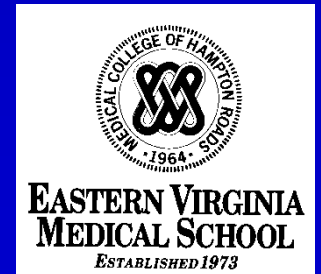


The Wheezing, Coughing Child

Theresa Guins, MD

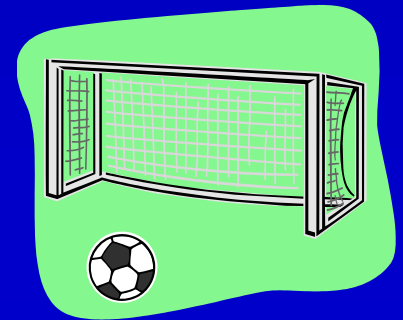
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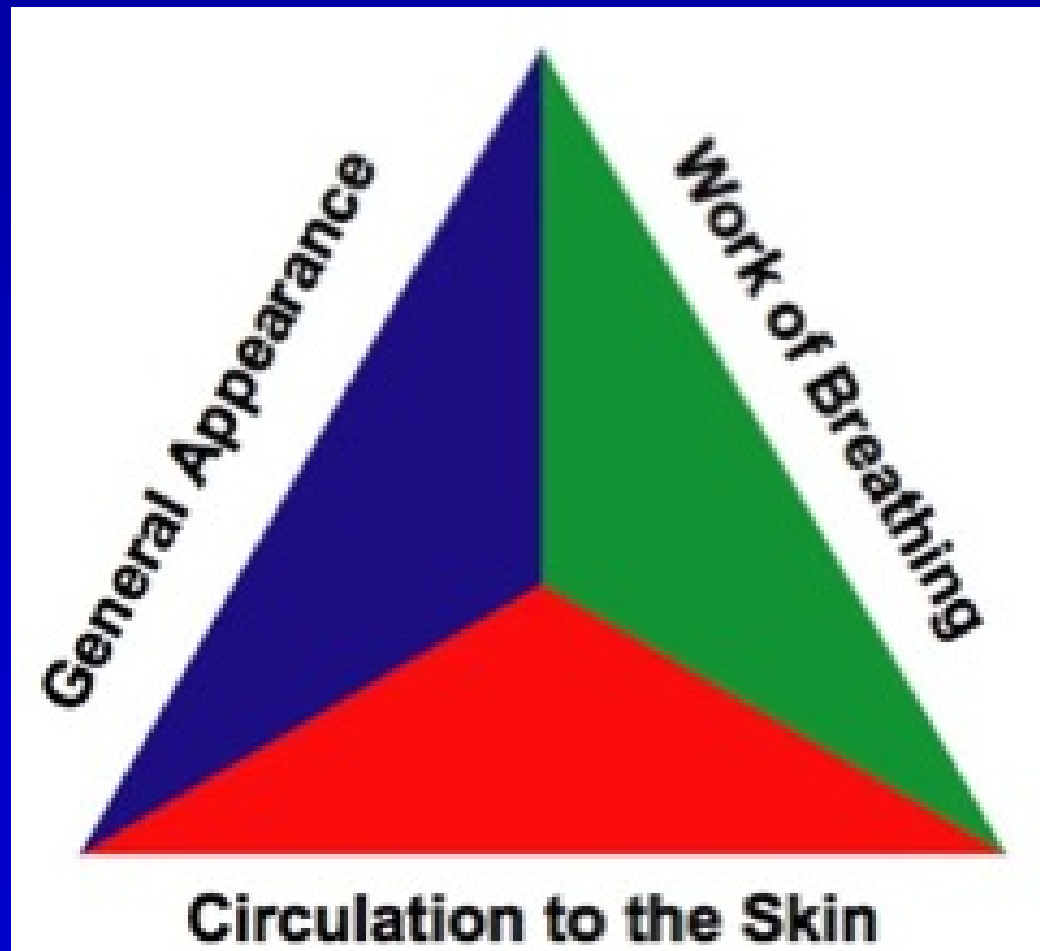


Objectives

- Assessment
- Asthma
- Bronchiolitis
- Croup
- Foreign Bodies
- Pertussis



Pediatric Assessment Triangle



Appearance

- **T**one
- **I**nteractiveness
- **C**onsolability
- **L**ook/Gaze
- **S**peech/Cry



Work of Breathing

- Audible abnormal airway sounds
- Abnormal positioning
- Retractions
- Nasal flaring
- Head bobbing



Normal Respiratory Rates

- **Infant** **30-60**
- **Toddler** **24-40**
- **Preschool** **20-30**
- **School-age** **12-25**
- **Adolescent** **12-16**

Circulation to Skin

- Pallor
- Mottling
- Cyanosis



Assessment

- **Always A B C 's First !!!**
 - Officially now CAB per new AHA guidelines!
- **A: Assess patency and ability to maintain the airway, intervene if necessary. Level of consciousness is very important to note.**

Assessment

- **B: Breathing**
 - Assess for increased work of breathing, Listen to evaluate aeration and breath sounds
- **C. Circulation**
 - Assess color (lips, mucous membranes, nail beds)
 - Pulses and capillary refill

Physical Exam— Auscultation

- Wheezing
- Stridor
- Crackles
- Rhonchi
- Upper Airway Sounds



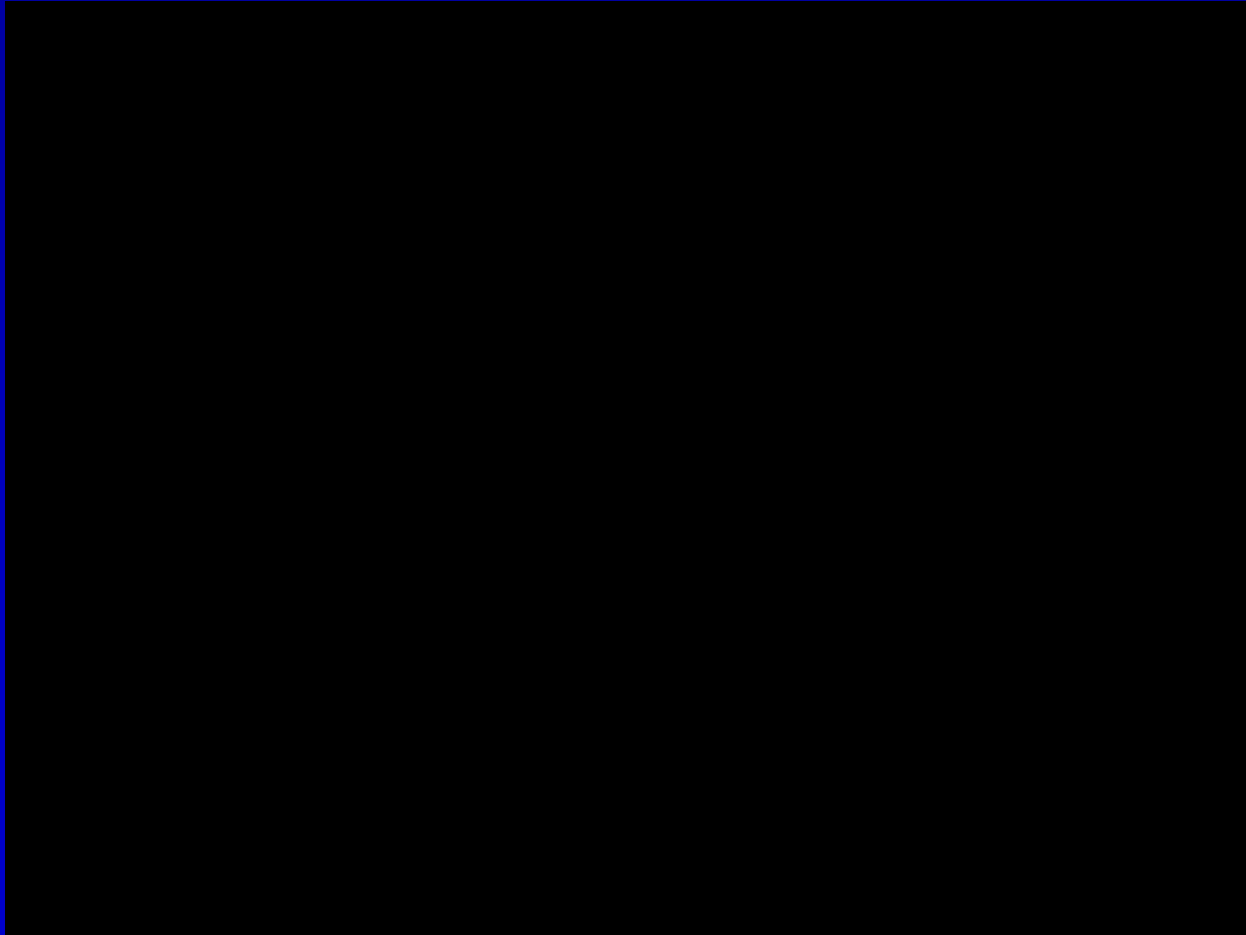
Wheezing

- Whistling noise thru constricted bronchioles
- Noise typically is heard during a prolonged expiratory phase
- Varying degrees of respiratory distress
- Frequently confused for transmitted upper airway noises
- Examples: Asthma, Bronchiolitis

Stridor

- High-pitched noise
 - Usually heard during inspiration
 - May see suprasternal retractions
 - Often anxious appearing
-
- Examples: Croup, Bacterial Tracheitis, Epiglottitis

Stridor at Rest



Crackles

- Sounds like velcro or Rice Krispies
- Difficult to hear in a noisy environment
- Characterize as focal or diffuse
- Varying degrees of respiratory distress
- Examples: Pneumonia, Congestive Heart Failure

Transmitted Upper Airway Noise

- Sources include:
 - Nasal, upper airway mucous
 - Relaxed hypo pharyngeal tissues
- Changes with respiration
- Frequently mistaken for wheezing
- Examples: URI, neurologically impaired patients



Tricks to Improving Your Exam

- Changing position, lying vs. sitting
- Distraction techniques
- Have patient cough
- Have patient breathe through mouth
- Have patient blow nose
- Decrease ambient noise
- Have them “blow out the candle”.

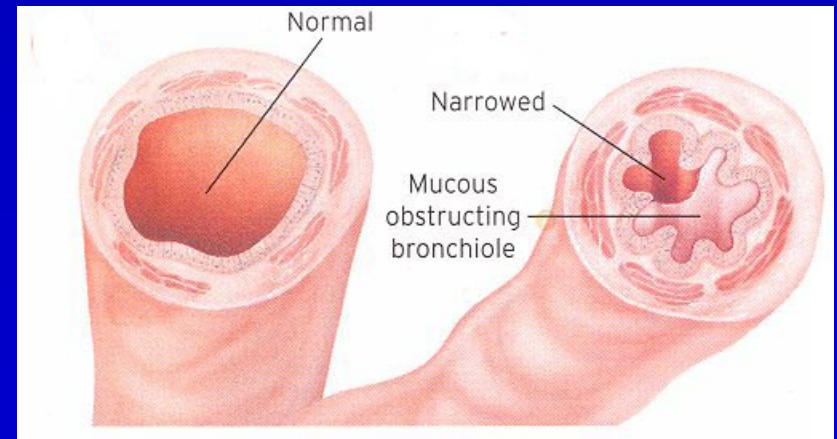
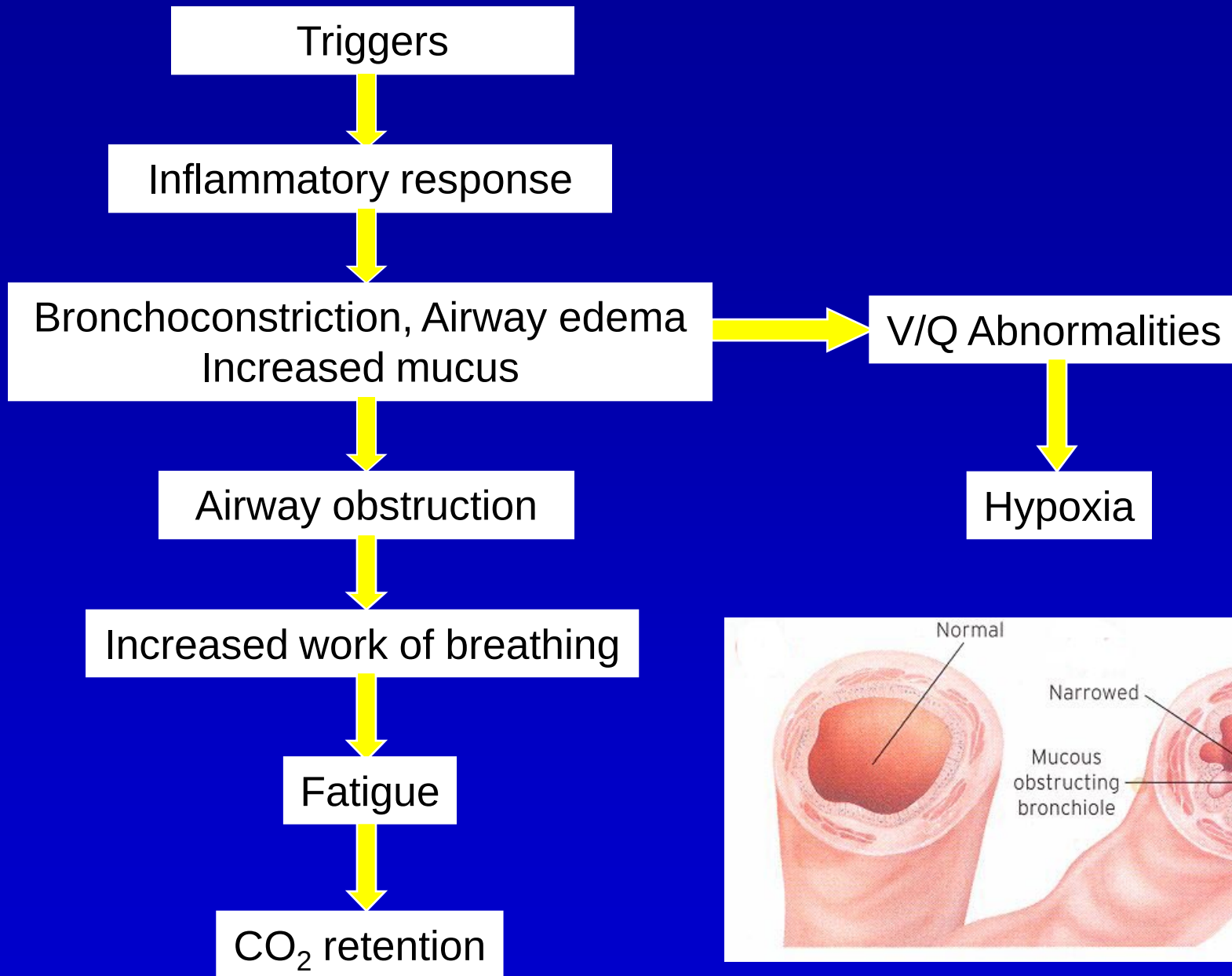
Asthma

Definition:

- **Chronic disease of the airways**
 - Inflammation
 - Hyperresponsiveness
 - Obstruction

Clinically: Recurrent episodes of wheezing, breathlessness, chest tightness and cough

- **Status asthmaticus**
Persistent airflow obstruction that fails to improve or worsens despite appropriate therapy



Assessment

History

- Risk factors for fatal asthma
 - Previous intubation
 - Rapid progression of attack
 - Self weaning of meds - esp steroids
 - ↑ in use of β -agonists
 - Hospital visit in previous year
 - Seizure / loss of consciousness
 - Hx of attack precipitated by food

Assessment

Physical Examination

- General appearance / level of consciousness - most useful
- Aeration, degree of wheezing
- Tachypnea / use of accessory muscles / ability to speak
 - Can they sing their ABC's?

Assessment

Ancillary Data

- **Pulse oximeter**
 - Room Air Sats $< 91\%$ - significant V/Q abnormalities
- **Blood Gases**
 - Rarely helpful
- **Asthma scoring system, use go guide Asthma pathway in ED management**

Clinical Asthma Score

Clinical Variables	1 Point	2 Points	3 Points
Respiratory Rate			
2-3 years	≤ 34	35-39	≥ 40
4-5 years	≤ 30	31-35	≥ 36
6-12 years	≤ 26	27-30	≥ 31
>12 years	≤ 23	24-27	≥ 28
O ₂ Saturation	≥ 93% on RA	90-92% on RA or any O ₂ by nasal cannula or simple face mask	≤ 89% on RA or any O ₂ by non-rebreather
Auscultation	Normal breath sounds or end expiratory wheezing	Expiratory wheezing	Inspiratory & expiratory wheezing, diminished breath sounds or both
Retractions	None or intercostal	Intercostal & substernal	Intercostal, substernal and supraclavicular
Dyspnea	None to mild, eg. Speaks in sentences, coos & babbles, can lie down	Moderate, eg. Speaks in partial sentences, utters short cries, prefers sitting	Severe, eg. Speaks in single words/short phrases, grunts, prefers tripod position
SEVERITY	Mild	Moderate	Severe
ASTHMA SCORE	5-7	8-11	12-15
PEFR	>70%	50% - 70%	< 50%

Management



Oxygen

- Mechanisms of action
 - Improves tissue oxygenation
 - Facilitates bronchodilation
 - Reduces pulmonary vasoconstriction
- Tight fitting or non-rebreather face mask / high flow oxygen
- Keep O_2 sats $\geq 92\%$

Treatment Options

- Quick relief medications
 - Beta-adrenergic agonists (Albuterol)
 - Anticholinergics (Atrovent)
 - Magnesium Sulfate
- Medications to reverse inflammation
 - Corticosteroids

β -Adrenergic Agonists

- Quick relief drugs of choice
- Mechanisms of action
 - Smooth muscle relaxation
 - Decrease airway edema
 - Enhance mucociliary clearance
 - Inhibit inflammatory mediator release

β -Adrenergic Agonists

- Albuterol (β_2 selective agonist) is treatment of choice
 - Titrate to effect AND side effects
Dose: <20 kg: 2.5 mg : > 20 kg: 5 mg
 - Zopinex, same medicine, just more \$\$\$\$
- Continuous neb
 - 5 – 20 mg/hr or 1 neb every 15 min for severe asthma.
 - Monitor for adverse effects

β -Adrenergic Agonists

Intramuscular Epinephrine

- Indications

- Severe bronchospasm, no air movement
- Patient unable to cooperate with or not responding to inhaled therapy
- Dose: 0.01 mg/kg IM of the 1:1000
 - Max dose: 0.5 mg



β -Adrenergic Agonists

Adverse effects

- Dose and route related
- Tachycardia, tremors, agitation, vomiting, arrhythmias
- $\downarrow$ in O_2 sats due to worsening V/Q ratio

BUT if patient looks better and is moving air better

PATIENCE – Treat the patient and not the oximeter

Atrovent

Anticholinergics : Mechanism of action

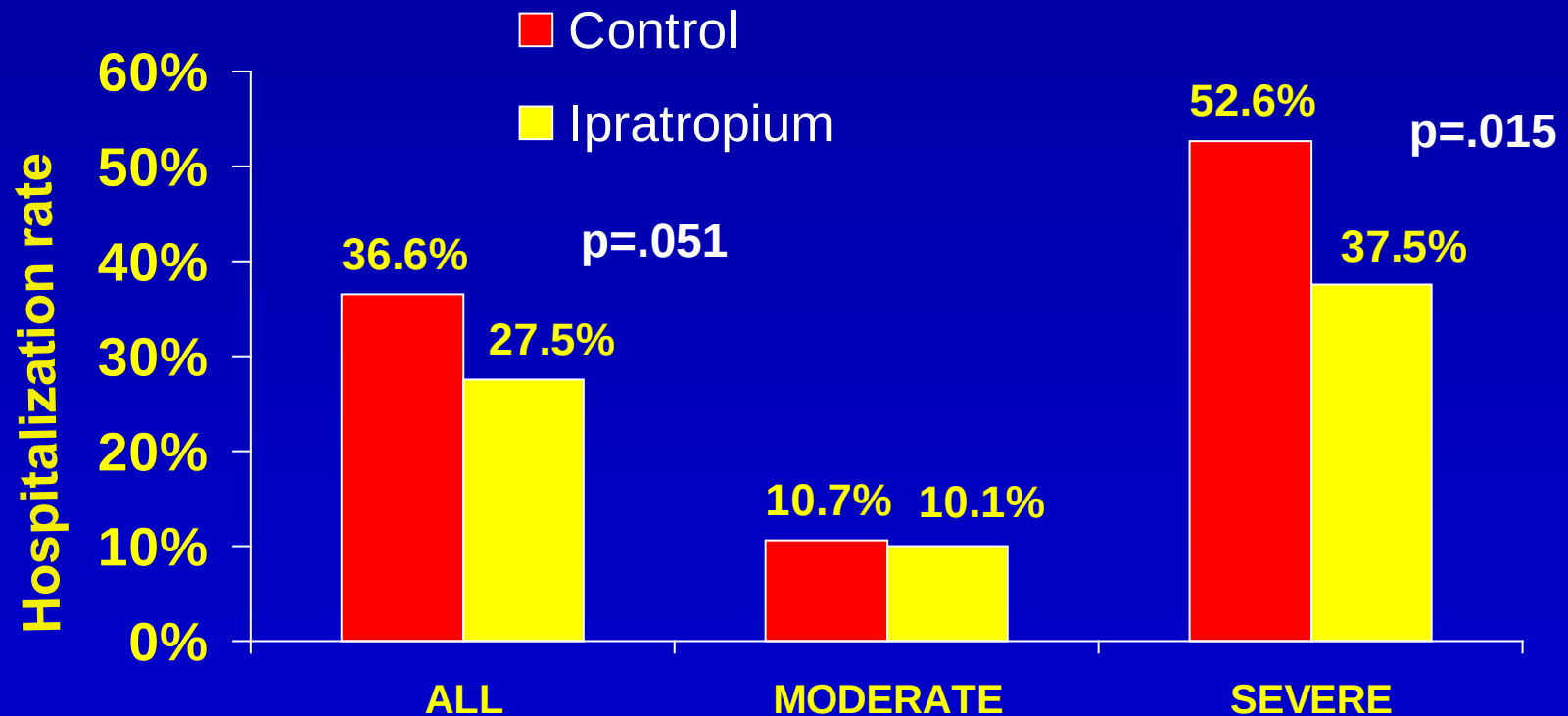
- **Inhibit parasympathetic mediated bronchoconstriction**
- **Decrease mucosal edema and secretions**
- **Weak bronchodilators when used alone**
- **Augments effects of the Albuterol**

Atrovent

Indications

- Moderate / severe asthma exacerbations
- Patient not responding appropriately to initial β - agonist therapy
 - Dose: 0.25 – 0.5 mg q 20 minutes for 3 doses
 - Combine with albuterol

Hospitalization Rate



N= 434; NNT = 7

Corticosteroids

Mechanisms of action

- **Suppress mediators of inflammation
→ decrease airway edema and
secretions**
- **Reverse down regulation of β -
agonist receptors thus potentiating
their effectiveness → increase
bronchodilation**

Corticosteroids

- Early Administration is important!
- However, most EMS drug boxes don't carry PO steroids and most pediatric asthma patients don't need IV's
- Oral therapy as effective as IV in children
- Benefit seen at 4 - 6 hrs post administration
- IV Solumedrol: only in extreme cases or very long transport times

Magnesium Sulfate

Mechanisms of action

- Blocks calcium mediated smooth muscle contraction → bronchodilation
- Potentiates effect of β -adrenergic agonists
- Decreases inflammatory response
- Results of clinical studies conflicting

Magnesium Sulfate

- **Indications**

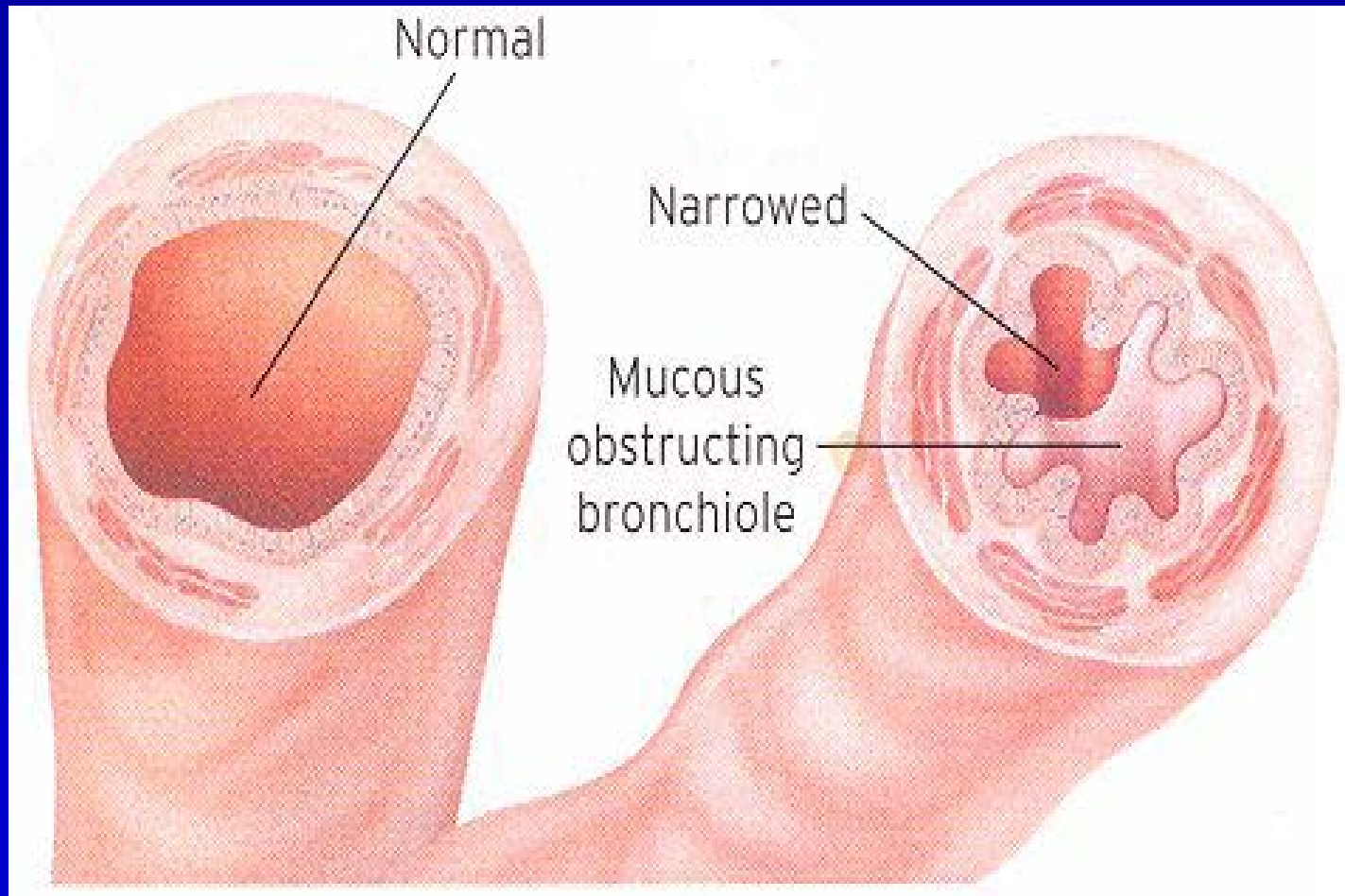
- **Severe bronchospasm unresponsive to initial β -agonist treatment**
- **Best dose not known**
 - 25-75 mg/kg; 2 g max dose
 - Infuse slowly over 20 minutes in kids
 - Monitor HR / BP, may cause hypotension
 - Role in EMS unsupported in children, consider if long transport time

Summary

- **Rapid assessment**
- **β -agonists - frequently and in appropriate dose**
- **Ipratropium - enhances bronchodilation**
- **Corticosteroids - give upon arrival to ED**
- **Maintain oxygenation - children die from hypoxia, not hypercarbia**
- **Consider IV Solumedrol and/or Magnesium only in severe cases with long transport times**



Bronchiolitis



Characteristics

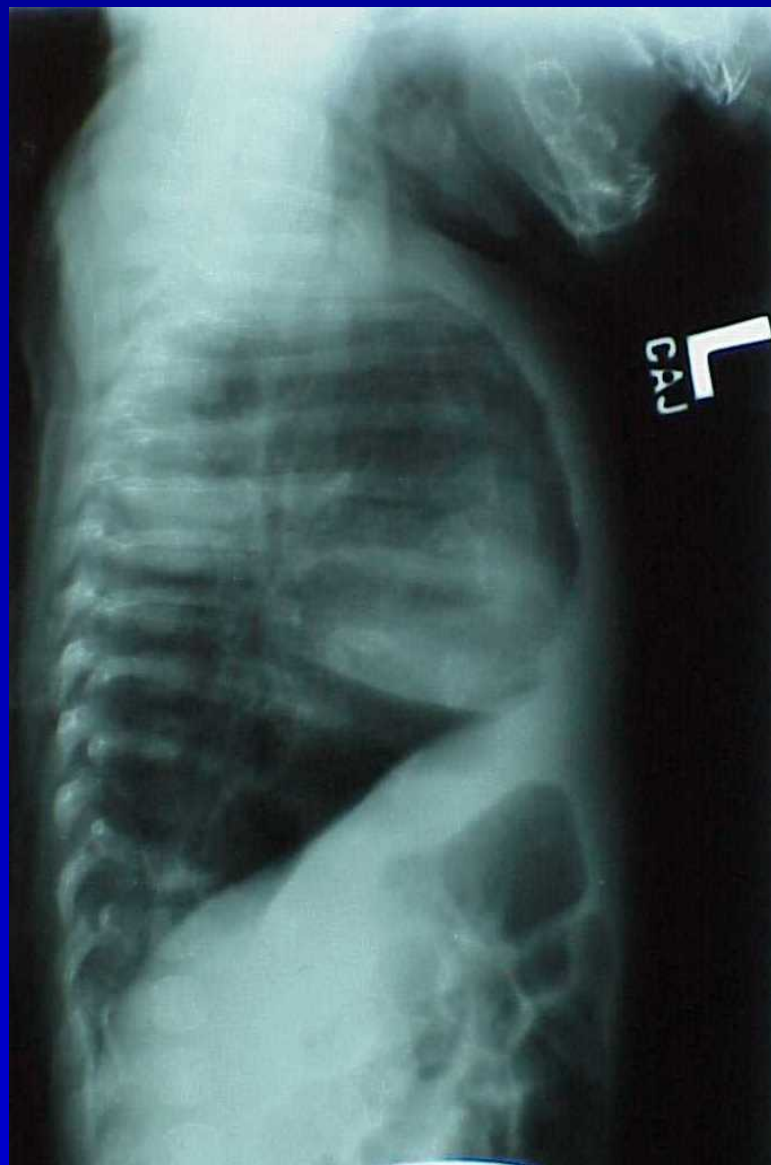
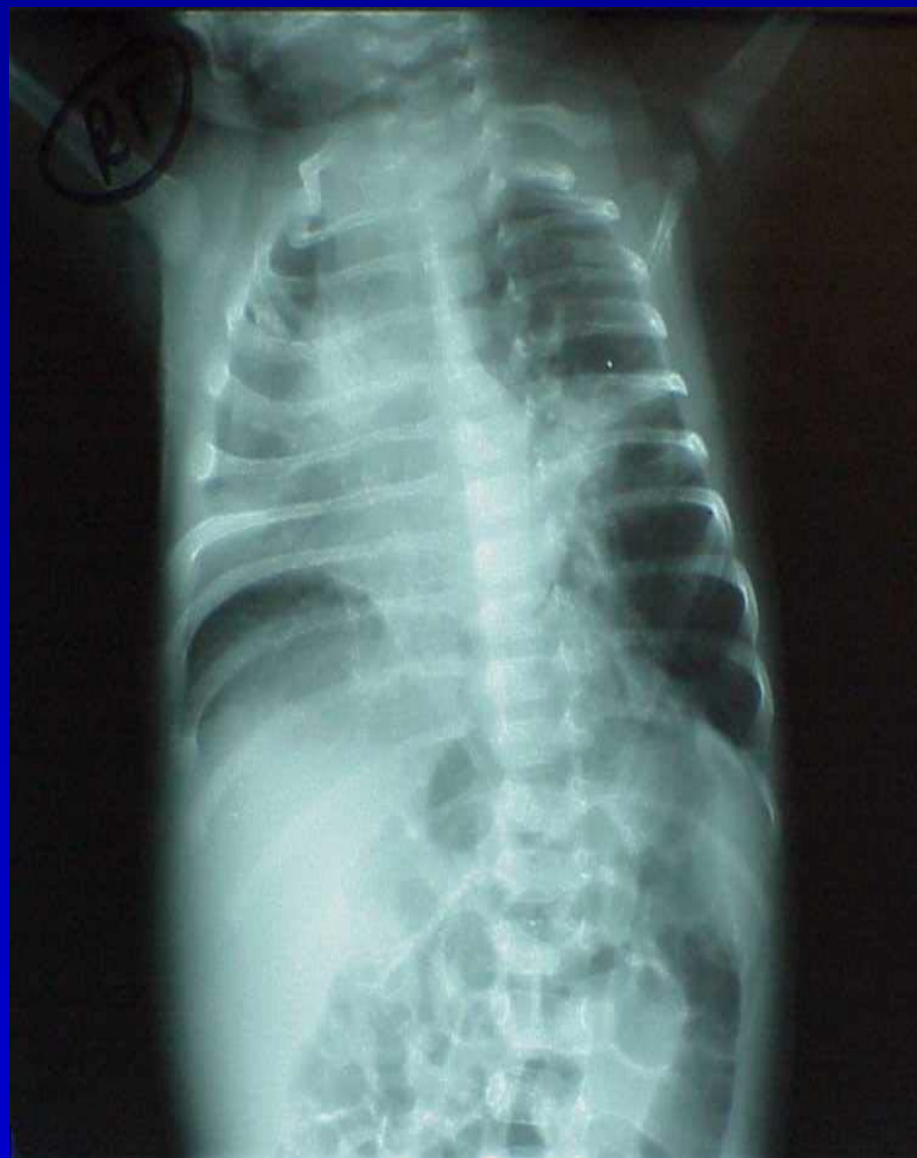
- Inflammatory obstruction of the small airways
- Children < 2 years
- Usually viral, >50% RSV
- URI → Wheezing → Respiratory distress

Epidemiology (RSV)

- Winter / Spring (Nov - Mar)
- 60,000 - 90,000 hospitalized per year
 - 80% < 6 months old
 - 2 - 5% develop respiratory failure
- 500 deaths / year

Pathophysiology

- **Bronchiolar obstruction/inflammation**
 - Cellular debris / Mucus / Mucosal edema
- ♦ **Airway obstruction → Hyperinflation / atelectasis**
 - V / Q abnormalities → Hypoxia →
 - ↑ WOB → Fatigue → CO₂ retention



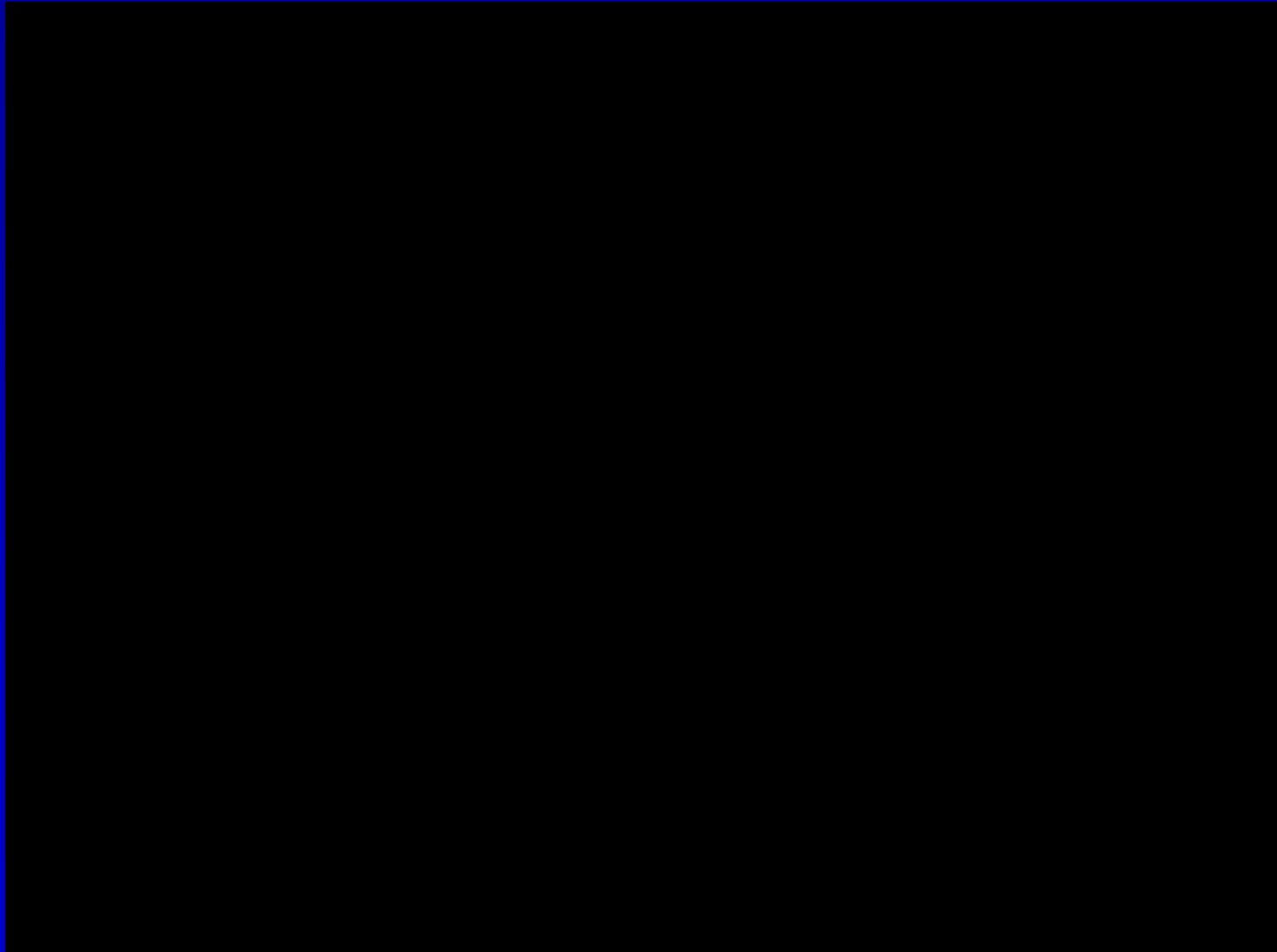
Pathophysiology

- **Infants affected more severely**
 - **Small airway diameter**
 - **High airway resistance**
 - **More mucous glands**
 - **Poor airway recoil**
 - **High ribcage compliance**

Clinical Course

- Day 1 - 3: Rhinorrhea / mild cough
- Day 4 - 5: Cough worsens, wheezing, decreased PO intake, irritability, fever
 - Tachypnea, tachycardia, retractions, grunting, wheezing, fine crackles
- Day 11 - 14: Recovery

Bronchiolitis



High Risk Infants

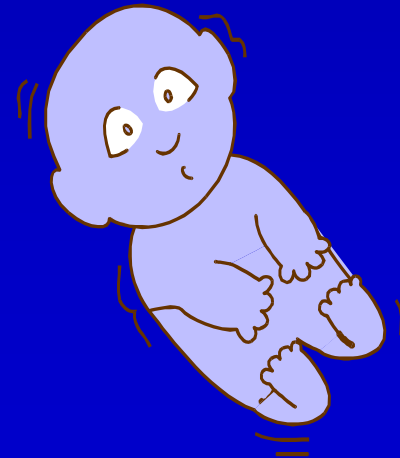
- Prematurity (< 34 - 36 weeks)
- Chronic lung disease (BPD, CF)
- Congenital heart disease
- Age < 8 weeks, greatest < 4 weeks
 - Risk of hospitalization: 10 - 60%
 - Disease more severe

Complications

- Severe respiratory distress
- Respiratory failure
- Apnea (15 - 20% of hospitalized infants)
- Dehydration
- Bacterial superinfection (1%)
- Pneumothorax / pneumomediastinum (rare)

Predictors Of Severe Disease

- General appearance - “Looks sick”
- High risk infant
- O_2 sats $\leq 92\%$
- $RR > 70$



Differential Diagnosis

- Asthma
- Congestive heart failure
- Foreign body aspiration
- Pertussis
- Cystic Fibrosis
- Bacterial pneumonia / sepsis

EMS Management

IN “DISTRESS”

- O₂ to keep sats $\geq$ 92% (mask or cannula)
- IV not necessary in the field
- Bronchodilators - evidence for efficacy controversial

Beta₂ Agonists

- Subgroup of patients may respond to β_2 agonists (Albuterol)
- Non-responders more likely to be admitted
- Adverse affects:
 - Tachycardia, irritability, hypoxia

Epinephrine

- α receptor stimulation:
 - Vasoconstriction $\rightarrow$ reduces microvascular leakage $\rightarrow$ reduces bronchial mucosal edema
- β receptor stimulation:
 - Reverses bronchial smooth muscle contraction $\rightarrow$ bronchodilation

Epinephrine

- Several studies show epinephrine is more effective than albuterol or placebo
- The preferred bronchodilator in the treatment of bronchiolitis
- Not adequately studied prehospital

Steroids

- Theoretically reduces airway responsiveness and inflammation
- Earlier trials suggested a beneficial effect in bronchiolitis
- Most subsequent studies do not show a benefit
- Currently NOT recommended

Antibiotics

- 65 - 70% of hospitalized infants with bronchiolitis are febrile
- Incidence of SBI : 0 - 1.9 %
- Antibiotics are not routinely indicated

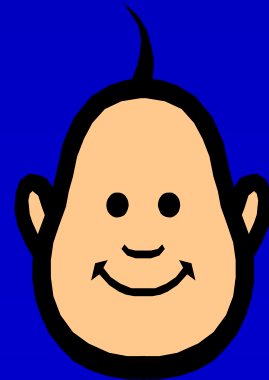
Conclusions

- **Albuterol may improve clinical scores. Does not reduce admission rates or length of hospitalization**
- **Epinephrine improves clinical scores and acute symptoms. May decrease hospitalization rate, length of time in ED**
- **Steroids - no evidence to support efficacy**

Conclusions

Wheezing, not in distress

- RR < 70, O₂ sats ≥ 92%, adequate PO
 - Send home
 - Ensure good follow - up



Conclusions

Wheezing, in distress

- Racemic or L - epinephrine nebulized x 2
OR
- Albuterol nebulized x 2
- Observe 1 - 2 hours
 - Improves - Home. Consider albuterol MDI for 3 - 5 days
 - Does not improve - Admit

Drug Doses

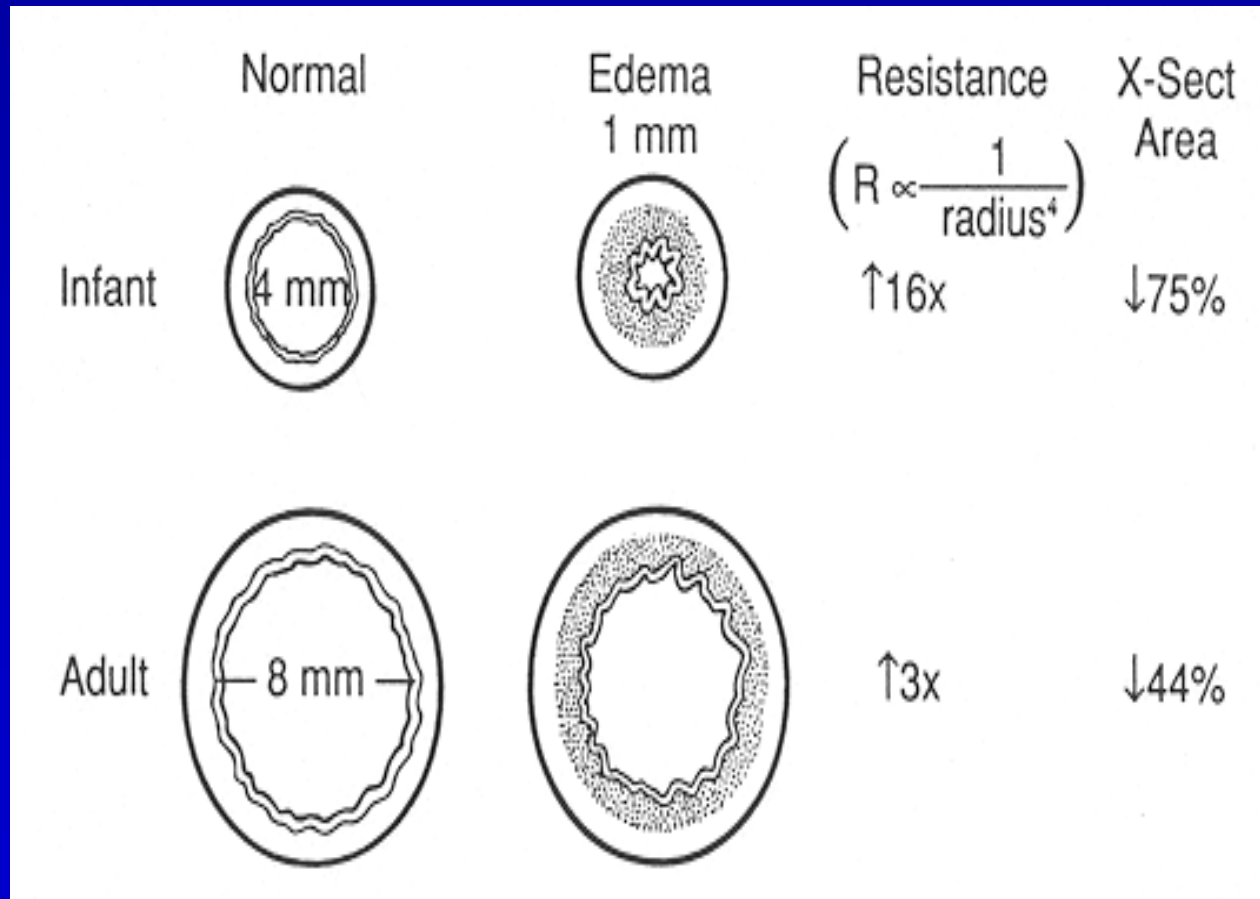
- Racemic epinephrine
 - 0.25 cc < 10 kg / 0.5 cc > 10 kg
- L – epinephrine (1:1000)
 - 2.5 cc < 10 kg / 5.0 cc > 10 kg
- Albuterol
 - 2.5 mg < 20 kg / 5 mg > 20 kg



Croup

- Also known as laryngotracheitis or laryngotracheobronchitis
- Infection causes inflammation of the larynx and subglottic airway
- Typical age is 6 months to 5 years.
 - Rare beyond age 6 years.

Airway Resistance



Steeple Sign



Croup

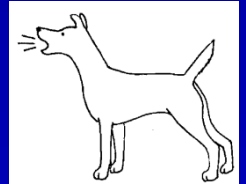
- Cause is primarily viral
 - Parainfluenza virus
 - RSV, Influenza and Adenovirus less often
 - Virus invades epithelium causing edema of the vocal cords and subglottic area
- Outbreaks most common in fall/winter
- Most EMS calls/ED visits 10pm-4am.

Clinical Presentation

- Many have 12 to 48 hours of URI symptoms prior to onset of upper airway obstruction.
- Spasmodic croup- abrupt onset of stridor and barking cough, typically while asleep.
- Fever is common, ranges 38 to 40.5.

Clinical Presentation

- Mild cases: Hoarse with a barky cough



- More severe:

- Stridor
- Retractions
- Diminished breath sounds
- Agitation



Croup

- Hypoxia and cyanosis can develop, but rare.
- Prolonged respiratory distress can lead to fatigue and respiratory failure.
- Need for intubation or death from croup are also rare occurrences.

History

- **Factors in the history that may suggest significant worsening:**
 - Sudden onset of symptoms
 - Rapidly progressing symptoms
 - History of prior episodes of croup
 - Underlying airway abnormalities

Differential Diagnosis

- Bacterial Tracheitis
- Acute Epiglottitis
- Peritonsillar or Retropharyngeal Abscess
- Airway Foreign Body
- Congenital Airway Anomalies

Evaluation

- **ABC's – Assess the child for signs of obstruction or impending failure/arrest.**
- **Keep the child as comfortable as possible.**
 - agitation and fear may make the airway narrowing worse.

Evaluation

- Before even touching the child, assess:
 - Overall appearance
 - Work of breathing
 - Chest expansion
 - Quality of the cry/voice
 - Abnormal sounds, stridor vs. wheezing?

SICK!



NOT SICK!



Physical Findings

- Increased work of breathing
 - Tachypnea, retractions, nasal flaring
- Inspiratory stridor
 - At rest, or only heard when agitated/crying?
- Breath sounds are usually clear!!
 - Wheezing is a sign of lower airway obstruction

Treatment of Croup

- Mist
- Oxygen
- Steroids
- Nebulized epinephrine

Treatment

- **Mist/Humidified air – no proven benefit**
 - May help prevent inspissation of secretions
- **Oxygen: If the child is in moderate to severe distress or hypoxic.**
 - Use judgment in the non-hypoxic child that is more agitated by the therapy.

Treatment

- **Corticosteroids – mainstay of therapy**
 - Decreases the edema in the airway
 - Requires several hours for onset of effect
 - Not recommended in the pre-hospital setting
 - Dexamethasone is the steroid of choice.

Treatment

- **Nebulized Epinephrine**
 - Rapid improvement due to decrease in the airway edema.
 - Racemic vs. L-epinephrine: Equally effective with the same incidence of side effects.
(most common is tachycardia)

Nebulized Epi

- **Indications:**
 - Children with croup who are in severe respiratory distress
 - Stridor at rest
- **Dose: 0.5 mL/kg per dose of the 1:1000 preparation. Max dose: 5 mL.**

Treatment

- Intubation: VERY rarely necessary!
- Less than 1% of patients seen in the ED for croup require intubation.
- If deemed necessary, use an ETT that is $\frac{1}{2}$ to 1 size smaller to account for the edema in the airway.

Transport Priorities

- **Maintain an adequate airway**
- **Keep the patient as calm as possible, in position of comfort.**
- **Oxygen if necessary.**
- **Nebulized epinephrine if in severe distress or severe stridor at rest.**

Disposition

- Most children who present to the ED for croup are discharged to home.
- If a nebulized epi treatment was given, the child is observed for 2 to 3 hours for recurrence of stridor.
 - Return of stridor requiring further nebulized epi treatment meets criteria for admission.

Foreign Body Aspiration

- Food items are the most commonly aspirated FB.
- Balloons are the most common FB to result in death.



Airway Foreign Bodies

- 80% of episodes occur in children < 3yo, peak age between 1-2 yo
- Food most commonly aspirated by infants and toddlers (peanuts)
- Toy balloons most common object involved in fatal childhood foreign body aspiration

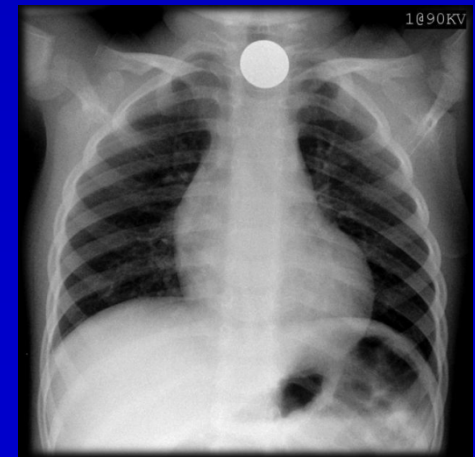


Your First Clue: Foreign Body Aspiration

- **A history of choking is the most reliable predictor of FB aspiration.**
- **Other signs and symptoms include:**
 - **Upper airway: Stridor, respiratory or cardiopulmonary arrest.**
 - **Lower airway: Coughing, wheezing, retractions, decreased breath sounds, cyanosis.**

Esophageal Foreign Bodies

- Peak age 6 mos-6 years
- Coins most commonly ingested object (66%)
- Button batteries, must be removed emergently!
- Approximately 10% of ingested foreign body will require intervention



Esophageal Foreign Bodies

- **Clinical presentation**
 - 6-49% will be asymptomatic
- **Common symptoms include**
 - Drooling
 - Dysphagia
 - Cough
 - Gagging/vomiting



EMS Management

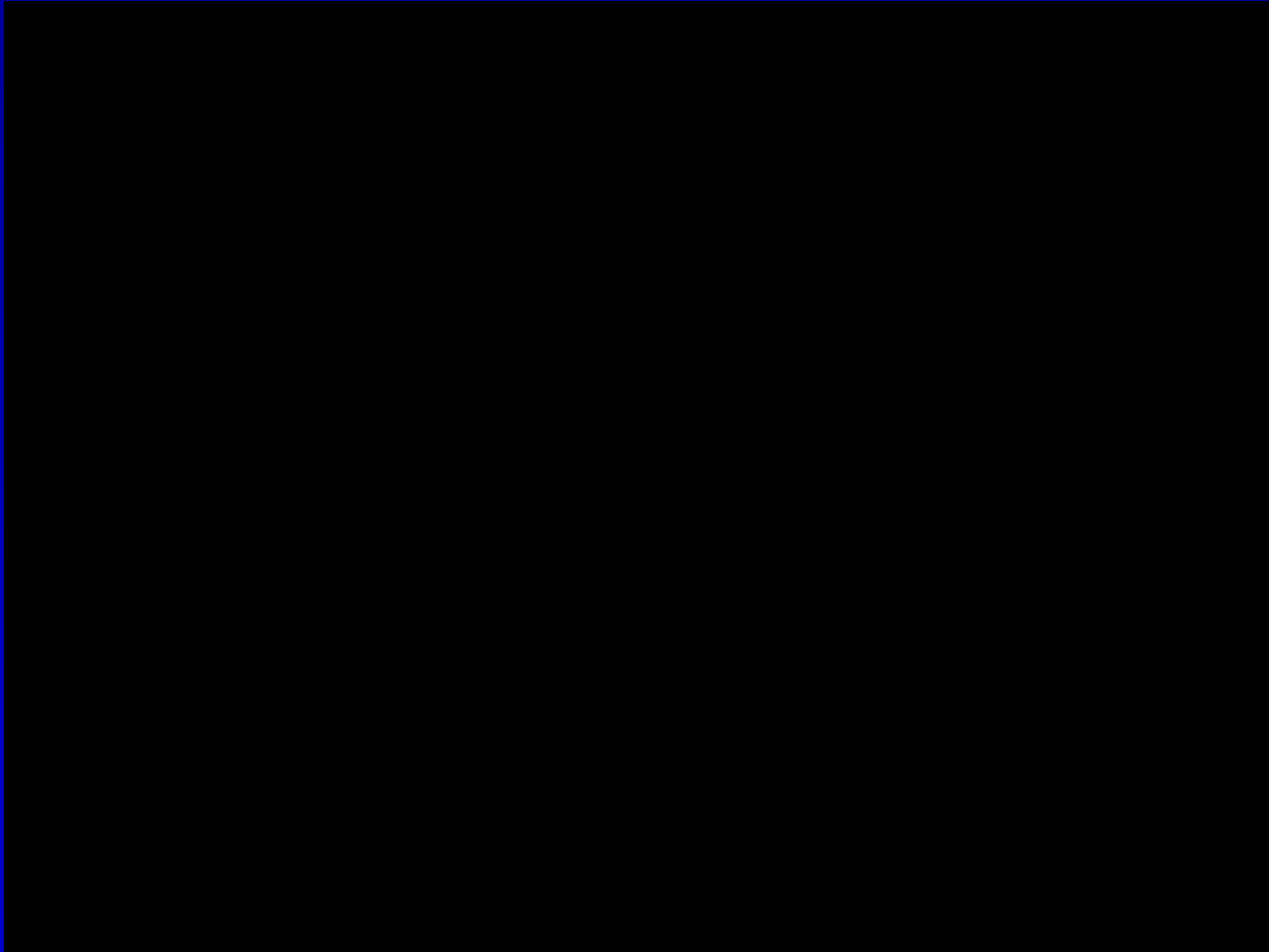
- **Upper airway FB:**
 - If patient is able to cough or speak:
 - Leave in a position of comfort.
 - Provide supplemental oxygen.
 - Priority transport to ED for removal.
- **Lower airway/esophageal FB:**
 - Position of comfort, transport

Definitive Management

- Laryngoscopy and removal with pediatric Magill forceps
- If unable to grasp FB at or near the vocal cords, OK to push it in to secure the airway!



What Illness is This?



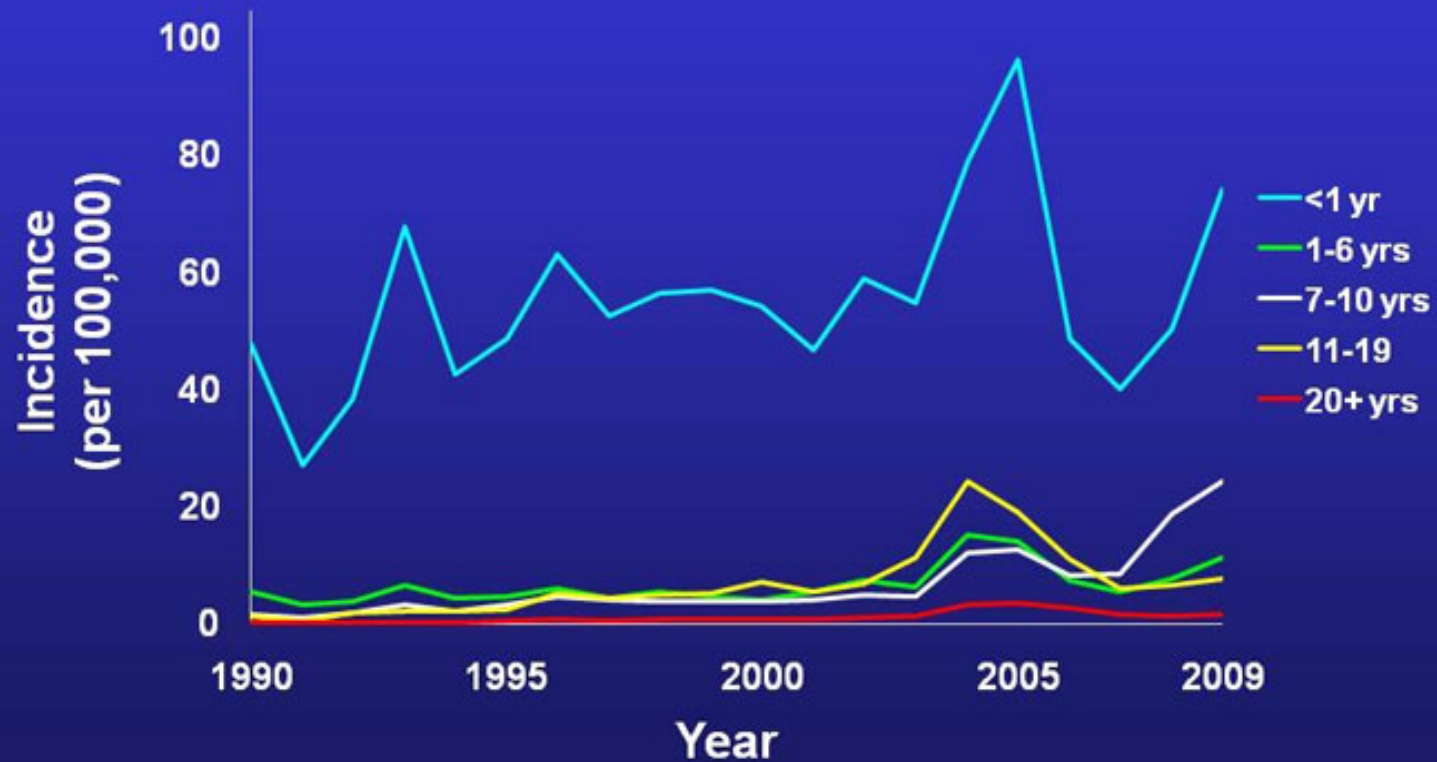
Pertussis

- Pertussis is a highly communicable, potentially lethal, vaccine-preventable disease.
- It lasts for many weeks and typically afflicts infants and children with severe coughing, whooping, and posttussive vomiting.

Facts

- Pertussis is caused by a bacterium named *Bordetella pertussis*.
- Transmission: by close contact with cases via aerosolized droplets.
- Neither infection nor immunization provides lifelong immunity
- In 2009, 17,000 cases of pertussis were reported in the U.S.

Reported pertussis incidence by age group 1990-2009



SOURCE: CDC, National Notifiable Diseases Surveillance System, 2009

Epidemiology

- Lack of natural booster events and waning immunity since childhood immunization were responsible for the increase in cases of pertussis in people older than 10 years of age noted before use of the adolescent booster immunization.
- The incubation period is 7 to 10 days, with a range of 5 to 21 days

Clinical Manifestations

- Pertussis begins with mild upper respiratory tract symptoms similar to the common cold (catarrhal stage).
- It then progresses to cough and then usually to paroxysms of cough (paroxysmal stage) characterized by inspiratory whoop and commonly followed by vomiting.
- Fever is absent or minimal.

Clinical Manifestations

- Symptoms wane gradually over weeks to months (convalescent stage).
- Sudden unexpected death can be caused by pertussis, especially in the young infants.
- The duration of classic pertussis is 6 to 10 weeks.

Treatment

- Antimicrobial agents administered during the catarrhal stage may ameliorate the disease.
- After the cough is established, antimicrobial agents have no discernible effect on the course of illness but are recommended to limit the spread of organisms to others.
- Azithromycin, erythromycin, or clarithromycin are appropriate first-line agents for treatment and prophylaxis

EMS Priorities

- **Pediatric Assessment Triangle**
- **Provide Oxygen if sats <95%**
- **Supportive care, no IV needed**
- **No medications have any effect**
- **Proper isolation measures**

Complications

**Bilateral subconjunctival hemorrhages
and facial bruising in children with
pertussis.**



Control Measures

- All health care professionals should observe standard precautions and wear a respiratory mask when examining a patient with a cough illness suspected or confirmed to be pertussis.
- Exposed, unprotected people should be given prophylaxis promptly.

Control Measures

- Preexposure immunization of health care personnel with tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tda.p) vaccine is recommended



Questions?



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