



Your Virtual Health Partner

Respiratory Distress in the Pediatric
Patient: Think quick and calmly

Are kids really so different?

- You be the judge



Children are not small adults...

Children are still growing in every way. Their bodies are different, they perceive things and communicate differently, and the long term implications of treatment



Respiratory Emergencies

- # 1 reason for pediatric hospital admissions
- One of the top leading cause of death during the first year of life.
- Leading cause of Cardiorespiratory arrest in pediatric population.



Children's airways are different than adults....

- Large head, short neck with underdeveloped muscles
 - Airway obstruction may occur easier
 - Support pads under shoulders to maintain position
- Airway is considered "adult-like" at around 8 years of age



Why are children more vulnerable?

Airways are smaller!!!

Full Term Newborn Airway

1mm of edema, the diameter will be 44% of normal.

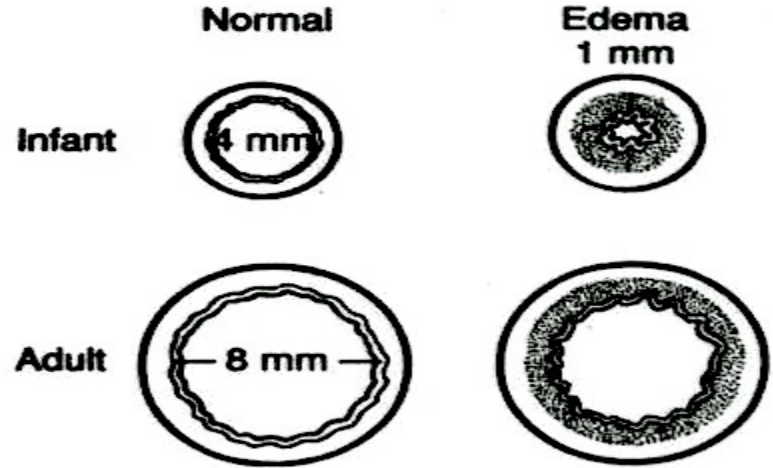
Adult Airway-

1mm of edema, the diameter will be 81% of normal.

Poiseuille's law

If radius is halved, resistance increases 16fold

Resistance increases 3x in an adult and 16x in an infant.

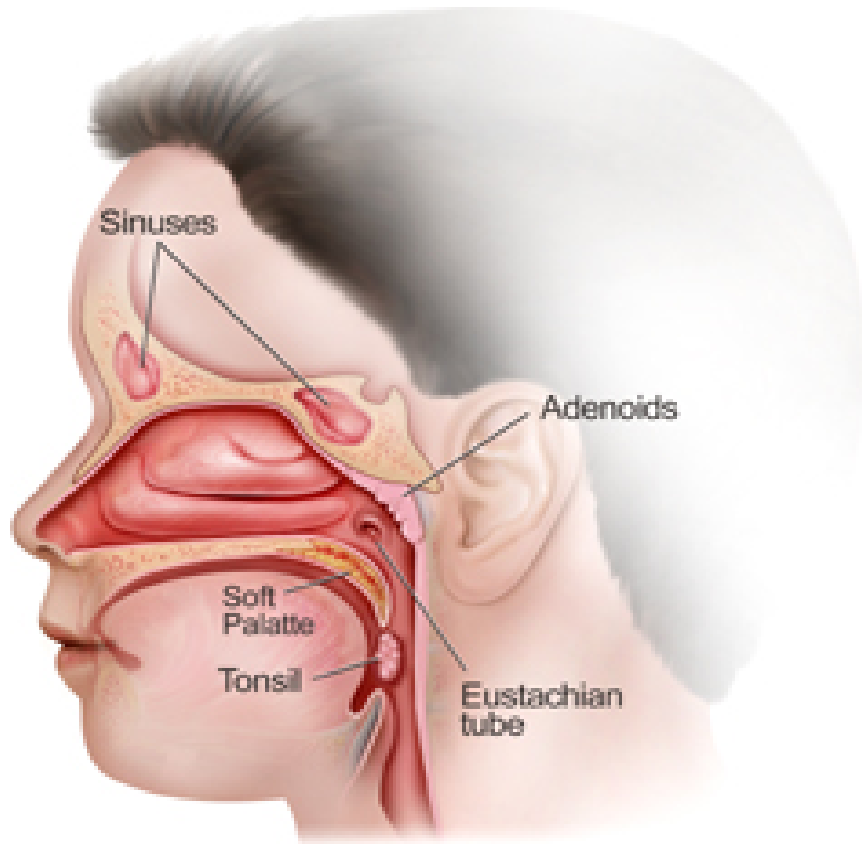


$$R = \frac{8 n l}{\pi r^4}$$

Why are children more vulnerable?

- Obligate nose breathers until about 6 months
 - Essential to keep clear with suctioning
- Primarily use diaphragms to breathe
- Increased chest wall compliance
- Increased metabolic rate, increased O₂ consumption
 - *Typical oxygen consumption 6-8 ml/kg/min in a child vs. 3-4 ml/kg/min in adult*



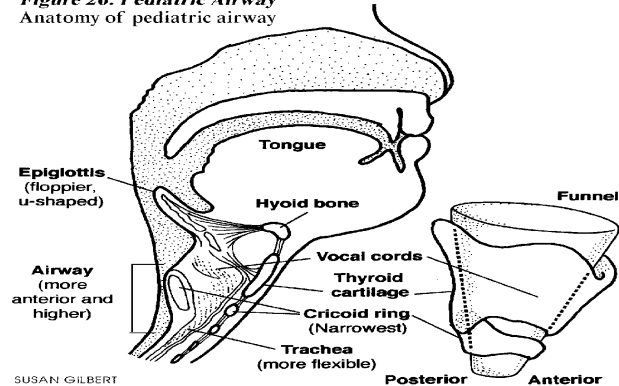


- Lymphoid tissue achieves adult size at 2 year of age
- Large tongue in proportion to mouth
 - #1 obstruction in decreased LOC
 - Repositioning and using adjuncts- NPA, OPA to open airway
- Decreased cartilage in airways

Why are children more vulnerable?

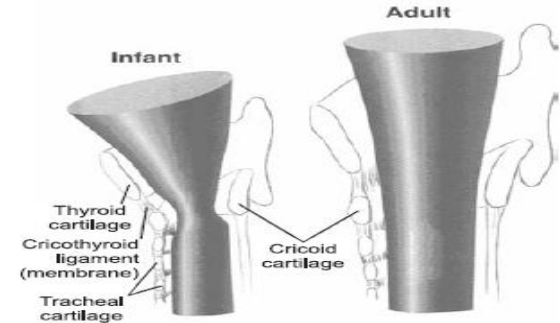
- Large, anterior floppy epiglottis
- Narrow subglottic region
- Short tracheal length
 - ETT size = $16 + \text{age}/4$ ($16 + 4/4 = 5.0$)
 - Use straight (Miller) blade to intubate
 - Right mainstem ETI is more common
 - ETI & maintenance is more difficult

Figure 26: Pediatric Airway
Anatomy of pediatric airway



SUSAN GILBERT

Figure 1. Comparison Of Infant And Adult Airway



From: Henretig, et al. Textbook of Pediatric Emergency Procedures

A Closer Look Normal Pediatric Airway



Pediatric Airway with Inflammation



PULMONARY PHYSIOLOGY

- PRINCIPLES OF RESPIRATION
 - Oxygenation [oxygen into body]
 - Control of breathing
 - Amount of inspired oxygen
 - Ventilation [oxygen in and out of lungs]
 - Ventilation-perfusion ratio
 - Lung compliance
 - Surfactant
 - Elasticity of lung tissue
 - Perfusion [oxygen to tissues]
 - Oxygen delivery

Respiratory Assessment

- Start with the across the room visualization
- Hands on approach
 - Let them know what you are up to
- Look
- Listen
- Feel



Signs of Respiratory Distress

- Tachypnea
- Retractions
- [Wheezing](#)
- [Grunting](#)
- [Stridor](#)
- [Crackles](#)
- Head bobbing
- Nasal flaring
- Prolonged expiration
- Tachycardia
- Cool, pale skin
- Sweating
- Cyanosis
- Inability to lie down
- Agitation

Signs of Respiratory Failure

- Decreased irregular respiratory rate
 - Periodic breathing
 - Agonal
 - Apnea
- Changes in LOC
- Weak pulses & poor skin perfusion
- Bradycardia
- If not treated, hypoxemia & acidosis will cause a complete cardiopulmonary arrest

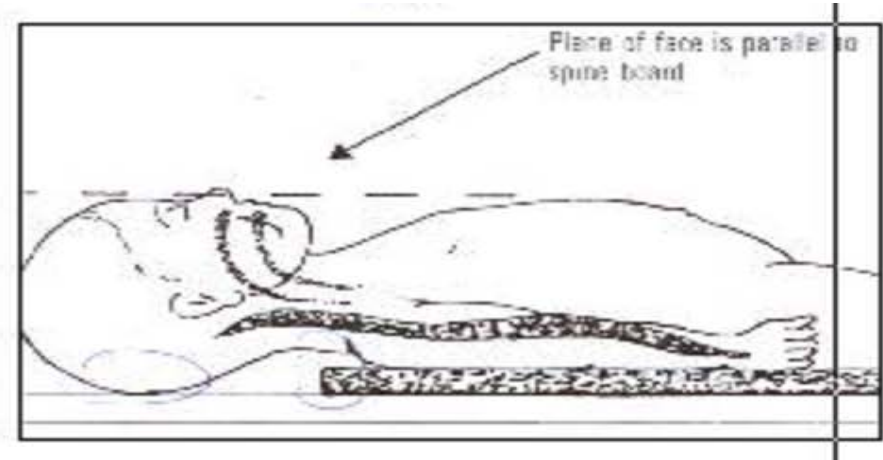
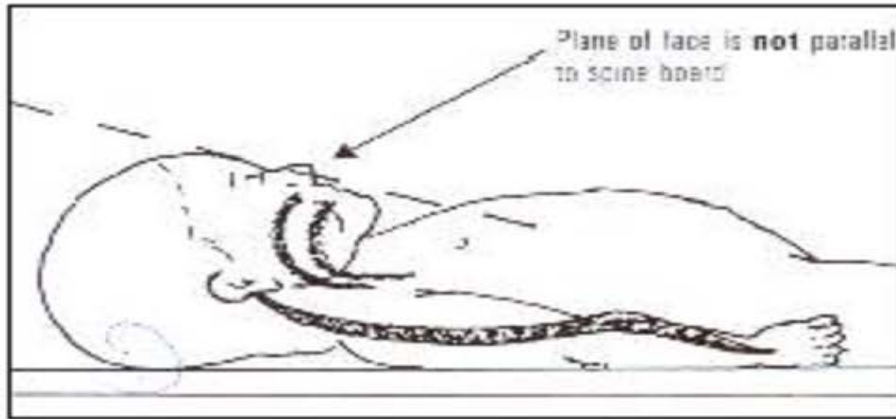


Treating Respiratory Distress/Failure

- Early recognition is imperative
- Allow caregivers to be involved with child and care to improve patients cooperativeness
- Allow child to maintain a position of comfort
- Deliver oxygen to maintain SpO₂ >94%
 - NC, Simple Mask, NRB
- If child becomes less responsive
 - Open airway, jaw thrust maneuver for C-spine injury suspicion
 - Sniffing position
 - Shoulder roll
 - Suction airway



Hyperextension can compress airway. Positioning is key!



Treating Respiratory Distress/Failure

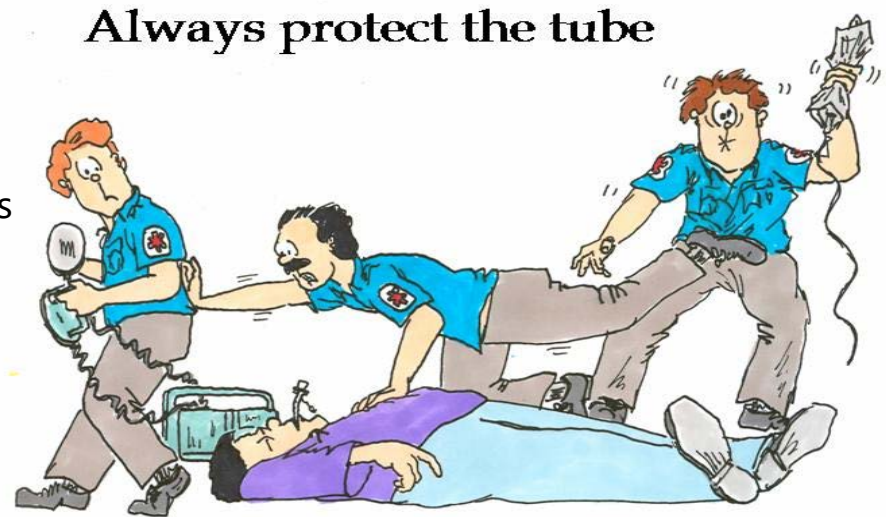
- Oropharyngeal airways
 - Unconscious with absent gag reflex
- Bag-Valve-Mask Ventilation
 - Appropriate size mask
 - "E-C" clamp technique
 - Small tidal volume (just enough to see chest rise)
 - Appropriate rate for age



- Intubation
- Laryngeal Mask Airway (LMA)
 - Subglottic airway; used in OR frequently in peds

RSI Medications- Be prepared

- Atropine
 - Pupil dilation
- Etomidate
 - Avoid in patients <10 years of age
 - Causes adrenal suppression
- Succinylcholine 1.5 – 2mg/Kg
 - Bradycardia, especially if given in repeated doses
 - Sodium Bicarb
- Rocuronium 1mg/kg
- Lidocaine
 - Increases CPP
- Versed, Ativan, Propofol
 - Hypotension



Causes of Respiratory Distress/Failure



- Respiratory infection
- Pathology
- Foreign body
- Trauma
- Congenital Defects

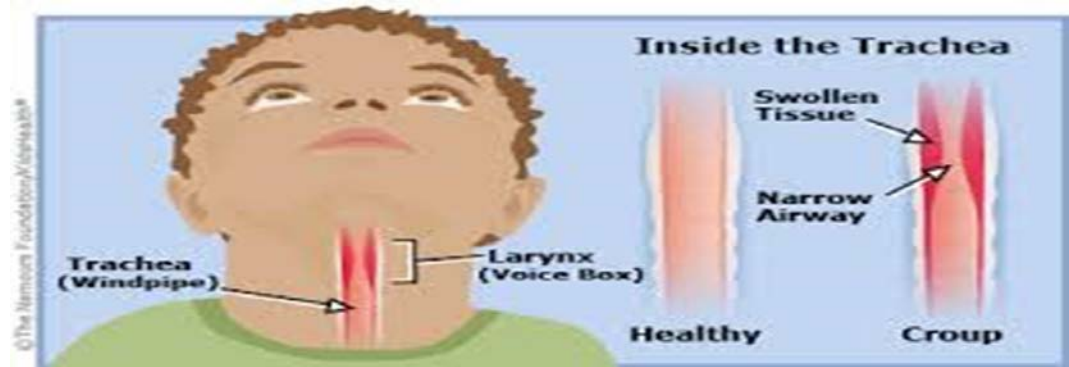
HISTORY & ASSESSMENT ARE KEY

Upper Airway Emergencies



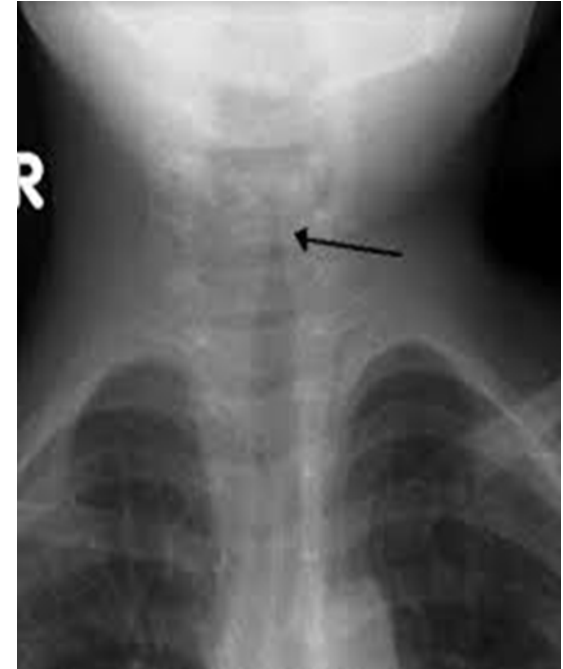
Croup

- Laryngotracheobronchitis
 - Swelling of the vocal cords and adjacent trachea
- Age:
 - 6 months to 6 years
 - Peaks in the second year of life
- Peak Season
 - Cases peak in late autumn, September to December)
 - Correlates with the peak prevalence of parainfluenza virus in the community



Croup – Key diagnostic factors

- Symptoms are a result of upper-airway obstruction due to generalized inflammation of the airways usually the result of a viral infection
- Characterized by 1-3 days
 - [Seal-like barky cough](#)
 - Often accompanied by stridor
 - Voice hoarseness
 - Fever
 - Respiratory distress
- Symptoms increase with agitation & at night
- Stridor will improve with cold or humidified air



Epiglottitis

- Serious illness that requires immediate attention & treatment
 - Most commonly caused by haemophilus B virus
- Significant swelling of the airway
- Most commonly seen in the winter months in children >1 year old
- Can have a sudden onset of symptoms
- Symptoms
 - High Fever
 - Lethargy
 - Difficulty breathing
 - Decreased ability to swallow
 - Drooling
 - Sit in tripod position
 - Stridor
 - Can easily become agitated



Croup and Epiglottitis - Treatment

- Focus on maintaining the airway with minimal invasive interventions in conscious child
- Provide oxygen via NRB to maintain SpO₂ > 94%
- Keep patient calm and comfortable
 - Utilize caregivers to provide family centered care
- Suctioning is contraindicated
- Consider:
 - Albuterol or Duoneb
 - Racemic Epi or Nebulized Epinephrine 0.5mL/kg of 1:1000 diluted in 3mL NS
 - If unable to give nebulizer tx, consider IM
 - If Epi not available, give DuoNeb, 3mg Albuterol & 0.5mg Ipratropium in 3mL NS by nebulizer
- IS AN IV NECESSARY?

Foreign Body Aspiration

- Common in children
- Severity & nature of symptoms depend on size of object & location in the airway
- Suspect in any previously healthy, afebrile infant/child with sudden onset of symptoms
- Symptoms of sudden respiratory distress with:
 - Coughing
 - Choking
 - Stridor
 - Wheezing



Foreign Body Aspiration Treatment

- Keep the child calm!
- Administer oxygen
- Do not attempt blind sweeps
- Suctioning is contraindicated
- If wheezing is present, foreign body is in a smaller airway
 - Do Not administer bronchodilators such as Duoneb or Albuterol

WHY?



Lower Airway Emergencies

Bronchiolitis

- An acute viral infection of the lower respiratory tract
- Peak Season: November to May
- Primarily affects infants, < 3 years of age, with the peak incidence occurring between 2-6 months of age
- Characterized by:
 - Epithelial cell destruction
 - Cellular edema
 - Airway obstruction by inflammatory debris and mucous

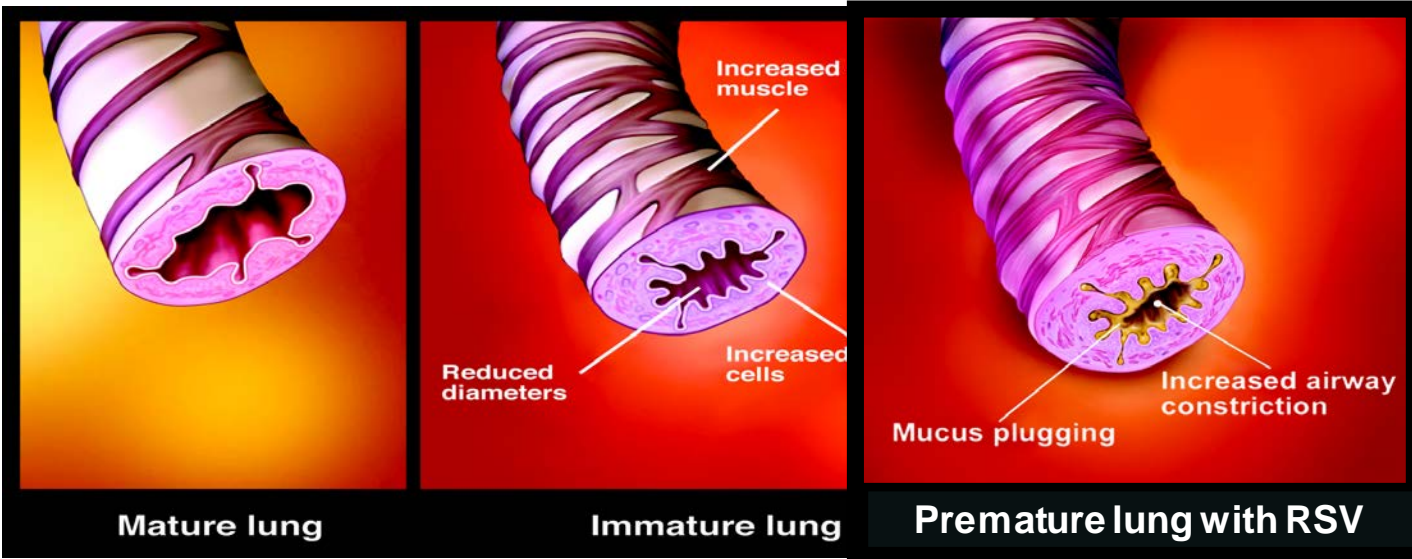
Bronchiolitis Symptoms

- Cough
 - May increase in severity over several days
 - Can be variable, from dry to wet to croupy
- Wheezing
 - Because the airways are obstructed by mucous and debris, wheezing and crackles are common.
- Rhinitis
- Grunting, nasal flaring
- Retractions
- Low grade fever
- Poor feeding
- Apnea

Respiratory Syncytial Virus

- Responsible for 50% of bronchiolitis cases
- RSV is an enveloped RNA paramyxovirus
- Transmission requires close contact
 - Has a 98% rate for first-time exposures
 - 75% rate for subsequent exposures
- Risk factors
 - Less than 1 year of age
 - Attendance at day care
 - Older siblings
 - History of prematurity
 - Medically fragile infant- hx of congenital abnormality
 - Immunocompromised infant

RSV in the Airway



Bronchiolitis - Treatment

- O2 as needed
- Nasal Suction!!!!
- Bronchodilators should not be routinely use for management
 - A one-time trial of inhaled bronchodilators can be tried & continued if patient responds
- If severe respiratory distress or bronchodilator is not effective:
 - 0.5 mL Racemic Epinephrine nebulizer treatment or 3-5 mg 1:1000 Epinephrine nebulized treatment
- IV & fluids if dehydrated
- Antibiotics should only be used if there is a coexisting bacterial infection.



Asthma

- Leading cause of chronic illness in children
- Affects > 6 million children
- > 470,000 hospitalizations
- > 10 million missed school days
- Causes > 5000 deaths annually
- Who dies of asthma
 - 1/2 of all deaths are in patients with mild disease
 - African American children are 4-6 times more likely to die

What is Asthma?

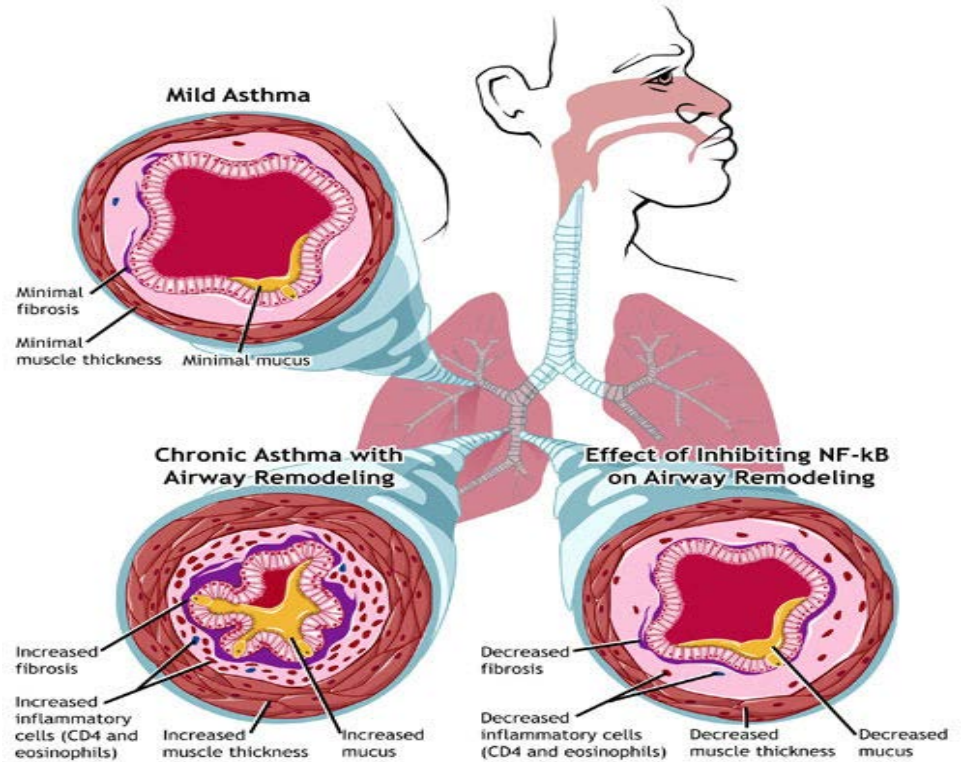
- An airway disorder characterized by periods of reversible airflow obstruction
 - Airflow is obstructed by inflammation and airway hyper reactivity in reaction to certain exposures.

Exposures

- Exercise
- Infection
- Allergens
- Stress
- Airborne irritants
- Cold

Pathophysiology of Asthma

1. Smooth muscle spasm causing bronchoconstriction
2. Edema of mucosal membranes
3. Increased secretions
 - Mucous plugging
- Air trapping/Hyperinflation
 - Exhalation prolonged
- Hypoxemia
 - Inhomogeneous distribution of affected areas results in V/Q mismatch, mostly shunting.



Symptoms of Asthma

- Wheezing
 - “quiet chest”
- Coughing- intermittent or continuous in an effort to keep the bronchioles open
- Retractions
- Shortness of breath
- Tight feeling in chest
- Use of accessory muscles
 - Sit in tripod position
- *Symptoms may occur or be worse at night or early morning.*
- *Child may only display one symptoms or all symptoms.*

Key Assessments

- Level of Consciousness
 - Anxious
 - Lethargic
- Coughing
 - Inspiratory
 - Expiratory
- Air Movement
- Accessory muscle use
- Phonation
 - Speaking in complete sentences or single words

Treatment

- Oxygen- >94%
- Positioning
 - Sitting upright
 - Position of comfort
- Medications- bronchodilators
 - Albuterol
 - Duoneb (ipratropium bromide 0.5 mg/albuterol sulfate 3.0 mg)
 - UNINEB
- If severe respiratory distress or duoneb is not effective:
 - Epinephrine 0.01mg/kg (1:1,000) IM to max dose of 0.3mg
 - OR 0.01mg/kg (1:10,000) IV
 - Consider Methylprednisolone 2mg/kg
- IV fluids at maintenance
- If respiratory failure- BVM & consider intubation

Treatment

- Following albuterol, hypoxia may worsen initially before improving
 - Ventilation/perfusion mismatch
 - Tachycardia
 - Onset up to 10-15 minutes
 - Jittery, shakes
- Bronchodilators should be given with a mask so that the child can breath in as much as possible

ASTHMA PATHWAY

IF MILD

- Consider around the clock Albuterol Q4hrs for 24-48 hours
- Oral steroids
- Admit if SpO2 remains < 90% or if patient may need treatment sooner than Q4H

IF MODERATE

- Give PO Prednisolone (unless recent emesis)
- Start weight based UNINEB
- Start Albuterol MDI q2H
- If SpO2 remains < 90% consider further diagnostic testing

IF SEVERE

- Place IV and start fluids
- Consider Methylprednisolone
- Place on Continuous Albuterol at >40% FiO2
- Consider Magnesium Sulfate with Normal Saline bolus

UNINEB:

Albuterol (Nebulized) + Ipratropium Bromide

< 10 kg =

3 Albuterol (2.5mg x3 =
7.5mg) +

1 Ipratropium Bromide
(500mcg)

Usually given over 20
minutes

> 10 kg =

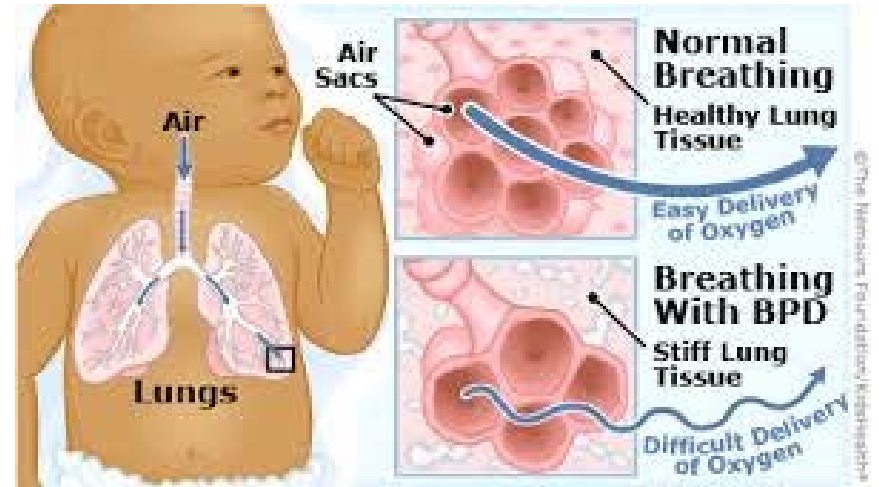
6 Albuterol (5mg x 3 = 15
mg) +

2 Ipratropium Bromide (1000
mcg)

Usually given over 20
minutes

Bronchopulmonary Dysplasia (BPD)

- Seen in children that were born prematurely or on prolonged ventilation or high oxygen concentration in infancy
- Children are considered medically fragile
 - Expend considerable amount of energy to breathe
 - Home oxygen
 - Tracheostomy
 - Home ventilation
- High mortality rate
- Characterized by chronic respiratory distress- baseline
 - Retractions
 - Crackles
 - Wheezing
- Prone to infections
- Little respiratory reserve
- Require quick interventions



Always Consider

Respiratory distress may not
be primarily due to a
respiratory issue

CNS Causes of Respiratory Distress

- Seizures
- Hypoxic Ischemic Encephalopathy (HIE)
- Extracranial hemorrhage
- Intracranial hemorrhage
- Drug Exposure/depression
- Drug withdrawal
- Meningitis

Neuromuscular Causes of Respiratory Distress

- Myopathies (myotonic dystrophy)
- Myasthenia gravis
- Spinal cord injury
- Phrenic nerve injury

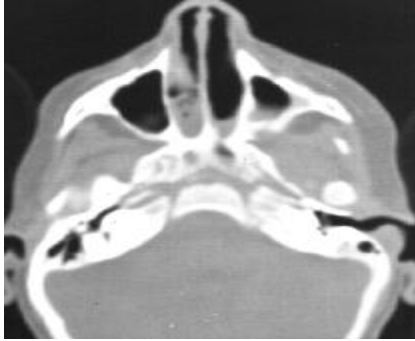
Cardiovascular Causes of Respiratory Distress

- Cyanotic heart disease
- Acyanotic heart disease
- Cardiomyopathy
- Persistent pulmonary hypertension
- Shock

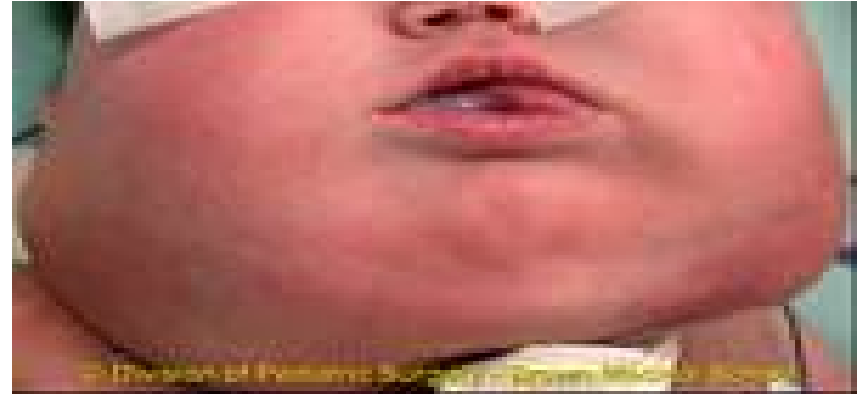
Hematologic Causes of Respiratory Distress

- Anemia
- Polycythemia
- Shock
- Sepsis
- Sickle cell disease

A Picture is Worth a Thousand Words



Cystic Hygroma



DOES THE CAUSE REALLY MAKE A DIFFERENCE?



Respiratory Case Scenarios

Let's manage some
patients together...



Case scenario 1

- 3 month old is admitted to the hospital with a runny nose, poor appetite, and frequent coughing.

Classify patient

Sick or not sick?

Scenario 1 Assessment



Scenario 1 Assessment

Vitals

H.R. = 136

R.R. = 60

WOB = Intercostal and subcostal retractions

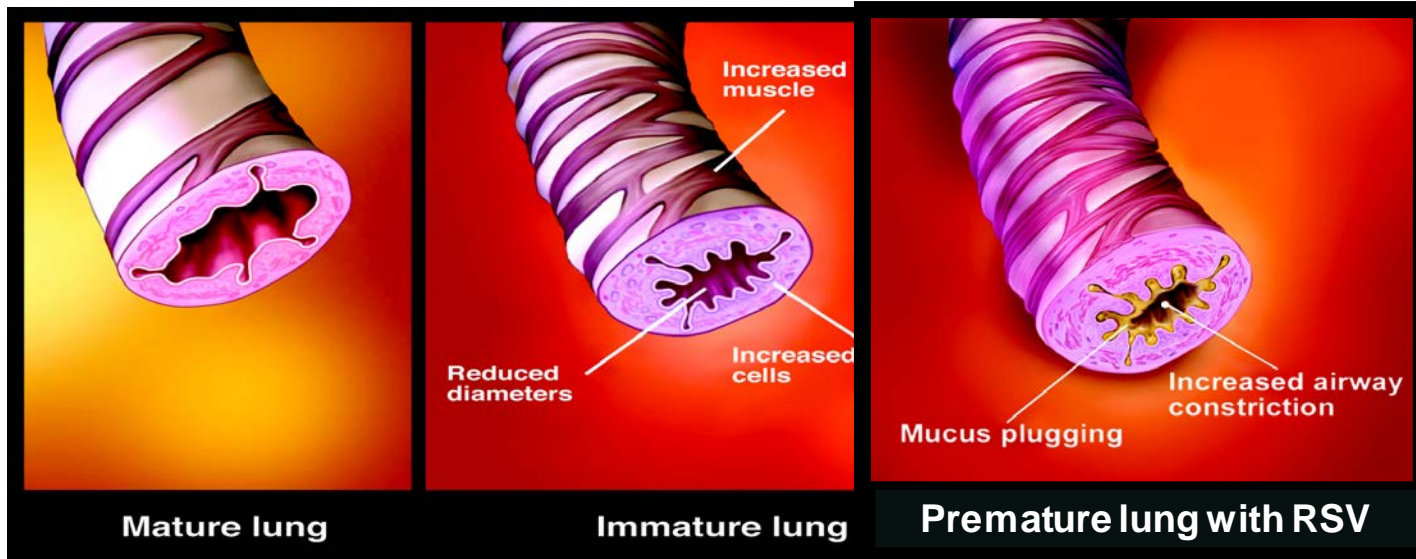
B.S. = Noisy breathing (crackles and wheezing)

SpO2 on Room Air = 88%

Periodic apnea spells – self-resolved

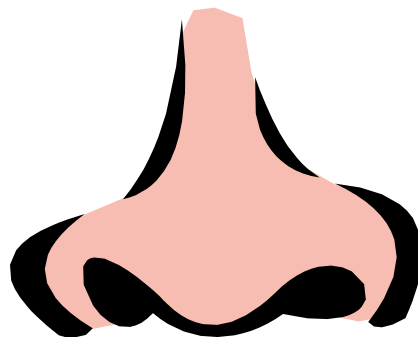
Diagnosis

RSV



Scenario 1 Treatment

- "A" Airway Management
 - Secretion Management
 - * Suction before all feeds.
- "B" Breathing
 - Oxygen Therapy
- "C" Circulation
 - Hydration
- Treat symptoms
- Prophylaxis



SUCTION

The Nose

- Nose is responsible for 50% of total airway resistance at all ages



Ⓢ ***Infant: blockage of nose = respiratory distress***

Case Scenario 2

- 7 year old child is brought to the Emergency Department with a chief complaint of SOB.

Classify

Sick or not sick?

Case Scenario 2 Assessment



Case Scenario 2

Vitals

H.R. = 132

R.R. = 28

WOB = substernal and intercostal retractions

B.S. = diminished throughout, wheezes

SpO2 on Room Air = 87%

Diagnosis

Asthma

Scenario 3 Treatment

- “A” Airway Management
 - Oxygen
 - Sitting Position, Position of Comfort
- “B” Breathing
 - Albuterol
 - Duoneb
 - UNINEB
 - Steroids
 - Encourage Coughing
- “C” Circulation
 - Hydration

Asthma Attack and Dehydration

Many patients who present with signs of asthma exacerbation are hypovolemic on presentation.

WHY?

These patients typically have poor intake and increased insensible fluid loss from the respiratory tract.

Should I intubate an asthmatic?

- AVOID IF AT ALL POSSIBLE!
- Indications include cardiac or respiratory arrest, severe hypoxia, exhaustion, or deterioration of mental status.
- Approach with Caution!
 - Tracheal intubation may aggravate bronchospasms, induce laryngospasm, increase barotrauma, and depress circulatory function.
 - Intubation is associated with a mortality rate of 10 to 15%.

QUESTIONS

Discussion

References

- <https://emedicine.medscape.com/article/908172-overview>
- www.prrjournal.com
- www.creighton.edu/.../docs/Respiratory_Management_in_Pediatrics.pdf
- *6th Edition Sheehy's ENA Core Curriculum Emergency Nursing*

Thank You!!!



— You can email questions to below.

- Cindy.Pirrung@avera.org