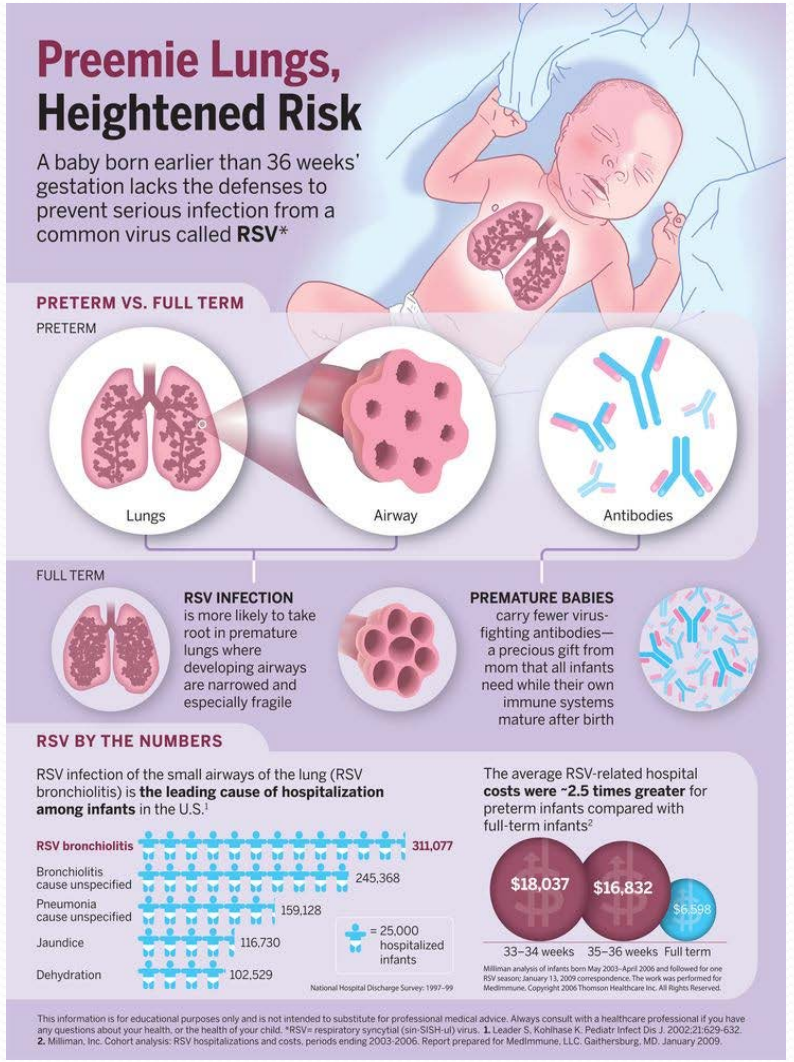


Clinical Manifestations

- 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*

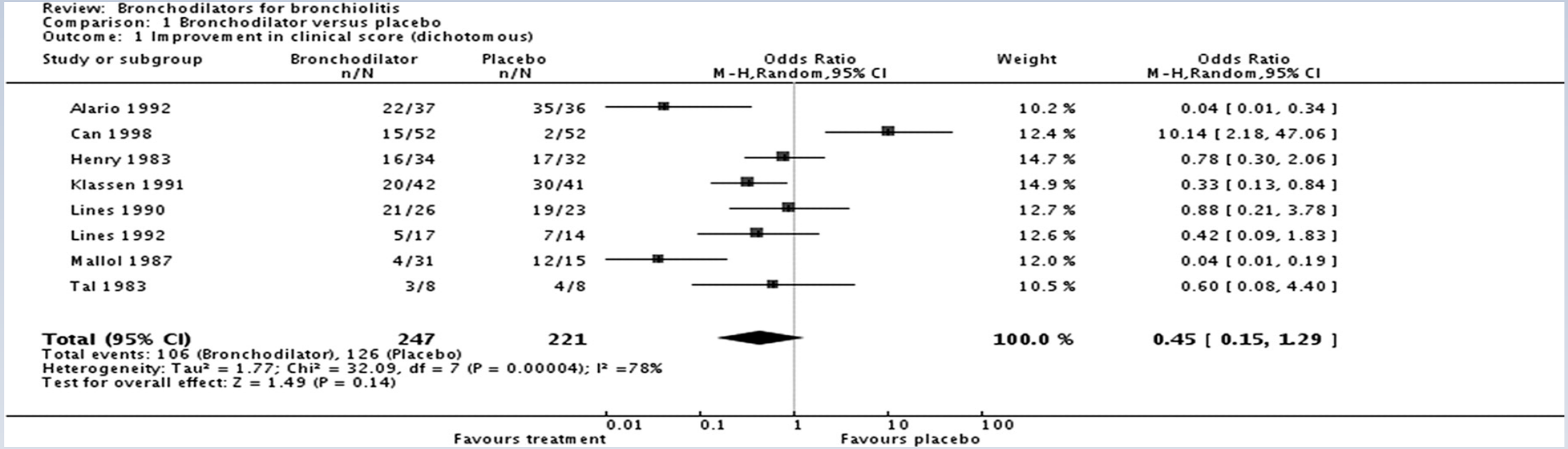
Most likely to benefit from immunoprophylaxis:
Infants receiving medication to control heart failure
Infants with moderate to severe pulmonary hypertension
Infants with cyanotic heart disease
Not indicated
Infants with hemodynamically insignificant heart disease:
Secundum atrial septal defect
Small ventricular septal defect
Pulmonic stensosis
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.



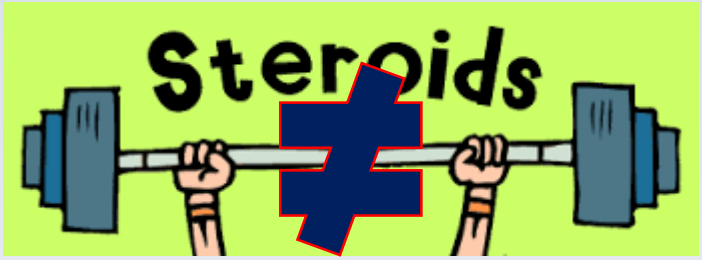
Zorc J J , Hall C B Pediatrics 2010;125:342-349

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-

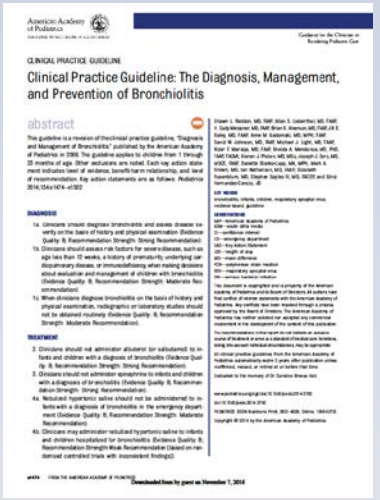
  infants with acute moderate-to-severe bronchiolitis who were treated in the emergency department, a single dose of 1 mg of oral dexamethasone per kilogram **did not** significantly alter the rate of hospital admission, the respiratory status after 4 hours of observation, or later outcomes.



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)


Clinical Practice Guideline: The Diagnosis, Management, and Prevention of Bronchiolitis

[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

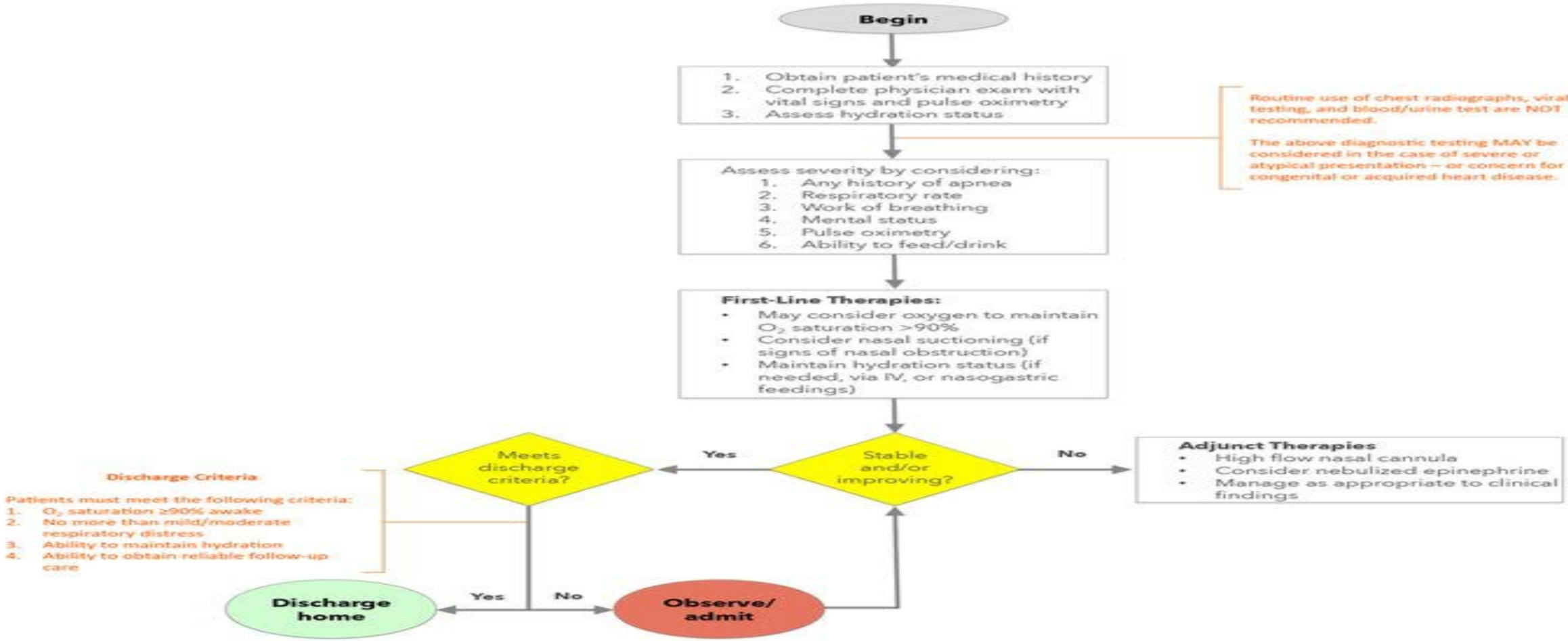
Recent multicenter research on therapy for bronchiolitis supports previous AAP recommendations against the routine use of bronchodilators or corticosteroids

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)

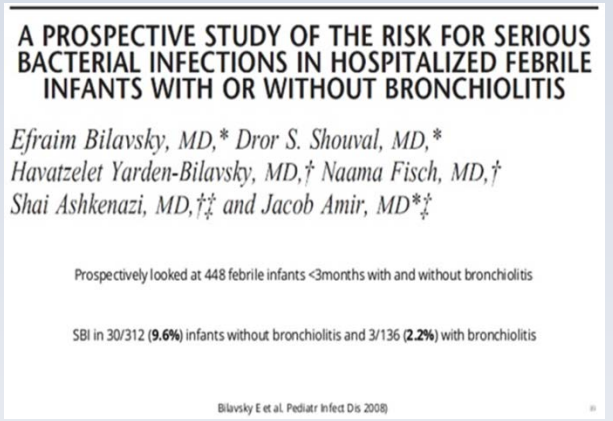
Updated 11-6-16

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	3/264 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%)	@

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

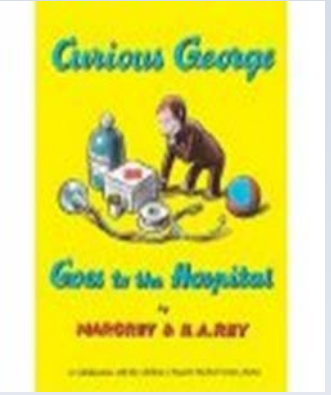
Serious Bacterial Infection

- 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

Can not prevent infection 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

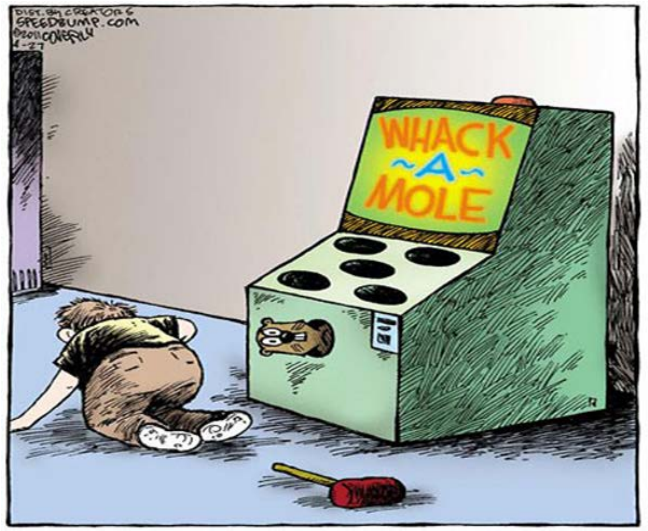
Stay home when you're sick

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



Case 3

- 12 yr old male
- URI symptoms x 3 days, non productive cough
- Increased distress past 6 hours
- Long hx asthma
- Multiple admissions, PICU x 2, never intubated
- Ran out of Albuterol- used 1 MDI past week
- Flovent “ as needed”, but ran out 1 mth ago
- Mom smokes, but “ not in house”
- Doesn’t know what peak flow meter is

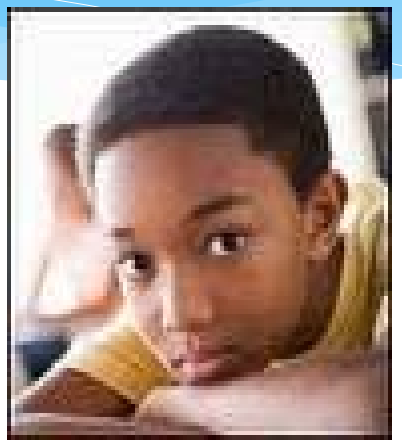
NRB placed, sats up to 95 % on 100% FIO2
Albuterol started at triage
Pt still in distress
What do you want to do?
Where will this pt go?
Does he need blood gas?
Will chest film change your management?

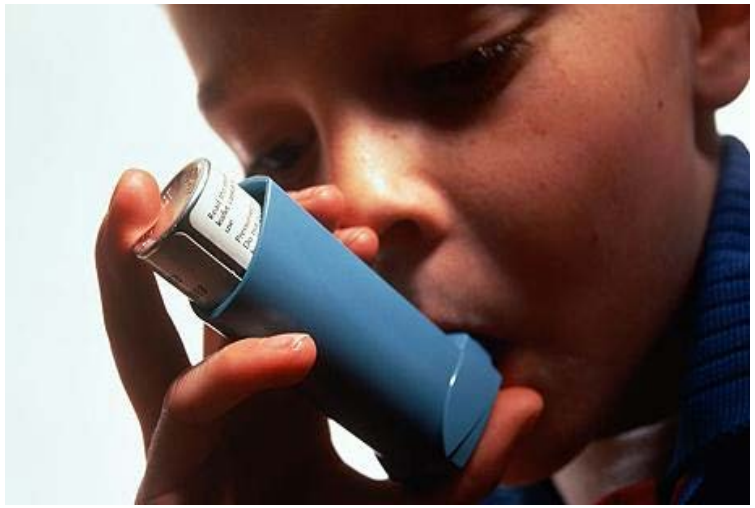
Pediatric Asthma

- 10 million missed school days annually
- Loss of parent productivity- $ 1 billion/year
- Health care costs- > $6 billion/year
- 13 million outpt vists/yr
- 1.6 million annual ED visits
- > 5000 deaths/year

Prevalence Rates

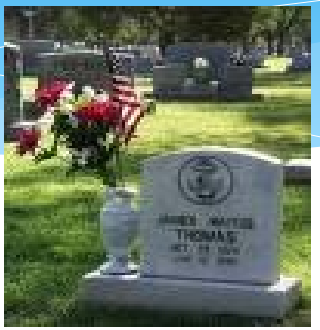
- Boys 50% > girls
- African Americans 44% > white/ hispanics
- 12% greater if below poverty line
- **Highest at risk : poor, black, male**





Pediatric Asthma Mortality

- Rates more than doubled since 1980
- Black child 4x higher risk of dying
- Urban adolescent highest risk group
- Limited access to care
- Delay in seeking care
- Over use albuterol/ rescue meds
- Under use steroids
- Major risk factor for death = prior intubation



Definition

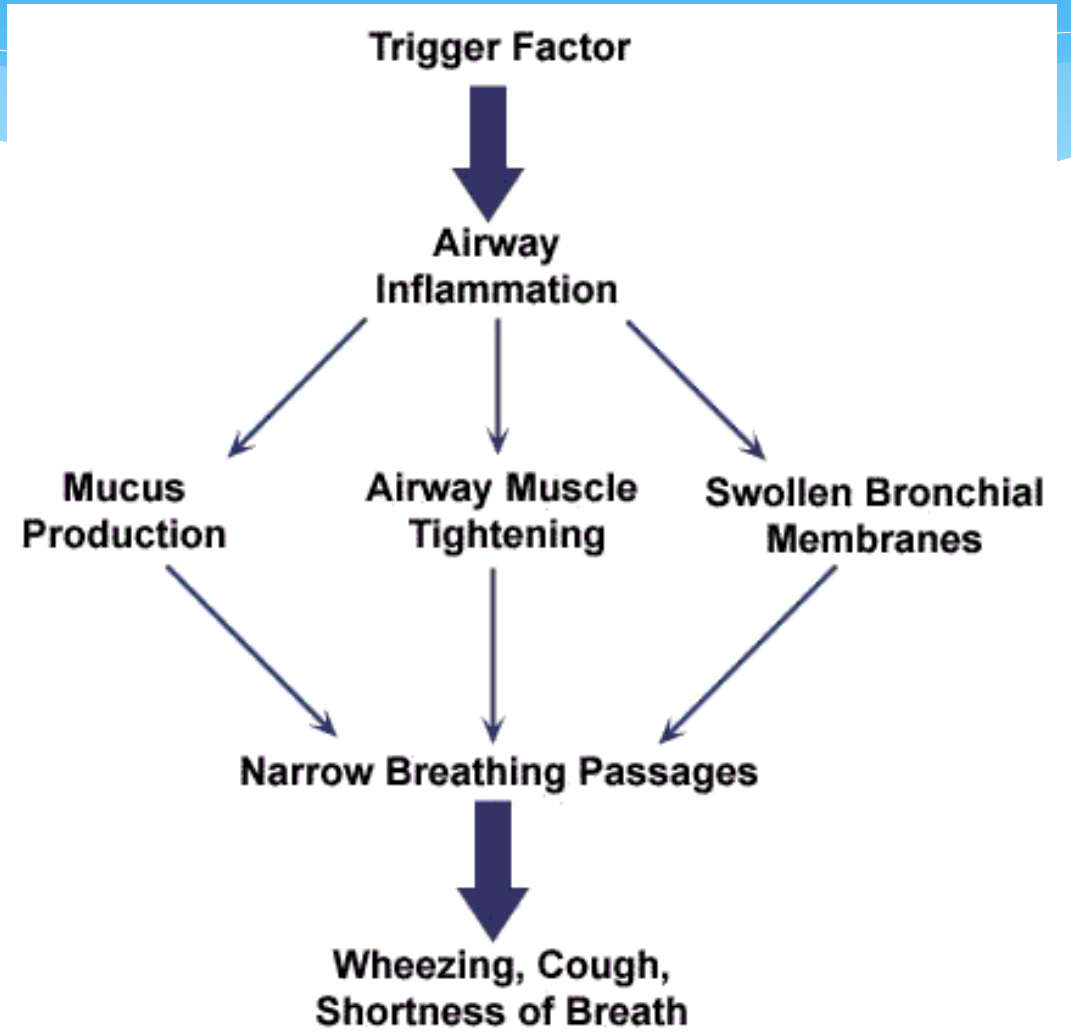
- Chronic inflammatory disease
- Frequent exacerbations
- Reversible airflow obstruction w/ meds
- **Multiple triggers**- viral URI, mycoplasma, exercise, allergies, environmental (tobacco, dust, roaches)
- Manifested :

  shortness of breath

  cough

  wheeze

  chest tightness

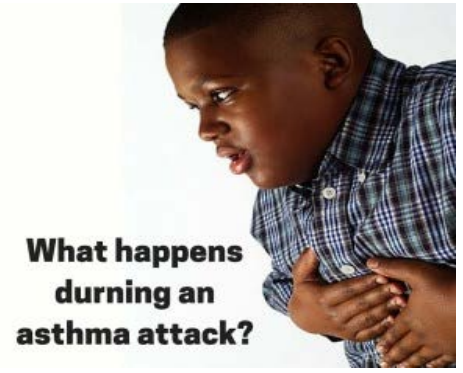


History

- Current flare- onset/ severity symptoms
- Prior flares- PICU, intubation, near fatal episodes
- Baseline severity of disease- ED visits, last steroids, peak flow, hospitalization
- Social issues: followup, compliance with meds, ability to pay for meds, distance to ED
- **Even those with mild RAD can present with sudden, severe, life threatening attack**

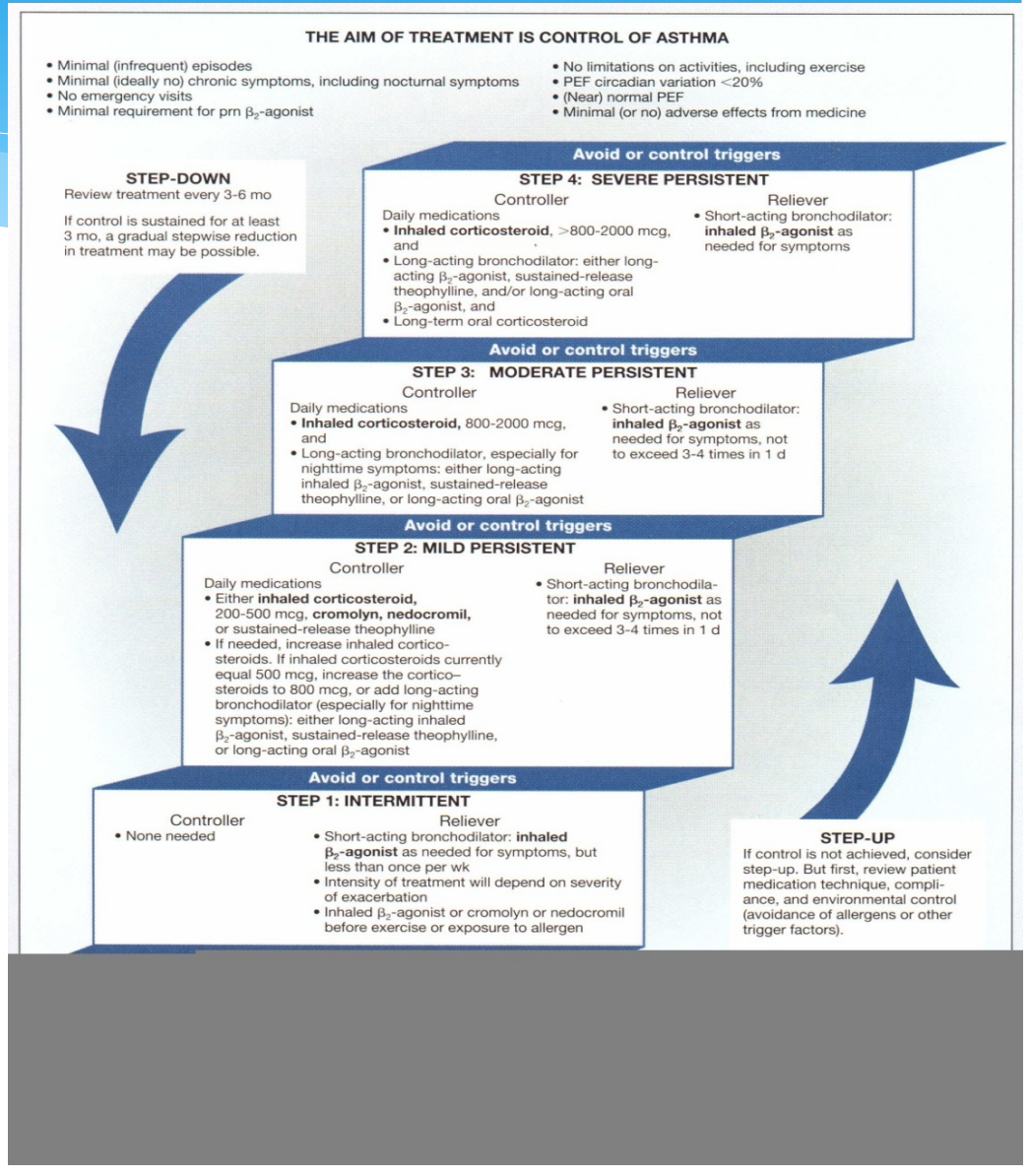
Physical exam

Pressured speech
Tachypnea
Tachycardia
Accessory muscle use
Wheezing
Aeration
Prolongation expiratory phase
Pulse oximetry
Subtle changes in mentation



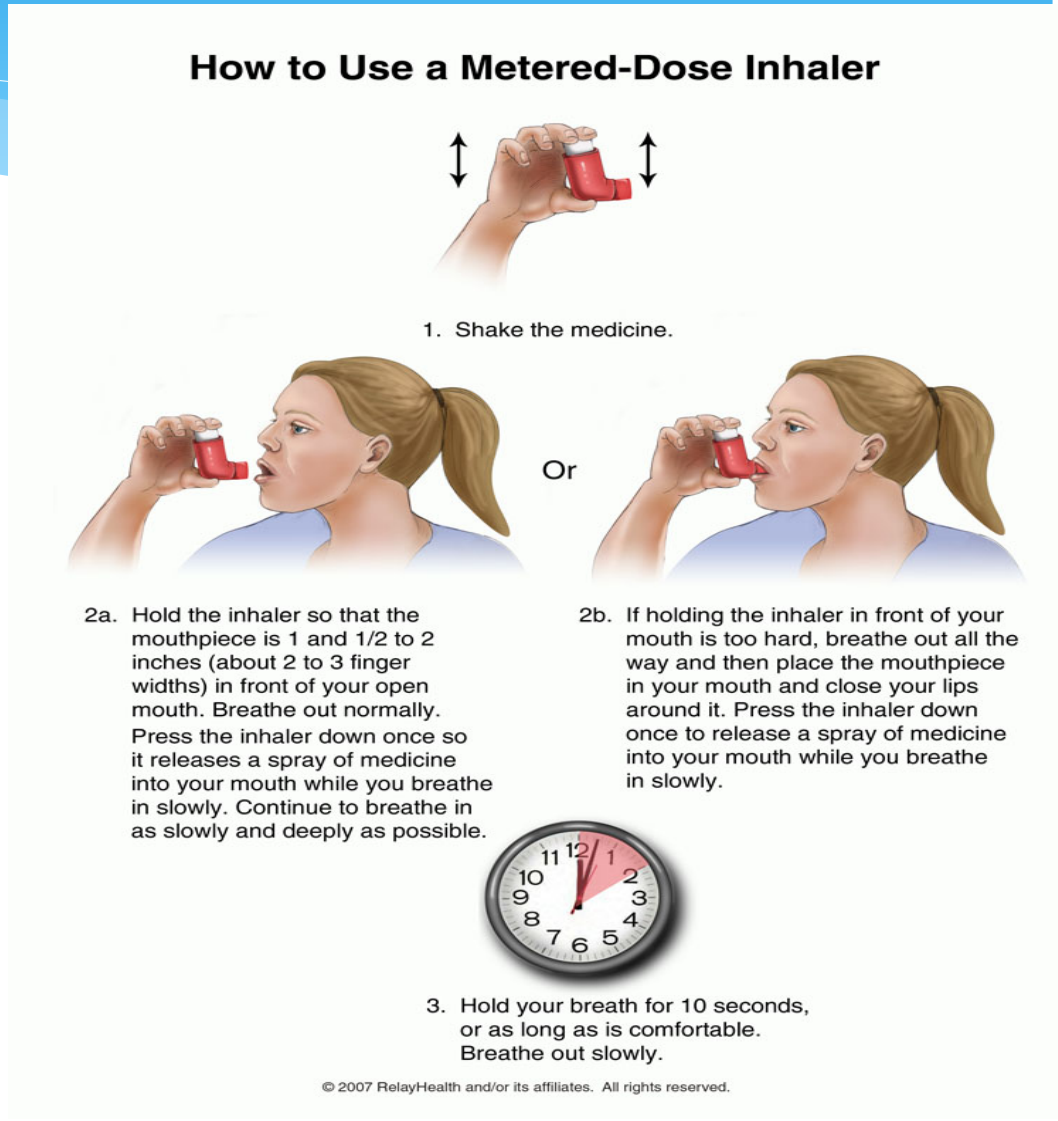
Treatment

- Inhaled Beta agonists
- Nebulized Anticholinergic Agents
- Corticosteroids
- Magnesium sulfate
- Heliox
- Intubation



Inhaled Beta Agonists

- Standard 1st line therapy
- Most effective way to relieve airflow obstruction
- Rapid onset of action (5 minutes)
- Albuterol- relaxes smooth muscle to relieve bronchospasm
- Delivery- MDI vs Nebulizer
- Dosing- intermittent vs continuous



Albuterol Delivery- MDI or Nebulizer

- **Multiple studies demonstrate equivalent efficacy as long as MDI used with spacer/ mask**

  (Chou, 1995, Williams, 1996, Schuh, 1999, Leversha, 2000)

- MDI/ spacer :
  more efficient delivery of meds
  portable
  able to be incorporated for home use
- Optimal dose not well established
  most 4 puffs = 1 nebulized tx
- Nebulizer can deliver humidified oxygen
- Nebulizer best for severely ill

Albuterol Dosing

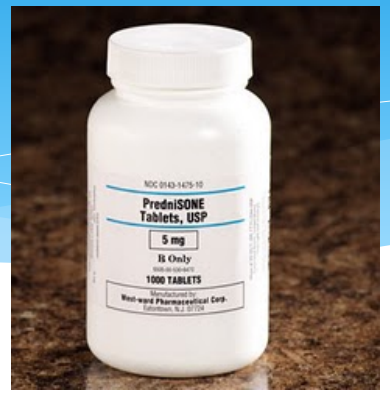
- NAEPP recommendation is nebulized albuterol q 20 minutes x 3 treatments
- < 50 kg- 2.5 mg (0.5cc)
- > 50 kg- 5.0 mg (1 cc)
- Essentially the same as continuous tx
- Continuous albuterol safe and effective
- Promptly initiate severe flare/ impending resp failure, little response to initial therapy
- 0.5 mg/kg/hr (max-15-20 mg/ hr)

Atrovent

- Derivative of atropine
- Onset quick- 15 minutes, peak 40-60 minutes
- Weak bronchodilator itself
- Adjunctive med to be used with beta agonist (Schuh, 1995, Qureshi, 1998, Zorc, 1999)
- Use mod –severe attacks
- Administer concurrently with 1st 3 albuterol treatments
- Frequency/ efficacy further treatments after initial hour not established

Corticosteroids

- Indicated for **most pts in ED** with asthma exacerbation
- Multiple studies have shown decreased hospitalization rate when given steroids early in ED course (Scarfone, 1993, Rowe, 1992,Tal , 1990)
- Effective within 2-4 hrs of administration- 2mg/kg
- IV and po route equivalent
- PO route preferred- short course safe and effective
- Severe distress, emesis may force IV
- Qureshi, 2001 – 2 doses Dexamethasone = 5 days prednisone (0.6 mg/kg, max 16 mg)
- Compliance improved, can give IM if pt fails po



PEDIATRICS®

Dexamethasone for Acute Asthma Exacerbations in Children: A Meta-analysis

Grant E. Keeney, MDa, Matthew P. Gray, MDa, Andrea K. Morrison, MD, MSa, Michael N. Levas, MDa, Elizabeth A. Kessler, MD, MSa, Garick D. Hill, MD, MSa, Marc H. Gorelick, MD, MSCEa, and Jeffrey L. Jackson, MD, MPHb,c

Pediatrics; originally published online February 10, 2014

CONCLUSIONS:

Practitioners should consider single or 2-dose regimens of dexamethasone as a viable alternative to a 5-day course of prednisone/prednisolone.

Inhaled Steroids

- Mainstay of chronic asthma management
- **Inhaled corticosteroids are the most effective drugs for asthma control**
  - reduce asthma mortality
  - decrease hospital visits and exacerbations
  - improve quality of life
- Potential use in acute setting ambivalent
- Initial studies-(Scarfone, 1995- nebulized dex, Devidal, 1998, budesomide) encouraging
- However, Schuh, 2000 showed inhaled fluticasone to be less efffective than oral prednisone in kids with severe attack in ED
- If not on chronic control meds, consider starting maintenance inhaled steroid regimen from ED
- Controversy re effects on growth with prolonged use

Magnesium Sulfate

- Bronchodilation- smooth muscle relaxant
- Effective IV route only
- Effects 20 minutes after infusion, can last up to 3 hrs
- Limited pediatric data but most suggest beneficial- especially severe attack (Ciarallo, 1996, 2000, Scarfone, 2000)
- **50-75 mg/ kg , Max dose 2 grams, IV over 20 minutes**
- Severely ill asthmatics, potential PICU admission, not responsive to aggressive conventional treatment have greatest benefit

Heliox

- Mixture helium and oxygen
- Reduces turbulent flow and airway resistance
- Use in upper airway obstruction well established
- Efficacy in lower airway disease controversial
- Need 60% helium to be effective
- Hypoxemia limits its usefulness

Mechanical Ventilation

- Should be avoided if at all possible
- Should be “ last resort”
- Increases airway hyper-responsiveness
- Increased risk barotrauma
- Increased risk circulatory depression/arrest
- Early recognition poor response to therapy/ potential PICU admission
- Indications include:
    - severe hypoxia
    - altered mentation
    - fatigue
    - resp or cardiac arrest
- Rising CO2 in face of distress or fatigue
- Ketamine if intubation required

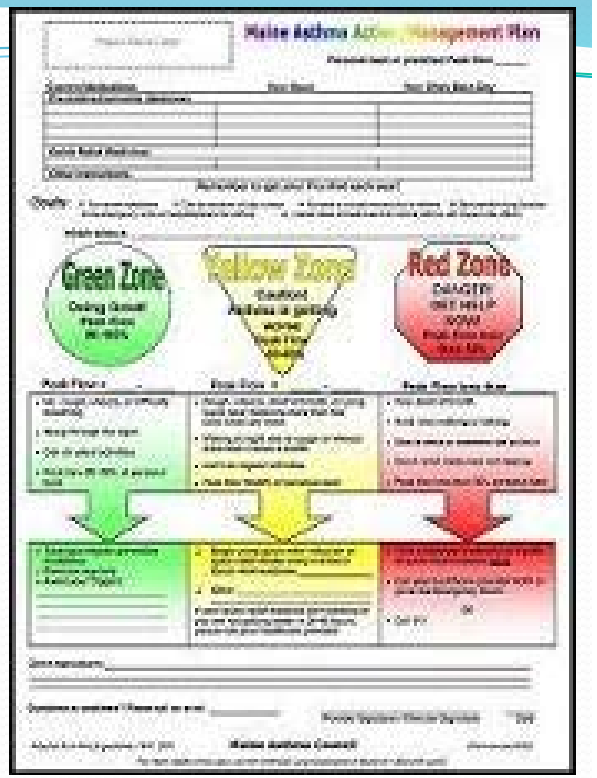
Ancillary Studies

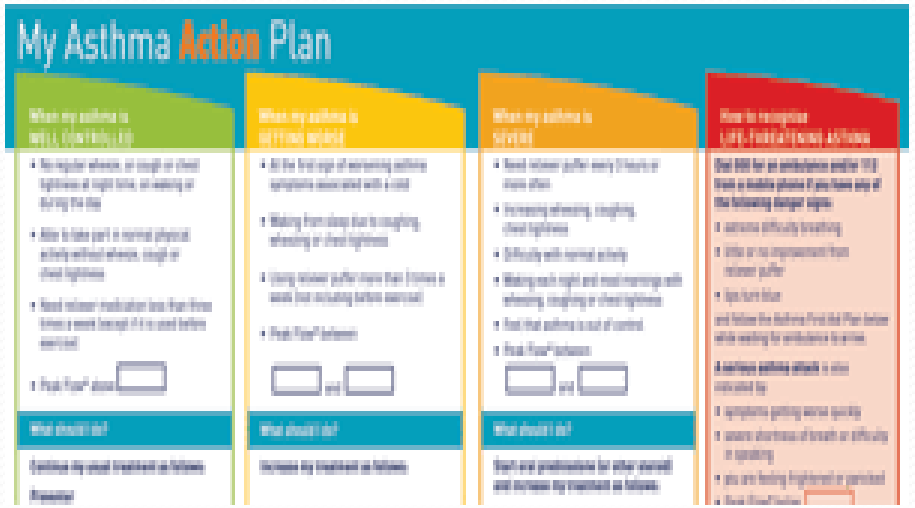
- Peak flow, especially in comparison from baseline
- ABG– painful, invasive, not routine
- Decision to intubate never made based on ABG result alone- look at pt!
- Baseline CBC, Basic not routinely needed
- **VBG- be wary if normal in context of distress/ tachypnea**
- Continuous albuterol- watch hypokalemia
- Mod- severe asthmatics may be dry- decreased po, emesis from meds, insensible losses- may need IVF
- Chest film- reserve for :
  - 1st time wheezers
  - clinically suspected pneumonia/ pneumomediastinum/pneumothorax
  - PICU player

Disposition

- Most asthmatics require at least 2 hrs assessment and treatment in ED
- Must observe for at least 1 hr after initial 3 treatments/ steroids given
- **Reassessment critical**
- Consider likelihood follow up, compliance with meds, triggers
- Admit if :

  can’t tolerate po
  distress/ hypoxic
  comorbidities
  PICU admission or intubation in past
  poor social situation/ non compliance





Sutter Health
Community Based, Not For Profit

Child Asthma Action Plan

Ages 0–5 Years Old: Review and update at each Doctor's visit

Patient Name: _____

DOB: _____

Healthcare Provider's Name: _____

Healthcare Provider's Phone #: _____

Green Zone — Child is Well

...and has no asthma symptoms, even during play

PREVENT asthma symptoms everyday:

- ■ Avoid things that make your child's asthma worse
- ■ Give your child the controller medicines everyday:

MEDICINE HOW MUCH WHEN

_____

_____

- ■ Optional Instructions:
- ☐ At the onset of respiratory illness,

Give _____ (ICS) _____ _____ times a day for _____ days

Yellow Zone — Child is Not Well

...and has asthma symptoms that may include:

- Coughing
- Wheezing
- Runny nose or other cold symptoms
- Breathing harder or faster
- Waking due to coughing or difficulty breathing
- Playing less than usual

Other symptoms that could indicate that your child is having difficulty breathing may include: difficulty feeding (grunting sounds, poor sucking), changes in sleep patterns, cranky and tired, decreased appetite

CAUTION, asthma symptoms are present

- ■ Give _____ (RESCUE MEDICINE) ☐ 2 ☐ 4 puffs ☐ nebulizer,

every 20 minutes for up to 1 hour, as needed

If your child feels better and is back in the Green Zone continue the Green Zone medicines

- ☐ If symptoms persist give _____ (RESCUE MEDICINE)

☐ 2 ☐ 4 puffs ☐ nebulizer, every _____ hours

- ■ *If your child still does not feel well* and he/she continues to need rescue medicine for more than _____ hours, call your doctor and have your child take the following medicines:

☐ Give _____ (ICS) _____ _____ times a day for _____ days

☐ Give _____ (ORAL STEROID) _____ _____ time(s) a day for _____ days

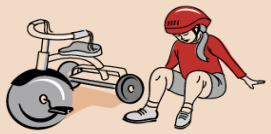
Continue all other Green Zone medicines

- ■ **If your child's symptoms worsen call your doctor**

Red Zone — Child Feels Awful!

Warning signs may include:

- Child's wheeze, cough or difficulty breathing continues or worsens, even after giving Yellow Zone medications
- Child's breathing is so hard that he/she is having trouble walking/talking/eating/playing or child is drowsy or less alert than normal



DANGER! Get help immediately!

- ■ Give _____ (RESCUE MEDICINE)

☐ 2 ☐ 4 puffs ☐ nebulizer, every 20 minutes

- ■ **Call your Doctor's office now. If you can't reach them, go to the hospital**

Call 911 if your child has trouble walking or talking due to shortness of breath or lips/fingernails are grey or blue

Completed by: **Date:**

AUTHORIZATION AND DISCLAIMER FROM PARENT/GUARDIAN: MY CHILD MAY CARRY AND SELF-ADMINISTER ASTHMA MEDICATIONS ☐ YES ☐ NO AND I AGREE TO RELEASE THE SCHOOL DISTRICT AND SCHOOL PERSONNEL FROM ALL CLAIMS OF LIABILITY IF MY CHILD SUFFERS ANY ADVERSE REACTIONS FROM SELF-ADMINISTRATION OF ASTHMA MEDICATIONS.

Parent Signature: _____ Date: _____

PHYSICIAN: MY SIGNATURE PROVIDES AUTHORIZATION FOR THE ABOVE WRITTEN ORDERS. STUDENT MAY CARRY AND SELF-ADMINISTER ASTHMA MEDICATIONS ☐ YES ☐ NO.

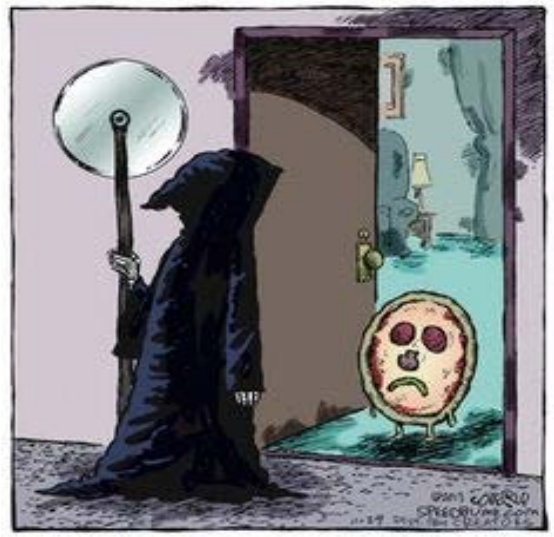
Physician Signature: _____ Date: _____

FOR MORE INFORMATION ON CHILDHOOD ASTHMA VISIT OUR WEBSITE AT: WWW.KIDS.SUTTERHEALTH.ORG

TOP SHEET: PATIENT **SECOND SHEET:** CHILD CARE/SCHOOL/OTHER SUPPORT SYSTEM **LAST SHEET:** MEDICAL RECORD

Risk Factors for Fatal Flare

- Hx of severe sudden exacerbation
- Prior PICU admission or intubation
- > 2 Hospitalizations past year
- > 3 ED visits past year
- > 2 MDI/ mth
- Current steroid or recent wean
- Medical comorbidiites
- Low socioeconomic status, urban setting
- **Adolescent- poor perception of symptoms**



Conclusions

- Respiratory distress multiple etiologies
- Goal- prevent progression to resp failure and cardiac arrest
- Age and season can guide diagnosis and tx
- Younger the pt, more likely to be viral- RSV
- Treat asthma aggressively
- Start steroids early in ED course
- Dexamethasone improves compliance
- Early recognition of need for PICU
- MDI/spacer/ mask more efficient than nebulizer- incorporate for home use
- Be wary of risk factors for fatal attack

Question 1

A 4 mth male presents to the ED with a fever 102.4, runny nose, cough, and wheeze for the past 2+ days
Mom reports no color changes
RR 48, SATS 96% R/A HR 150'S
He is social, easily consolable, and in no distress
He is taking the bottle as you exam him
Appropriate management includes:

A. Give him albuterol
B. Give a dose of dexamethasone
C. Get an xray
D. Admit to the hospital
E. Check a catheterized urine sample/ cx

Question 2

14 yr old known asthmatic with 3 days non productive cough
Afebrile
Has gone through an inhaler past 3 weeks
His parents smoke but " not in house"
He does not know what a peak flow meter is
He thinks he had steroids when he was admitted to the PICU 2 mths ago
He is 97 kg
Rr 28 with pressured speech
Diffuse wheeze
Intercostal and subcostal retractions
Exp >>> insp phase
Sats 98 % ra

All are true except:

a. He is increased risk for fatal flare
b. he needs a chest xray
c. Steroids should be started immediately
d. Continuous albuterol may needed
e. Magnesium sulfate may be helpful

Questions????