Recognition and Management of Respiratory Distress in Pediatrics

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Adults vs. Pediatrics

History

- Developmental History, Social History, Immunization History

Parents

- Trust parent as the historian
- Observe parent/child interactions
- Parents are the "2nd patient"

Vital Signs

- Infants
  - Higher normal HR
  - Faster RR
  - Lower BP
- Temperature – axillary, tympanic, temporal, rectal

Weight

- Everything is weight based

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Adults vs Pediatrics

Physical Exam Differences – pediatrics are not "just little adults"

HEENT → Fontanelle, Ear canal	Respiratory → Abdominal breathing, "noisy" breathers, faster RR	Cardiovascular/Circulatory → location of pulses, assess for murmur	GI/GU → rounded belly, umbilical hernias	Skin → Observe any scars/injuries for suspicious patterns

Primary cause of decompensation/cardiac arrest

Pediatrics: Respiratory	Adults: Cardiac

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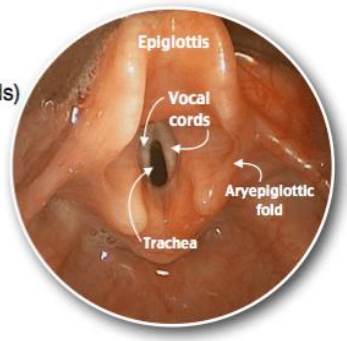
Anatomical Differences Between Pediatric and Adult Airways

Pediatric airway

- Proportionally **smaller larynx**
- **Narrowest** portion is the **cricoid cartilage** (below vocal cords)
- **Epiglottis** is **longer** and **narrower**
- **Head** and **occiput** are proportionally **larger**
- **Tongue** is proportionally **larger**
- **Neck** is much **shorter**
- **Larynx** is more **anterior** and **cephalad**
- **Adenoids** are are **larger**
- Risk of **mainstem intubation** is much **higher** in pediatrics due to short trachea and bronchus



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What puts a child at risk?

- Increased metabolic demand
- Increased oxygen consumption
- Increased minute ventilation
- Small lung volumes

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Pediatric Assessment in Respiratory Distress

- How to assess your patient status in 10 seconds?
  - Level of Consciousness
  - Work of Breathing
  - Color

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Signs/Symptoms of Respiratory Distress

- Tachypnea
- Nasal Flaring
- Retractions
- Grunting
- See-Saw Breathing
- Head Bobbing
- Skin Vitals: pale, mottled

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Tachypnea

- Why do we become tachypneic?
  - Increase RR to compensate for impaired gas exchange or need to excrete more Co2
- Why is this different in children?
  - Already have higher respiratory rate than adults
  - Smaller chest cavity and lung capacity
  - Weaker intercostal muscles

General Vital Signs and Guidelines

Age	Heart Rate (beats/min)	Blood Pressure (mmHg)	Respiratory Rate (breaths/min)
Premature	110-170	SBP 55-75 DBP 35-45	40-70
0-3 months	110-160	SBP 65-85 DBP 45-55	35-55
3-6 months	110-160	SBP 70-90 DBP 50-65	30-45
6-12 months	90-160	SBP 80-100 DBP 55-65	22-38
1-3 years	80-150	SBP 90-105 DBP 55-70	22-30
3-6 years	70-120	SBP 95-110 DBP 60-75	20-24
6-12 years	60-110	SBP 100-120 DBP 60-75	16-22
> 12 years	60-100	SBP 110-135 DBP 65-85	12-20

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Nasal Flaring

- Children do this unintentionally to increase size of upper airway

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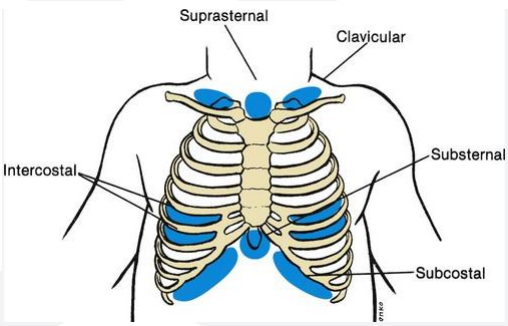
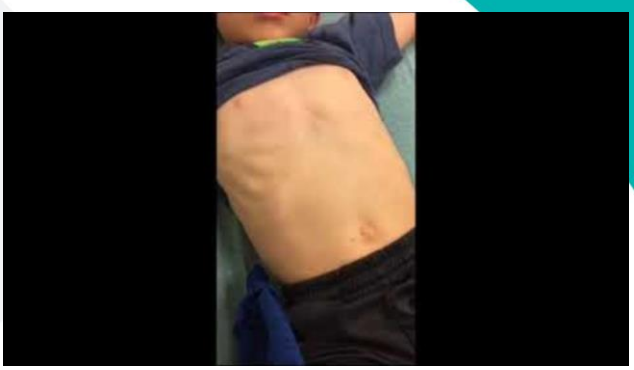
Retractions

- What are they?
  - Collapse of the soft tissue due to muscular effort and increased intrathoracic pressure
- Why do they happen?
  - Muscle activity is increasing in an effort to increase the tidal volume of the lungs
- Common locations:



Children's NEBRASKA



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Grunting

- What is it?
  - Sound made with closure of the glottis and attempt to breathe against own glottis to provide “self-peep”
  - Goal: maintain lung volume

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See-Saw Breathing

- What is it?
  - Rocking motion of the chest wall and abdomen due to forced exhalation
- Associated with bronchospasm

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Head Bobbing

What is it?	• Head bobs with taking a breath in effort to expand chest cavity
When does this happen?	• With increasing lethargy, but still has significant WOB • Late sign- impending respiratory failure

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Progression to Respiratory Failure

- Infant/Child can no longer maintain effective gas exchange with compensatory mechanisms
- Signs of inadequate oxygenation (hypoxia):
  - Desaturation
  - Cyanosis, mottling
- Signs of inadequate ventilation (hypercarbia):
  - Progressive tachycardia
  - Significant agitation progressing to lethargy and somnolence
  - Older Child: report they can't breathe, begin to be uncooperative
- Somnolence is a significant sign of impending failure

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Signs/Symptoms of Respiratory Failure

Breathing	Systemic
• Tachypnea (early) • Bradypnea/Apnea (late) • Retractions • Accessory muscle use • Decreased effort • Decreased chest expansion	• Altered mental status • Weak/Absent cry • Tachycardia (early) • Bradycardia (late) • Central cyanosis • Mottling • Hypoxemia (despite O2 administration) • Hypotonia

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Management of Respiratory Emergencies

- Airway Positioning
- Suctioning
- Utilize airway adjuncts
- Supplemental Oxygen
- ECG monitor (as needed)
- Inhaled medications
- Invasive Airways

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Complications to Suctioning

- Desaturation
- Trauma to the nare
- Excessive cough or gag, increasing risk of vomiting and aspiration
- Bronchospasm or Laryngospasm

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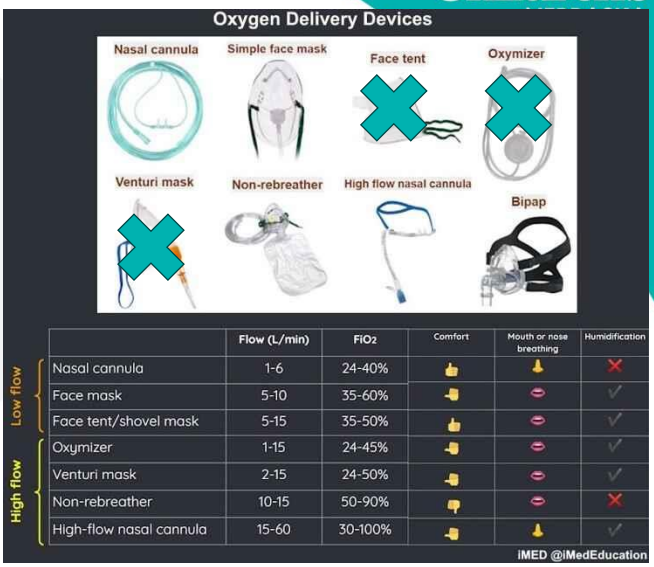
Non-Invasive Airway Devices

- Non-Invasive:
  - Nasal Cannula
  - Oxymask
  - Non-Rebreather



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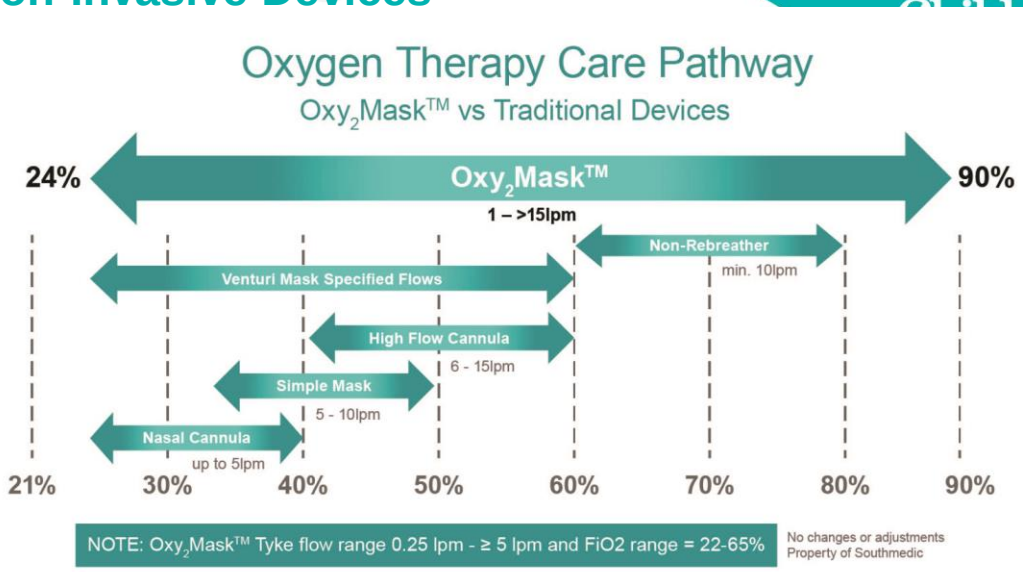
Non-Invasive Devices



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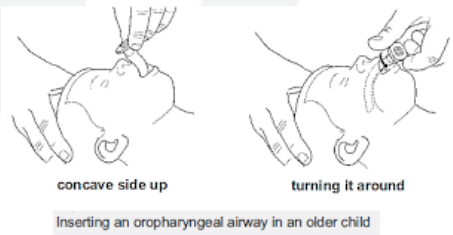
Airway Adjuncts

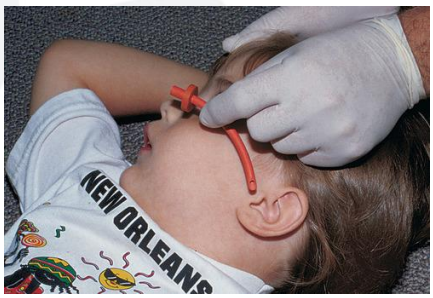
- Used for unconscious patients at risk for developing airway obstruction
  - How to measure?
  - How to insert?

Oropharyngeal Airway (OPA)



Inserting an oropharyngeal airway in an older child

Nasopharyngeal Airway (NPA)



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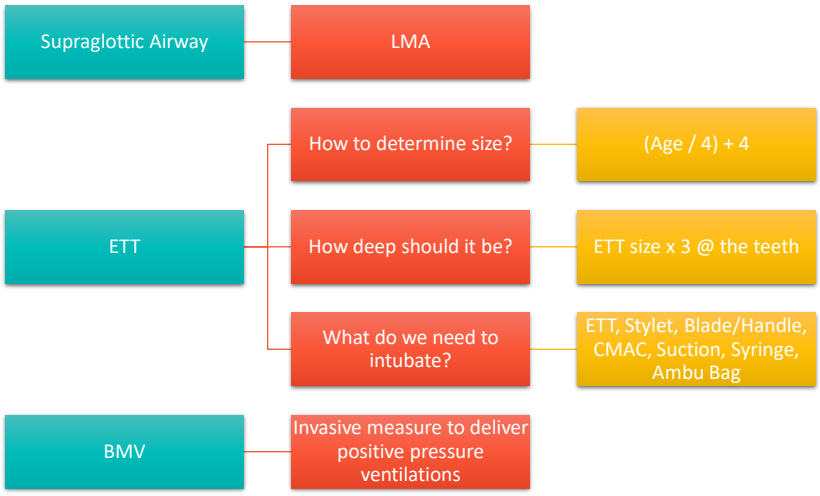
Invasive Airway Devices



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Bag Valve Mask

- Easy to learn, successfully used by range of skill levels, some practice needed
- Best performed as a two person technique (holder and bagger)
- Minimal prep needed, take equipment out of bag and attach to O2
- Doesn't interfere with cardiac massage initially but requires 30:2/15:2 ratio
- Causes significant gastric distension and regurgitation risk due to lack of funneling towards the trachea
- High rates of management difficulty or failure requiring switching to a different strategy
- Can be used on minimally conscious patient with intact gag reflex
- Does not allow for much positive pressure ventilation

Supraglottic Device

- Easy to learn, successfully used by a range of skill levels, some practice needed
- Performed as a one person technique successfully
- Minimal prep needed, take out of packaging, lubricate and attach O2
- Can be used either 30:2/15:2 ratio or continuous (but risk of leak)
- Can cause gastric distention and regurgitation but some models now have gastric port for decompression
- Moderate rates of management difficulty/failure due to positioning, leaks and failure to secure/monitor
- Requires unconscious patient with loss of gag reflex
- Allows for some positive pressure ventilation up to 25cmH2O then develops leaks
- Sits perilaryngeal and above epiglottis so not useful in upper airways obstruction

Endotrachial Intubation

- Requires training to a high level by dedicated practitioners with frequent practice needed
- Requires a two person technique (an intubator and a kit handler)
- Intensive prep needed to lay out equipment, check cuff, multiple stages
- Initially interferes with cardiac massage to insert, then can be used continuously
- Does not affect gastric distention/ regurgitation and allows for gastric tube to be easily passed
- Once correctly placed/secured, less airway management difficulties or unexpected loss of airway
- Requires unconscious patient and initial plus ongoing paralysis/sedation
- Allows high positive pressure ventilation (asthma, drowning, tension pneumothorax)
- Sits below epiglottis with cuff so can be used in almost all airway issues
- Higher risk of hyperventilation leading to respiratory alkalosis, reduced cerebral perfusion and barotrauma

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Common Pediatric Breathing Complications

- Upper Airway Obstruction
- Lower Airway Obstruction
- Disordered Control of Breathing
- Laryngospasm & Bronchospasm

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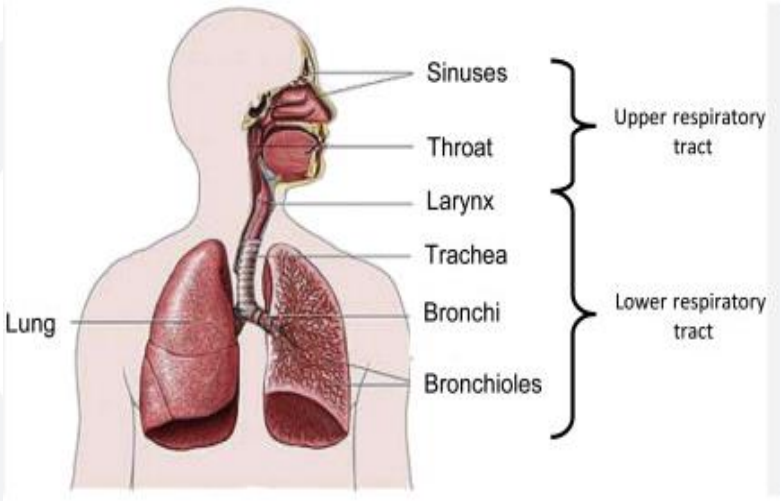
Basic Anatomy Review



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Upper Airway Obstruction

- **Causes**: Croup, Anaphylaxis, Foreign Body, Post-Intubation Swelling
- **Signs/Symptoms** : Nasal Flaring, Stridor, Tracheal Tugging
- **Treatment**: Nebulized Racemic Epi, Corticosteroids

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Lower Airway Obstruction

- **Signs/Symptoms**: Wheezing, Grunting, Subcostal & Intercostal Retractions
- **Treatment**: Suctioning, Bronchodilators, Corticosteroid
- **Causes**: Bronchiolitis, Asthma, Pneumonia

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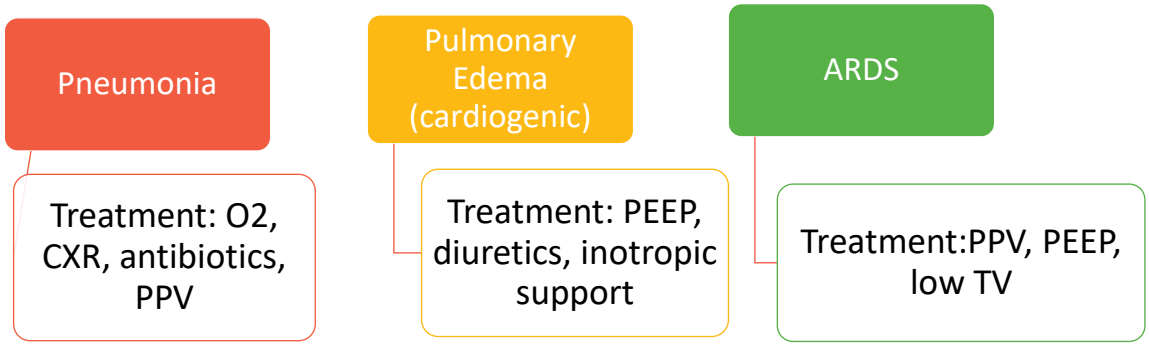
Lung Tissue Disease



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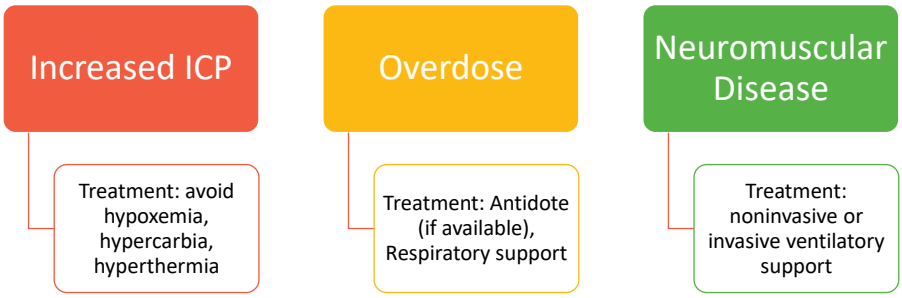
Disordered Control of Breathing



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Laryngospasm

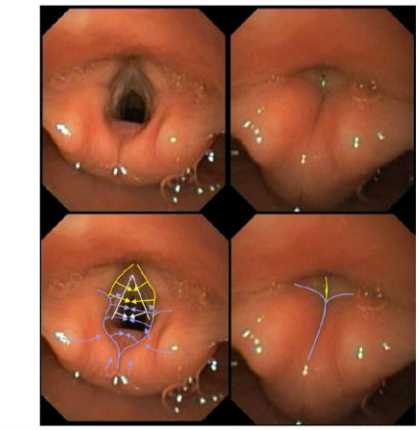

Fig. 6. Larynx before and during a laryngospasm. White, movement of the vocal cords; yellow, movement of false cords; blue, movement of arytenoids.

What is it?

- Partial or complete airway obstruction associated with increasing abdominal and chest wall efforts to breathe against a closed glottis
- Commonly occurs during induction and emergence of anesthesia

Causes:

- Oral or gastric secretions
- Blood
- Suctioning through oral airway
- Laryngoscope
- "light" anesthesia

Risk Factors:

- ENT Cases
- Upper respiratory infection within 2 weeks
- History of wheezing or eczema
- Family history of asthma, rhinitis, eczema, or smoking

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Laryngospasm

Children's NEBRASKA

How does it manifest?

Suprasternal and supraclavicular retractions

Tracheal tugging

Paradoxical chest

Abdominal movements

Inspiratory stridor (in partial spasm only)

No breath sounds (in complete spasm)

Early Recognition

No air movement/breath sounds

Absence of movement of reservoir bag

Flat capnography

Late signs:

- Desaturation
- Cyanosis
- bradycardia

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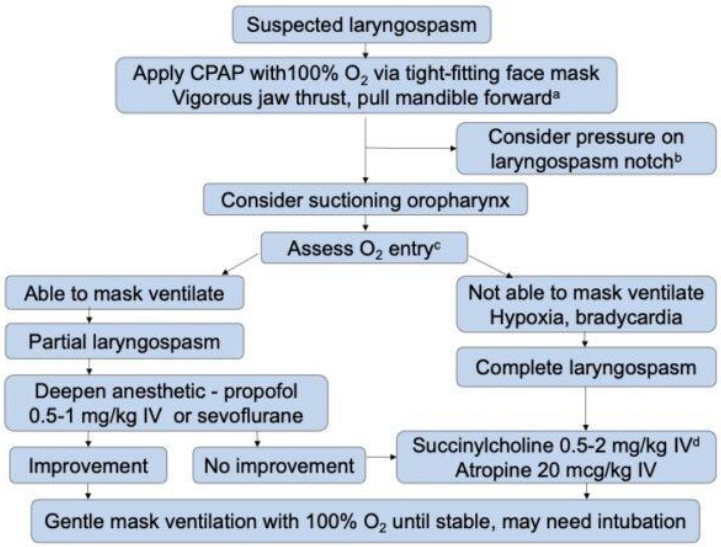
What do we do?



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Bronchospasm

What is it?	Causes	Risk Factors	How does it manifest
• Occurs when muscles that line the bronchi tighten	• Light anesthesia • Airway irritants: secretions, aspiration • Airway instrumentation: laryngoscope, intubation • Allergic response: latex, medications, antibiotics, local anestheics	• Family history of asthma • Chronic bronchitis • URI < 2 weeks prior to procedure • Exposure to smoking, animal dander, air pollutants	• Wheezing • Coughing

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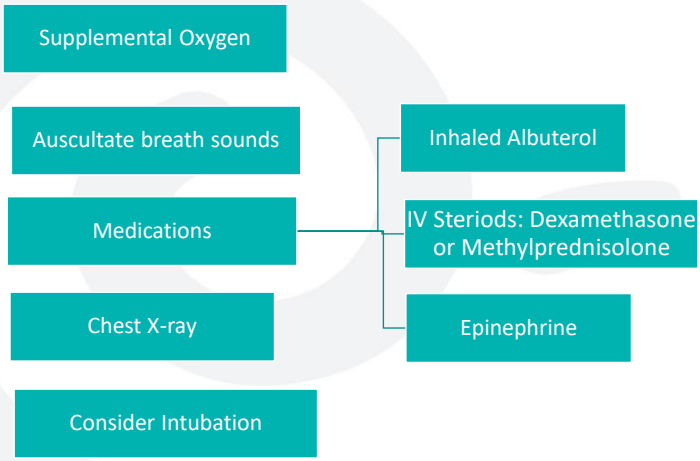
What do we do?



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Patient Desaturating... What do you do?

Position the airway / establish what should be a maskable airway	• Oral airway for deeply sedated patients • Nasal trumpet for more awake patients (this can also stimulate the patient to wake up ☺)
Look at how the patient is breathing while positioning airway:	• Rocker breathing suggests laryngospasm/obstruction • Tugging suggests bronchospasm • Small breaths suggest shallow breathing (patient needs supplemental O2 until more awake)
Apply CPAP (get the bag tight) and see if you can bag with the patient	
Have someone listen to breath sounds	• May not hear anything with laryngospasm • Will likely here wheezing with bronchospasm as complete bronchospasm is rare

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Key Takeaways

- Severe decompensation and cardiopulmonary arrest in pediatrics is typically respiratory in origin
- Decreased level of consciousness is a sign of impending respiratory failure
- Laryngospasm and Bronchospasm are common complications in pediatrics post-op

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That's all, you can take a deep breath

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