Pediatric Emergencies - Respiratory Emphasis

September 2021 CEU

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Objectives/Topics

- Background information
- Age group chart
- Vital sign chart
- Equipment size chart
- Resources
- Anatomy
- Physiology
- COVID
- Neonatal respiratory emergencies
- Pediatric respiratory emergencies
- Interventions

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Background Information

- Minority of EMS calls involve pediatric patients
- Majority of pediatric EMS calls are lower acuity
- Large proportion of pediatric EMS calls involve respiratory complaints/issues
- High stress
- High risk

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Age Range Chart

Age-group	Age
Newborn	0 days to 1 month
Infant	1 month to 1 year
Toddler	1 to 3 years
Preschool	3 to 6 years
School age child	6 to 12 years
Adolescent	12 to 18 years

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Vital Sign Chart

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

SBP Rule of Thumb:
0-28 days >60
1-12 mo >70
1-10 yrs = 70 + (Age x 2)
> 10 yrs = >90
Lower limit of DBP = 2/3 SBP

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Equipment Size Chart

Airway	Placement
Nasopharyngeal	Tip of nose to tragus
Oropharyngeal	From lip/teeth to angle of jaw
Bag valve mask	10cc/kg

Age	Weight (kg)	Cuffless	Cuffed	Depth (cm)	Miller	Macintosh
Preterm	<1	2.5	-	6 - 7	Miller 00 or 0	-
Preterm	1 - 2.5	3.0	-	7 - 9	Miller 0	-
Neonate	2.5 - 4	3.0	-	10	Miller 0	-
6mo	6 - 7.5	3.5	3.0	10 - 11	1	-
1 year	10	4.0	3.5	12	1	-
2 - 3 y	12 - 14	4.5 - 5.0	4.0 - 4.5	13 - 14	1.5	-
4 - 6 y	16 - 20	5.0 - 5.5	4.5 - 5.0	15 - 16	2	2
7 - 9 y	22 - 26	5.5 - 6.0	5.0 - 5.5	16 - 18	2	2
10 - 12 y	28 - 32	-	6.0 - 6.5	18 - 19	2	3
13 - 15 y	34 - 38	-	6.5 - 7.0	19 - 20	2	3
16 - 18 y	>40	-	7.0 - 8.0	21 - 24	2	3

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Equipment Size Chart

Relation to Other Tubes

- NG, OG, foley = 2 x ETT
- Chest Tube (max) = 4 x ETT

Apneic oxygenation

- Infant: 5L/min
- Child: 10 L/min
- Adolescent/adult: 15 L/min

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Always remember your Broselow Tape!

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Pediatric Resources

- Mercyhealth EMS Lectures
- Mercyhealth Protocols (Online + Print)
- Textbooks
- Open Source Online Content
- Print Quick Reference Guidelines (Broselow Tape)
- Phone Apps (Pedi STAT)
- Call Medical Control
- Memory?

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COVID-19

- Children of all ages can get COVID-19
- In the United States, children account for approximately 13-14% of laboratory-confirmed cases reported to the CDC
- Highest prevalence 14-17 years of age
- Hospitalized less than adults
- Death is rare
- Fever, cough, or shortness of breath are the most common symptoms
- Genetic and medical co-morbidities predispose to severe disease

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COVID-19

Clinical spectrum of COVID-19 and COVID-19-associated multisystem inflammatory syndromes in children

Acute COVID-19		COVID-19-associated MIS-C		
Mild	**Severe**	**Febrile inflammatory state**	**KD-like illness**	**Severe MIS-C**
In most children, COVID-19 causes no or only mild symptoms.	A small minority of children present with severe acute COVID-19 manifestations, including respiratory failure, ARDS, neurologic symptoms, coagulopathy, and shock. This occurs most commonly in children with underlying medical conditions. Some children with severe acute COVD-19 may develop signs of cytokine storm.	Some children may present with persistent fevers and mild symptoms (eg, headache, fatigue). Inflammatory markers may be elevated, but signs of severe multisystem involvement are lacking.	Some children meet criteria for complete or incomplete KD and do not develop shock and severe multisystem involvement.	Children with severe MIS-C have markedly elevated inflammatory markers and severe multisystem involvement. Cardiac involvement and shock are common.

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ABC's

Is it an:

- Stable airway?
- Unstable maintainable airway?
- Unstable/unmaintainable way?

Manage with:

- Oxygen
- BVM, Non-visualized airway, intubate
- IV, IO

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Assessment

- History
- What happened
- Onset of symptom
- Severity
- Home interventions
- Past medical history
- Medications
- Allergies
- Immunizations

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Examine them!

- Alertness
- Respiratory effort
- Color
- Vital Signs
- Look with shirt off
- Listen to their breathing
- Auscultation with stethoscope

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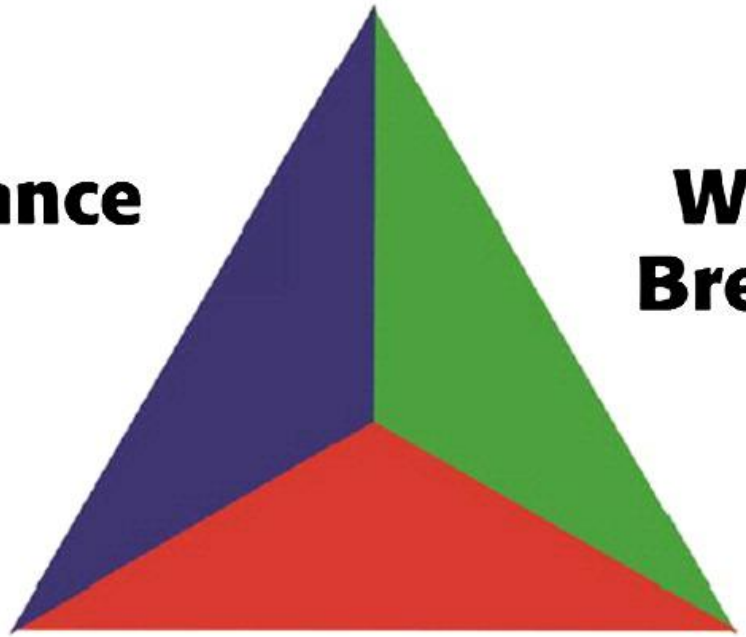
Appearance

Abnormal Tone
↓ Interactiveness
↓ Consolability
Abnormal Look/Gaze
Abnormal Speech/Cry



Work of Breathing

Abnormal Sounds
Abnormal Position
Retractions
Flaring
Apnea/Gasping

Circulation to Skin

Pallor
Mottling
Cyanosis

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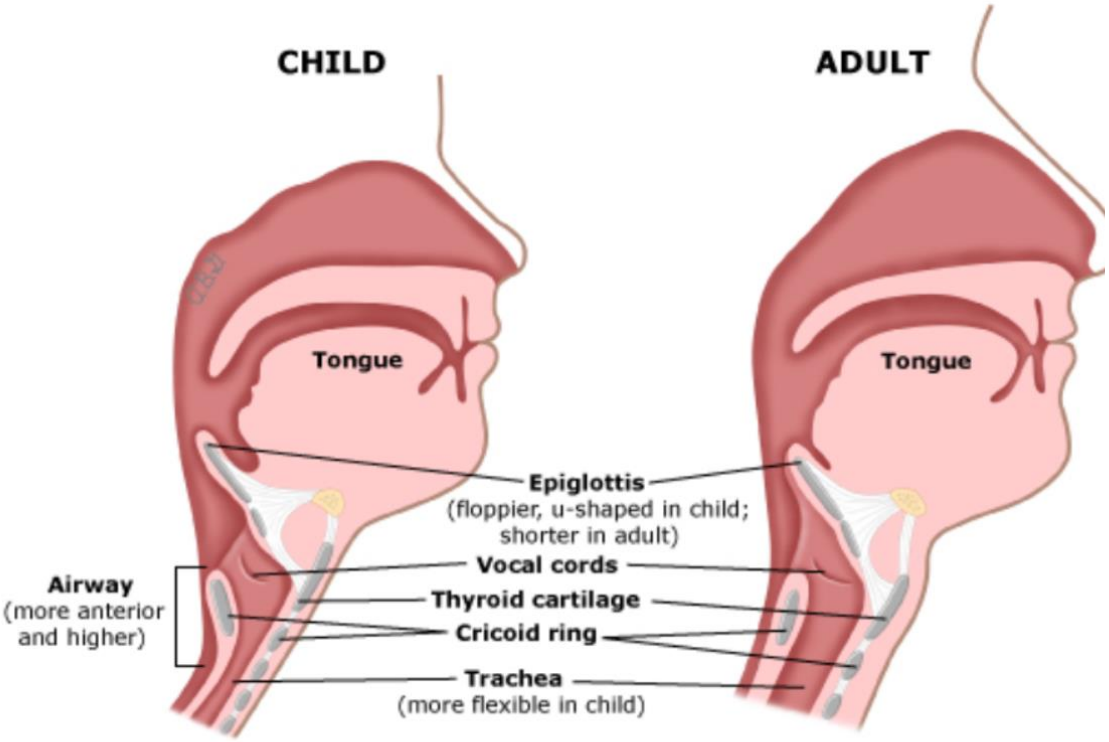
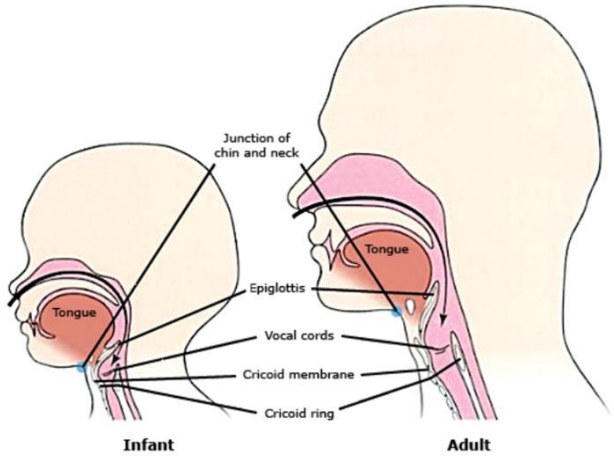
Anatomy

Anatomic differences between the pediatric and adult airway



Child versus adult airway



The anatomical differences particular to children are (a) higher, more anterior position of the glottic opening (note the relationship of the vocal cords to the chin/neck junction); (b) relatively larger tongue in the infant, which lies between the mouth and glottic opening; (c) relatively larger and more floppy epiglottis in the child; (d) the subglottic region as the functionally narrowest portion of the pediatric airway versus the vocal cords in the adult; (e) position and size of the cricothyroid membrane in the infant; (f) sharper, more difficult angle for blind nasotracheal intubation; and (g) larger relative size of the occiput in the infant.

Relative to adults, children have 1) large tongues relative to the size of the oral cavity 2) larger tonsils and adenoids 3) a more superior location of the larynx in the neck 4) a larger and floppy epiglottis and 5) the narrowest portion of the airway functionally occuring below the vocal cords. All of these differences make

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Physiology

- Age-related respiratory rates
- Variations in respiratory patterns, such as periodic breathing, which occurs commonly in the first six months of life
- Preferential nasal breathing in infants
- Infants and young children have small, relatively fixed, tidal volumes relative to body size (6 to 8 mL/kg), which can predispose to iatrogenic barotrauma from aggressive PPV
- Respiratory rate increases, instead of breathing depth

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Physiology

- Intrinsic muscle tone is required to maintain lung volumes and prevent chest wall distortion
- Infants and young children are more likely to experience respiratory muscle fatigue, atelectasis, and respiratory failure
- Lower functional residual capacity in young children, which leads to little intrapulmonary oxygen stores, and a more precipitous decline in oxygen saturation during apneic periods
- Children have a heightened need for pre-oxygenation

Physiology

- Infants have a higher metabolic rate and consume oxygen at a rate twice that of adults
- Higher oxygen consumption results in a shorter safe apnea time
- Infants and younger children have a lower percentage of efficient, skeletal muscle fibers in their intercostal muscles which, when displayed as retractions, predisposes them to fatigue and respiratory failure
- A higher vagal tone predisposes infants and children to more profound bradycardia, especially when combined with hypoxia

Neonatal Respiratory Emergencies

- Approximately 1% of births occur at home
- At-home deliveries potentially involve two patients
- Home births are associated with increased risks of fetal and neonatal death
- Most neonatal resuscitations, including identification and management of neonatal respiratory emergencies, occur in the hospital setting
- Transition from intrauterine to extrauterine is complicated and should be covered independently

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Neonatal Respiratory Emergencies

- Algorithm for neonatal resuscitation
- Lack of respiratory effort
- Blockage of the airways
- Transient tachypnea of the newborn (TTN)
- Respiratory distress syndrome (RDS)
- Persistent pulmonary hypertension (PPHN)
- Other etiologies

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Neonatal Resuscitation Algorithm

- APGAR scores are not used to guide resuscitation
- Initial stabilization (provide warmth, clear airway if necessary, dry, and stimulate)
- Breathing (ventilation and oxygenate)
- Chest compressions
- Administration of epinephrine and/or volume expansion

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Lack of Respiratory Effort

- Interferes with alveolar fluid clearance, lung inflation, and reduction of pulmonary vascular resistance
- Suggests that the infant is neurologically depressed (usually brain asphyxia) or has impaired muscular function
- Readily reversible problems include maternal exposure to opioids
- More severe and refractory problems include prolonged hypoxia or congenital neuromuscular disorders

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Blockage of the Airways

- Mechanical blockage prevents the infant from making adequate initial breaths
- Interferes with adequate fluid clearance, lung inflation, and the fall in pulmonary vascular resistance
- Causes of blockage include congenital airway malformation, the presence of meconium of mucus in the airway, and other developmental pathology

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Transient Tachypnea of the Newborn (TTN)

- Caused by failure of adequate lung fluid clearance at birth, resulting in excess lung fluid
- The liquid fills the airspaces and moves into the extra-alveolar interstitium, where it pools in perivascular tissues and interlobar fissures until it is cleared by lymphatic or vascular circulation

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Transient Tachypnea of the Newborn (TTN)

- Usually occurs within two hours after delivery
- Tachypnea is the most prominent feature
- Increased work of breathing manifested by nasal flaring, mild intercostal and subcostal retractions, and expiratory grunting may be present
- Corrected with supplemental oxygen, CPAP, or intubation

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Respiratory Distress Syndrome (RDS)

- Caused by deficiency of surfactant, the phospholipid mixture that reduces alveolar surface tension, which decreases the pressure needed to keep the alveoli inflated, and maintains alveolar stability
- Diffuse atelectasis leads to low compliance and low functional residual capacity
- Hypoxemia results from right-to-left shunting

Respiratory Distress Syndrome (RDS)

- Infants are nearly always preterm
- Respiratory distress and cyanosis occur at or soon after birth
- Typical signs include grunting, nasal flaring, and intercostal and subcostal retractions
- Antenatal glucocorticoid therapy, early intubation for surfactant therapy, and/or administration of CPAP or PEEP helps to provide adequate lung volume

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Persistent Pulmonary Hypertension (PPHN)

- Caused by the abnormal persistence of elevated pulmonary resistance that leads to right-to-left shunting of deoxygenated blood through the foramen oval and the ductus arteriosus, resulting in hypoxemia
- Caused by a combination of underdevelopment, maldevelopment, or maladaptation of the pulmonary vascular bed.

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Persistent Pulmonary Hypertension (PPHN)

- Usually occurs in term infants
- Characterized by tachypnea and cyanosis
- Differential pre- and postductal saturation is a common finding
- Corrected with supplemental oxygen, CPAP, or intubation

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Other Etiologies

- Congenital heart disease
- Pneumonia
- Pneumothorax and other pulmonary air leak disorders
- Congenital diaphragmatic hernia
- Tracheoesophageal fistula
- Cystic adenomatous malformation
- Primary ciliary dyskinesia

Pediatric Respiratory Emergencies

- Allergic Reaction/Anaphylaxis
- Reactive Airway Disease/Asthma
- Infectious Etiology
- Foreign body

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Treatment – Airway Support

- Positioning
- Suctioning
- Oxygen
- Non-visualized airway
- Intubation

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Allergic Reaction/Anaphylaxis

Symptoms and signs of anaphylaxis

Skin
Feeling of warmth, flushing (erythema), itching, urticaria, angioedema, and "hair standing on end" (pilor erection)
Oral
Itching or tingling of lips, tongue, or palate
Edema of lips, tongue, uvula, metallic taste
Respiratory
Nose - Itching, congestion, rhinorrhea, and sneezing
Laryngeal - Itching and "tightness" in the throat, dysphonia, hoarseness, stridor
Lower airways - Shortness of breath (dyspnea), chest tightness, cough, wheezing, and cyanosis
Gastrointestinal
Nausea, abdominal pain, vomiting, diarrhea, and dysphagia (difficulty swallowing)
Cardiovascular
Feeling of faintness or dizziness; syncope, altered mental status, chest pain, palpitations, tachycardia, bradycardia or other dysrhythmia, hypotension, tunnel vision, difficulty hearing, urinary or fecal incontinence, and cardiac arrest
Neurologic
Anxiety, apprehension, sense of impending doom, seizures, headache and confusion; young children may have sudden behavioral changes (cling, cry, become irritable, cease to play)
Ocular
Periorbital itching, erythema and edema, tearing, and conjunctival erythema
Other
Uterine cramps in women and girls

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Allergic Reaction/Anaphylaxis

Diagnostic criteria for anaphylaxis

Anaphylaxis is highly likely when any ONE of the following three criteria is fulfilled:
1. Acute onset of an illness (minutes to several hours) with involvement of the skin, mucosal tissue, or both (eg, generalized hives, pruritus or flushing, swollen lips-tongue-uvula)
AND AT LEAST ONE OF THE FOLLOWING:
A. Respiratory compromise (eg, dyspnea, wheeze-bronchospasm, stridor, hypoxemia)
B. Reduced BP* or associated symptoms of end-organ dysfunction (eg, hypotonia, collapse, syncope, incontinence)
2. TWO OR MORE OF THE FOLLOWING that occur rapidly *after exposure to a LIKELY allergen for that patient* (minutes to several hours):
A. Involvement of the skin mucosal tissue (eg, generalized hives, itch-flush, swollen lips-tongue-uvula)
B. Respiratory compromise (eg, dyspnea, wheeze-bronchospasm, stridor, hypoxemia)
C. Reduced BP* or associated symptoms (eg, hypotonia, collapse, syncope, incontinence)
D. Persistent gastrointestinal symptoms (eg, crampy abdominal pain, vomiting)
3. Reduced BP* *after exposure to a KNOWN allergen for that patient* (minutes to several hours):
A. Infants and children - Low systolic BP (age-specific)* or greater than 30% decrease in systolic BP
B. Adults - Systolic BP of less than 90 mmHg or greater than 30% decrease from that person's baseline

BP: blood pressure.

* Low systolic blood pressure for children is defined as:
  - Less than 70 mmHg from 1 month to 1 year
  - Less than (70 mmHg + [2 x age]) from 1 to 10 years
  - Less than 90 mmHg from 11 to 17 years

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Allergic Reaction/Anaphylaxis

EMERGENCY MEDICAL RESPONDER

- If altered level of consciousness or no radial pulse, position patient supine with legs raised
- **EPI-Pen(>66lbs/30kg)** IM (0.3mg) or **EPI-Pen Jr(<66lbs/30kg)** IM (0.15mg) to lateral mid-thigh for moderate or severe reactions). Hold in place for 10 seconds and massage area for 10 seconds after injection.
- Alternative medical director approved epinephrine auto injectors may also be used.
- Oxygen 10-15 LPM by non-rebreather mask
- Assist with patient-prescribed medications
  - **Albuterol Sulfate** MDI 2 Puffs
- Nebulizer Therapy: If wheezing
  - **Albuterol Sulfate** Unit Dose (2.5 mg in 3 ml) administer per hand held nebulizer or mask; May repeat X 2 additional doses

EMT

- Administer Nebulizer Therapy: **Albuterol Sulfate** 2.5mg in 3 ml with **Ipratropium Bromide (Atrovent)** 0.5mg in 2 ml administer per hand held nebulizer, mask or in-line nebulizer; May repeat albuterol X 2 additional doses
  ** If patient is under 3 years of age, do not use Ipratropium Bromide (Atrovent), use only Albuterol via HHN
- **EPI-Pen(>66lbs/30kg)** IM (0.3mg) or **EPI-Pen Jr(<66lbs/30kg)** IM (0.15mg) to lateral mid-thigh for moderate or severe reactions). Hold in place for 10 seconds and massage area for 10 seconds after injection.
- Alternative medical director approved epinephrine auto injectors may also be used.
- Drawn up epinephrine and syringe using above dosing only for departments with additional training to do so.

AEMT

- Initiate IV/IO 0.9% NS @ KVO
- If the patient is Hypotensive, run wide open for 500ml after verifying lung sounds not wet

PARAMEDIC

- If loss of consciousness or loss of gag reflex occurs, consider non-visualized airway or endotracheal intubation See *Respiratory Distress Guideline*
- **Epinephrine 1:1,000** 0.3 mg (peds 0.01mg/kg) IM for moderate to severe reactions. Repeat every 10 – 15 minutes X3 if patient is not improving, or as ordered per Medical Control
- **Diphenhydramine (Benadryl)** 50 mg PO if greater than 50kg(peds dose liquid or chewable 1mg/kg max 50mg) for mild reactions
- **Diphenhydramine (Benadryl)** 50 mg IM/IV/IO (peds 1mg/kg) for mild, moderate or severe reactions
- **Glucagon** 1 mg IV/IO/IM if the patient is taking Beta Blockers and is not responding to Epinephrine, repeat every 10 minutes, until you run out of glucagon
- **Methylprednisolone (Solu-Medrol)** 125 mg IV/IO/IM (peds 2mg/kg) for moderate to severe reactions
- **Push Dose 1:100,000 Epinephrine per section 5.42**

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It is important to reassess often:

Evaluate ABC's again

- Is there improvement?
- Possibly another cause?
- Repeat interventions?

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Case review #1

3 year old with respiratory distress for 2 days with noisy breathing and retractions

- History of wheezing
- Not diagnosed with asthma
- Exposed to cigarette smoke recently
- Prescribed MDI Albuterol given by parents without effect

<u>Your assessment reveals:</u>

- Alert in moderate distress
- Pulse 142, Respirations 38, Pulse Ox at 93%
- Minimal retractions
- Decreased breath sounds with moderate wheezing

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Case review #1 Discussion

1. Sick or not sick?
2. ABC's
3. Clinical assessment
4. Diagnosis?
5. Interventions
6. Reassessment

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Reactive Airway Disease/Asthma

Symptoms:

- Cough
- Wheeze
- Seasonal influence
- Patterns

  -Intermittent

  -Chronic

  -Morning “dipping”

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Reactive Airway Disease/Asthma

Precipitating factors

- Respiratory tract infections
- Exercise
- Weather
- Tobacco smoke
- Allergens
- Irritant exposures
- Stress

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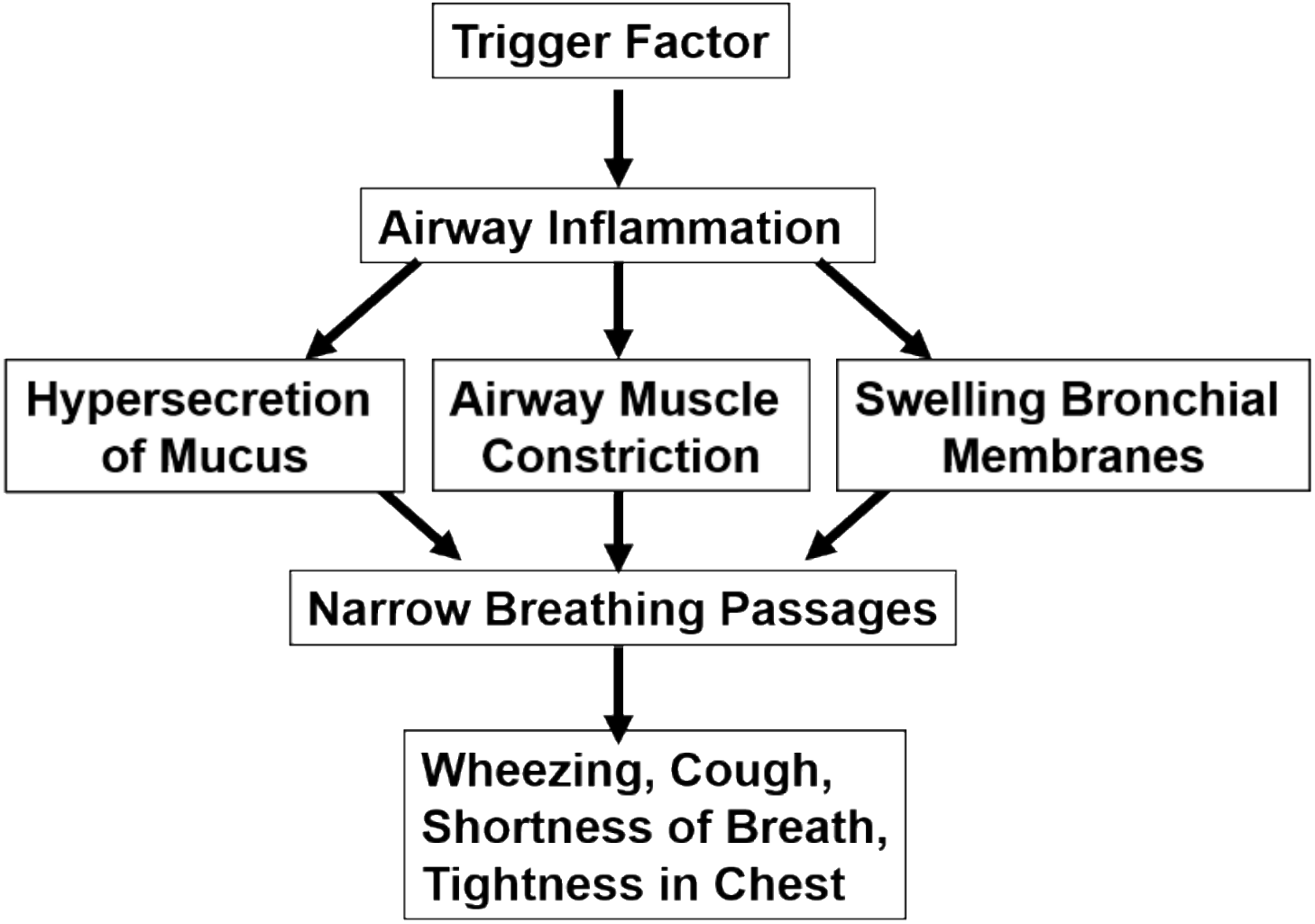
Reactive Airway Disease/Asthma



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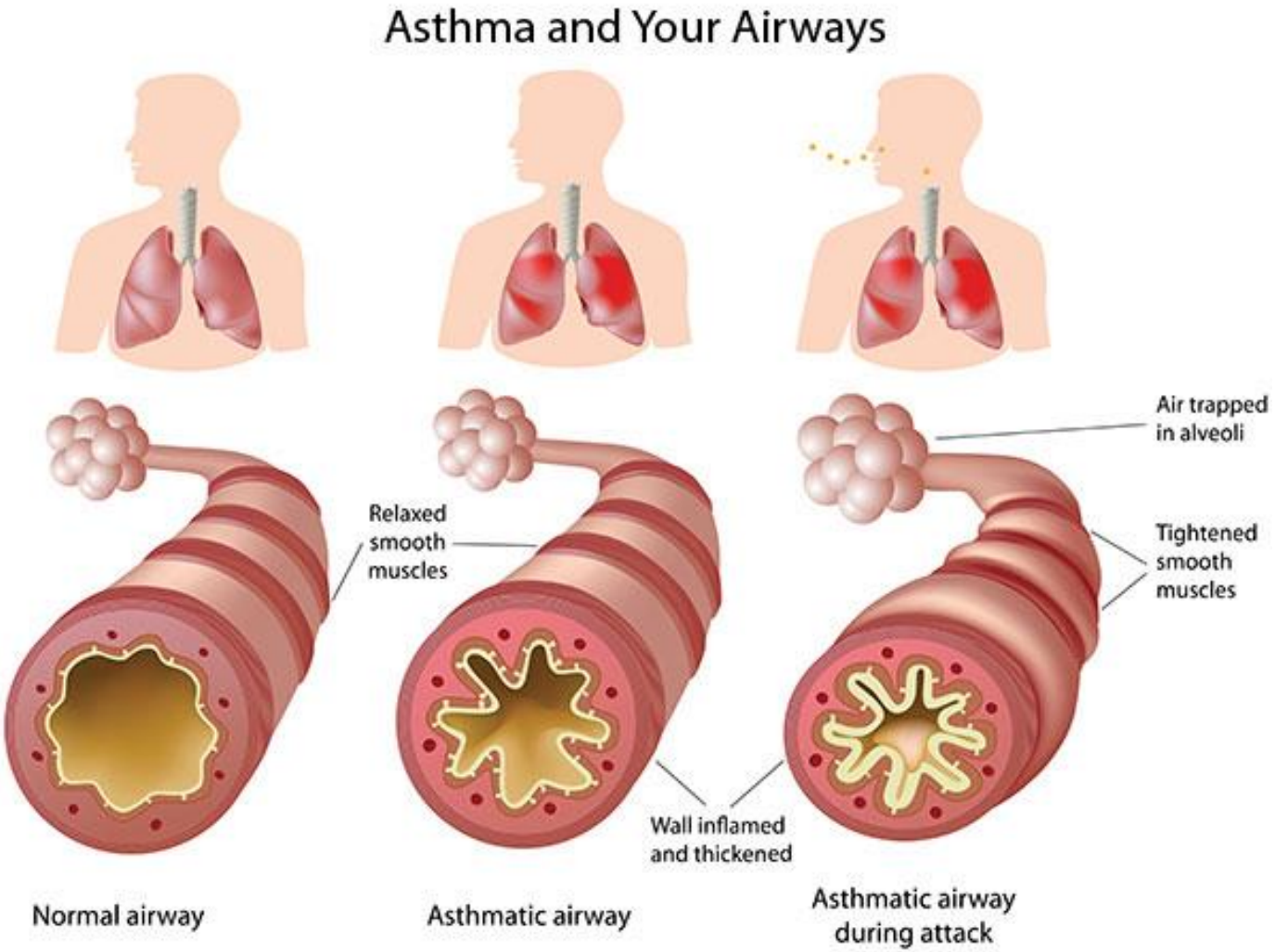
Reactive Airway Disease/Asthma



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Reactive Airway Disease/Asthma

Mild Exacerbation

- Normal alertness, slight tachypnea, expiratory wheezing only, a mildly prolonged expiratory phase, minimal accessory muscle use, and an oxygen saturation of >95%

Moderate Exacerbation

- Normal alertness, tachypnea, wheezing throughout expiration with or without inspiratory wheezing, more prolonged expiratory phase, significant use of accessory muscles, and an oxygen saturation that is typically 92-95%

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Reactive Airway Disease/Asthma

Severe Exacerbation

- Inability to repeat a short phrase, extreme tachypnea, inspiratory and expiratory wheezing, significantly prolonged expiratory phase, very poor aeration, significant use of accessory muscles, and an oxygen saturation that is typically below 92%

Signs of Impending Respiratory Failure

- Cyanosis, inability to maintain his/her respiratory effort, depressed mental status, SpO2 <90, and respiratory acidosis.

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Reactive Airway Disease/Asthma

EMERGENCY MEDICAL RESPONDER

- Routine Medical Care
- Allow/assist the patient to assume a position of comfort (usually upright)
- Oxygen: Per nasal cannula at 2-6 LPM or per non-rebreather at 10-15 LPM (depending on the apparent severity)
- Assist with patient-prescribed medications: If no nebulizer available **Albuterol Sulfate** MDI with spacer 2 Puffs, may repeat X 2
- Administer Nebulizer Therapy: **Albuterol Sulfate** 2.5mg in 3 ml administer with hand held nebulizer, mask or in-line nebulizer; If no improvement, may repeat albuterol X 2 if needed
- Assisted Ventilation: Consider assisting breathing with gentle synchronous ventilations with bag-valve mask (BVM); Support ventilation with BVM if apnea or hypopnea occurs
- Airway Adjuncts: If there is loss of consciousness, insert an oropharyngeal, nasopharyngeal, or advanced airway depending on presence of gag reflex refer to *Respiratory Distress Guidelines*

EMT

- Assist with patient-prescribed medications: If no nebulizer available **Albuterol Sulfate** MDI with spacer 2 Puffs, may repeat X 2
- Administer Nebulizer Therapy: **Albuterol Sulfate** 2.5mg in 3 ml with **Ipratropium Bromide (Atrovent)** 0.5mg in 2 ml administer per hand held nebulizer, mask or in-line nebulizer; May repeat albuterol X 2 additional doses
  ** If patient is under 3 years of age, do not use Ipratropium Bromide (Atrovent), use only Albuterol via HHN
- If in severe distress[1] and still alert, consider CPAP, see *CPAP Procedure*
- Status Asthmaticus(unresponsive to nebs, impending respiratory failure) **EPI-Pen(>66lbs/30kg)** IM (0.3mg) or **EPI-Pen Jr(<66lbs/30kg)** IM (0.15mg) to lateral mid-thigh for moderate or severe reactions). Hold in place for 10 seconds and massage area for 10 seconds after injection, if trained and credentialed.
- Alternative medical director approved epinephrine auto injectors may also be used.
- Drawn up epinephrine and syringe using above dosing only for departments with additional training to do so.

AEMT

- IV 0.9% NS @ KVO
- If signs of dehydration or hypovolemia are present, administer 500 ml boluses and check lung sounds

PARAMEDIC

- **Methylprednisolone (SoluMedrol)** 125 mg IV/IO/IM (peds dose 2mg/kg)
- Consider **Magnesium Sulfate** 2 gm (peds 25-50mg/kg) IV slowly (over 10 minutes)
- Consider low dose **Ketamine** for severe CPAP anxiety 0.25mg/kg IV/IO (max dose 25mg) or 0.5mg/kg IM (max dose 50mg), **Fentanyl** 50-100mcg IV/IO/IN/IM, or **Versed** 2mg IV/IO/IN/IM.
- RSA using **Ketamine** unless hypertensive or strong cardiac history dictates **Versed**
- For severe asthma or anaphylaxis, consider **Epinephrine** 0.3mg 1:1,000 IM
- For imminent respiratory arrest from asthma or anaphylaxis, consider **Push Dose 1:100,000 Epinephrine per section 5.42**

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Case review #2

3 YO with respiratory distress for 2 days with noisy breathing and retractions

- History of wheezing
- Not diagnosed with asthma
- Exposed to smoke recently
- Prescribed MDI Albuterol given by parents without effect

Your assessment reveals:

- Patient appears sleepy with severe respiratory distress
- Pulse 164, Respirations 24, Pulse ox at 91%
- Moderate retractions
- Breath sounds reveal minimal air on inspiration and no wheezing

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Case review #2 Discussion

1. Sick or not sick?
2. ABC's
3. Clinical assessment
4. Diagnosis?
5. Interventions
6. Reassessment

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Infectious Etiology

- Bronchiolitis
- Croup
- Pneumonia

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Case review #3

9 month old with nasal congestion and cough for 3 days, now with worsening respiratory distress, and low fluid intake.

History

- Patient's sister was ill last week with upper respiratory symptoms
- Patient was born 5 weeks premature

Assessment

- Alert, feels warm to the touch
- Decreased urine output according to mom
- Irritable
- Appears to be in moderate respiratory distress

Pulse 170, Respirations 60, Pulse ox at 92%

- Dry mucus membrane
- Severe nasal congestion and coughing
- Moderate retraction
- Auscultation reveals rhonchi and moderate air movement on inspiration

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Case review #3 discussion

1. Sick or not sick?
2. ABC's
3. Clinical assessment
4. Diagnosis?
5. Interventions
6. Reassessment

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Bronchiolitis

- Lower respiratory tract infection that primarily affects the small airways (bronchioles)
- Most commonly affects children <2
- Most commonly is caused by a virus
- Fever, cough, and respiratory distress (increased respiratory rate, retractions, wheezing, crackles)
- Usually preceded by 1-3 days of upper respiratory symptoms (nasal congestion)

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Bronchiolitis

- Bronchodilators - Not Recommended, unless severe
- Nebulized hypertonic saline - Not Recommended
- Glucocorticoids - Not Recommended
- Nasal suctioning
- Supplemental oxygen to keep SpO2 >90-92%
- +/- Fluids depending on patient status

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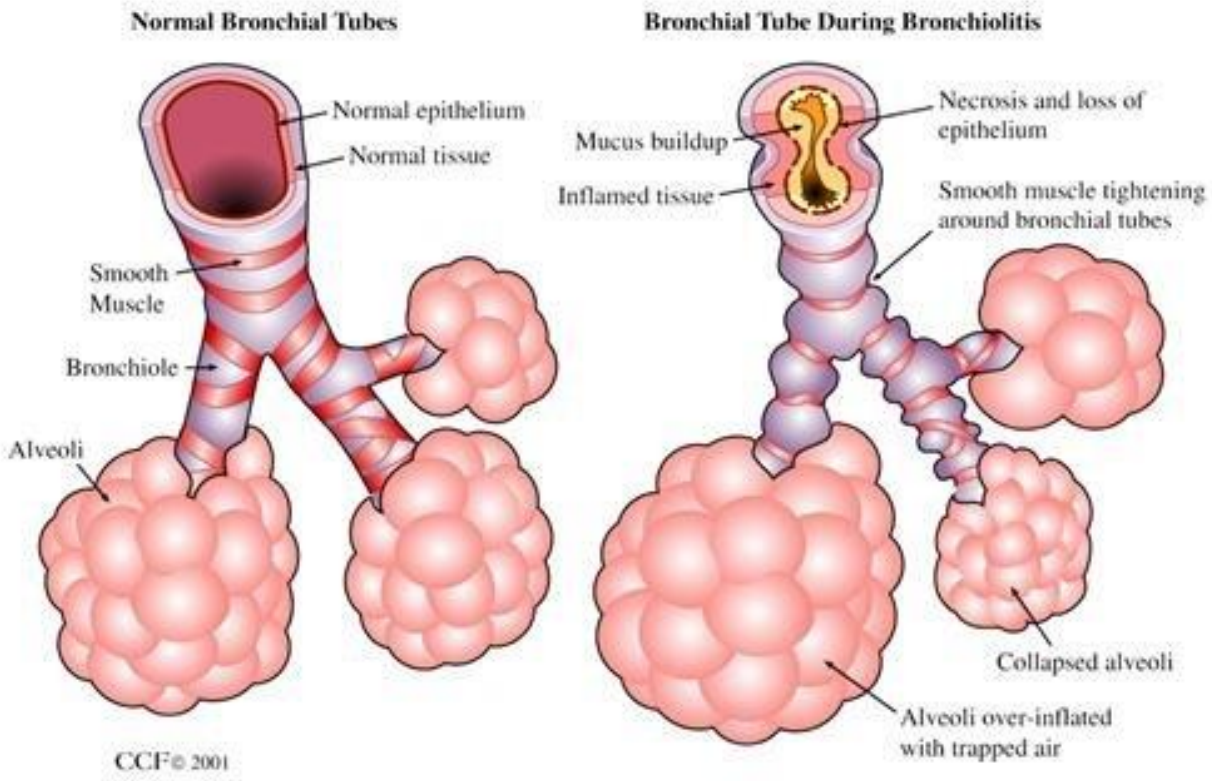
Bronchiolitis Pathophysiology



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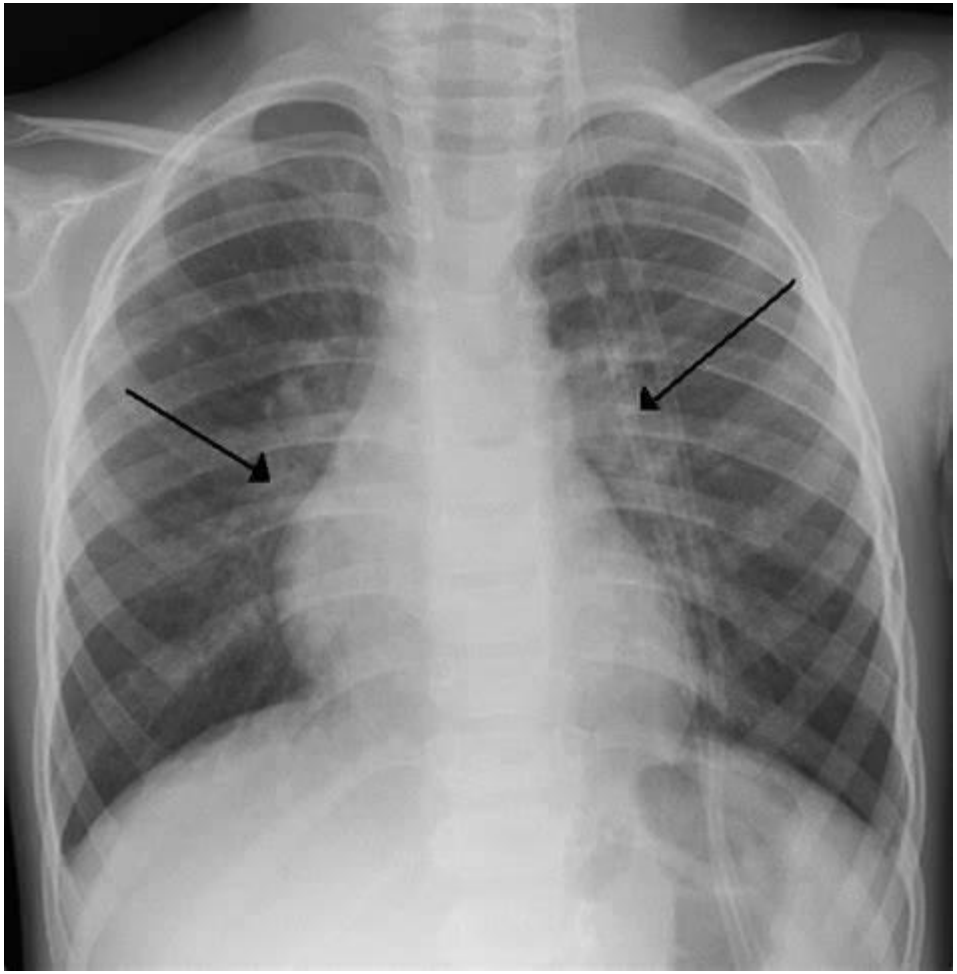
Chest X-ray showing bronchiolitis



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Case review #4

2.5 year old with 2 days of URI now with fever, barky cough and respiratory distress

History:

- Woke up with stridor and barky cough
- Fever for 2 days
- Vomited with coughing

Assessment:

Alert irritable and in moderate distress •

Pulse 180, Respirations 60, Pulse ox at 96%

Auscultation reveals inspiratory stridor

Severe retractions

Occasional barky cough

Air entry adequate

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Case review #4 discussion

1. Sick or not sick?
2. ABC's
3. Clinical assessment
4. Diagnosis?
5. Interventions
6. Reassessment

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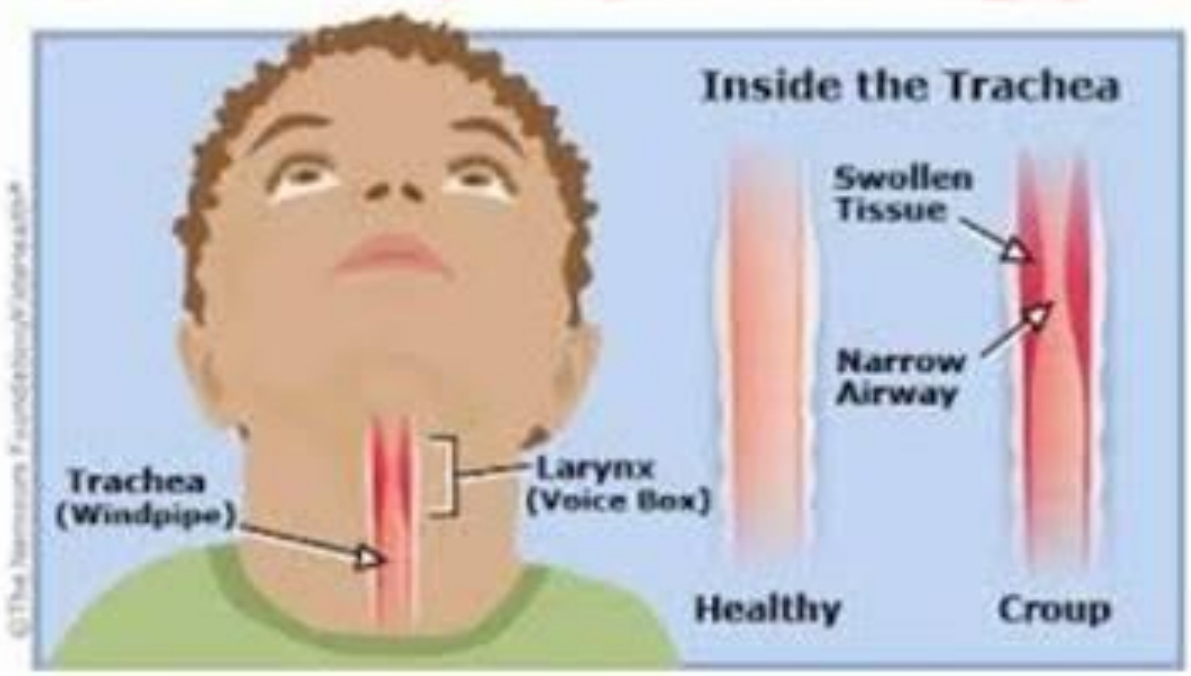
Croup

- Most commonly occurs in children 6 months to 3 years of age
- Most cases occur in fall or early winter
- Most commonly a viral etiology
- Begins with nasal discharge, congestion, and cold symptoms, then progresses to fever, hoarseness, barking cough, and stridor
- Maybe mild tachypnea and prolonged inspiratory phase
- Difficulty swallowing, drooling, and throat pain may be an indication that something more concerning is going on

pathophysiology



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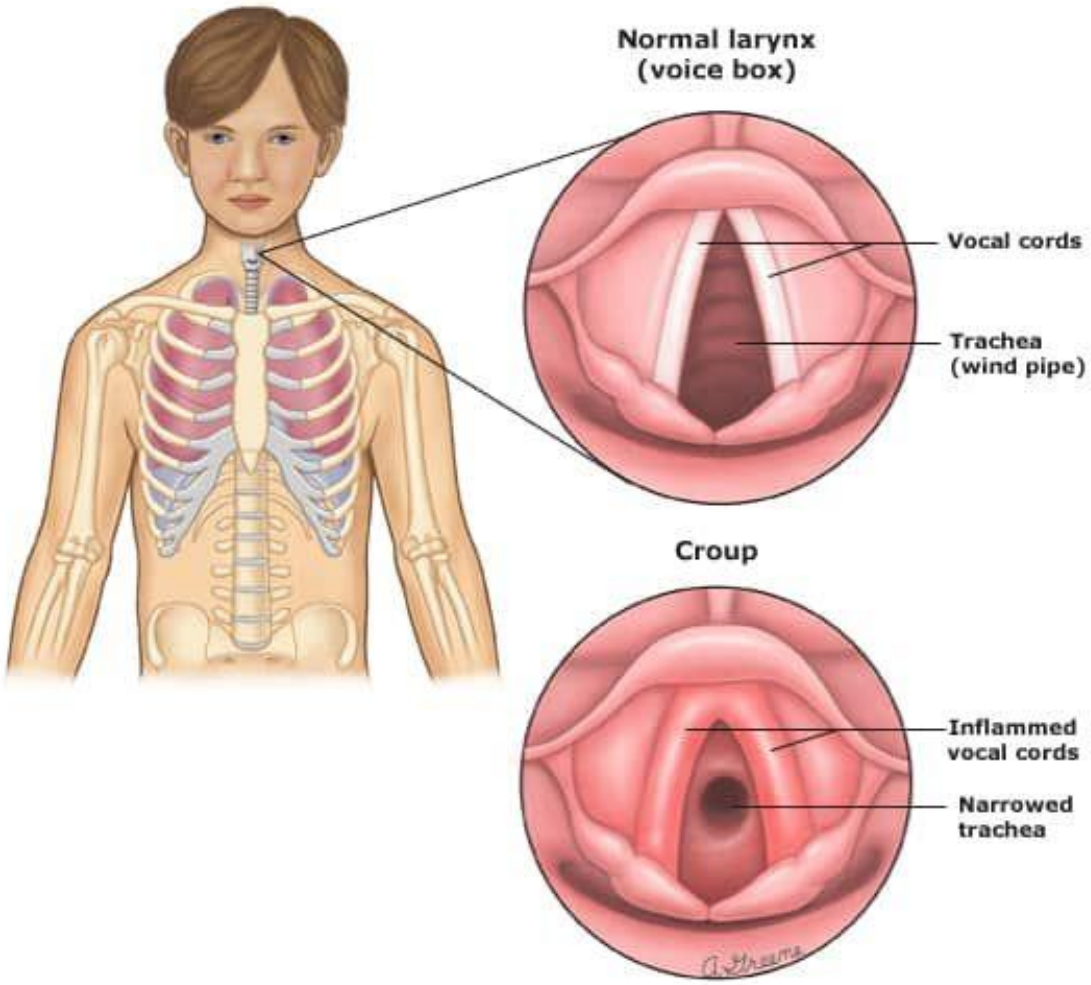

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Croup treatment

- Rapid assessment is necessary to identify children with severe respiratory distress and/or impending respiratory failure
- Children who exhibit severe respiratory distress require immediate pharmacologic treatment with nebulized epinephrine, corticosteroids, and respiratory support
- The child's hydration status should also be assessed and treatment
- +/- Humidified air
- Supplemental oxygen to maintain the SpO2 >/=92%

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Case review #5

5 year old presenting with SOB and a fever

History:

- Chest pain, fever for the past 2 days and today started with difficulty breathing and shortness of breath
- Goes to school and daycare

Assessment:

- Appears sluggish and sleepy
- Dry mucous membranes
- Warm to the touch
- Pulse 130, Respirations 50, Pulse ox 91%

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Case review #5 discussion:

1. Sick or not sick?
2. ABC's
3. Clinical assessment
4. Diagnosis?
5. Interventions
6. Reassessment

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Pneumonia

- The presenting signs and symptoms are non-specific; no single symptom or sign is pathognomonic for pneumonia in children
- Neonate and young infants may present with difficulty feeding, restlessness, or fusiness
- Neonates, young infants, and young children may present only with fever and leukocytosis
- Older children and adolescents may complaint of pleuritic chest pain

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Pneumonia

Severity of community-acquired pneumonia in infants and children

Clinical features of mild pneumonia	Clinical features of severe pneumonia
Temperature <38.5°C (101.3°F)	Temperature ≥38.5°C (101.3°F)
Mild or absent respiratory distress: ▪ Increased RR, but less than the age-specific RR that defines moderate to severe respiratory distress ▪ Mild or absent retractions ▪ No grunting ▪ No nasal flaring ▪ No apnea ▪ Mild shortness of breath	Moderate to severe respiratory distress: ▪ RR >70 breaths/minute for infants; RR >50 breaths/minute for older children ▪ Moderate/severe suprasternal, intercostal, or subcostal retractions (<12 months) ▪ Severe difficulty breathing (≥12 months) ▪ Grunting ▪ Nasal flaring ▪ Apnea ▪ Significant shortness of breath
Normal color	Cyanosis
Normal mental status	Altered mental status
Normoxemia (oxygen saturation ≥92 percent in room air)	Hypoxemia (sustained oxygen saturation <90 percent in room air at sea level)
Normal feeding (infants); no vomiting	Not feeding (infants) or signs of dehydration (older children)
Normal heart rate	Tachycardia
Capillary refill <2 seconds	Capillary refill ≥2 seconds

RR: respiratory rate.

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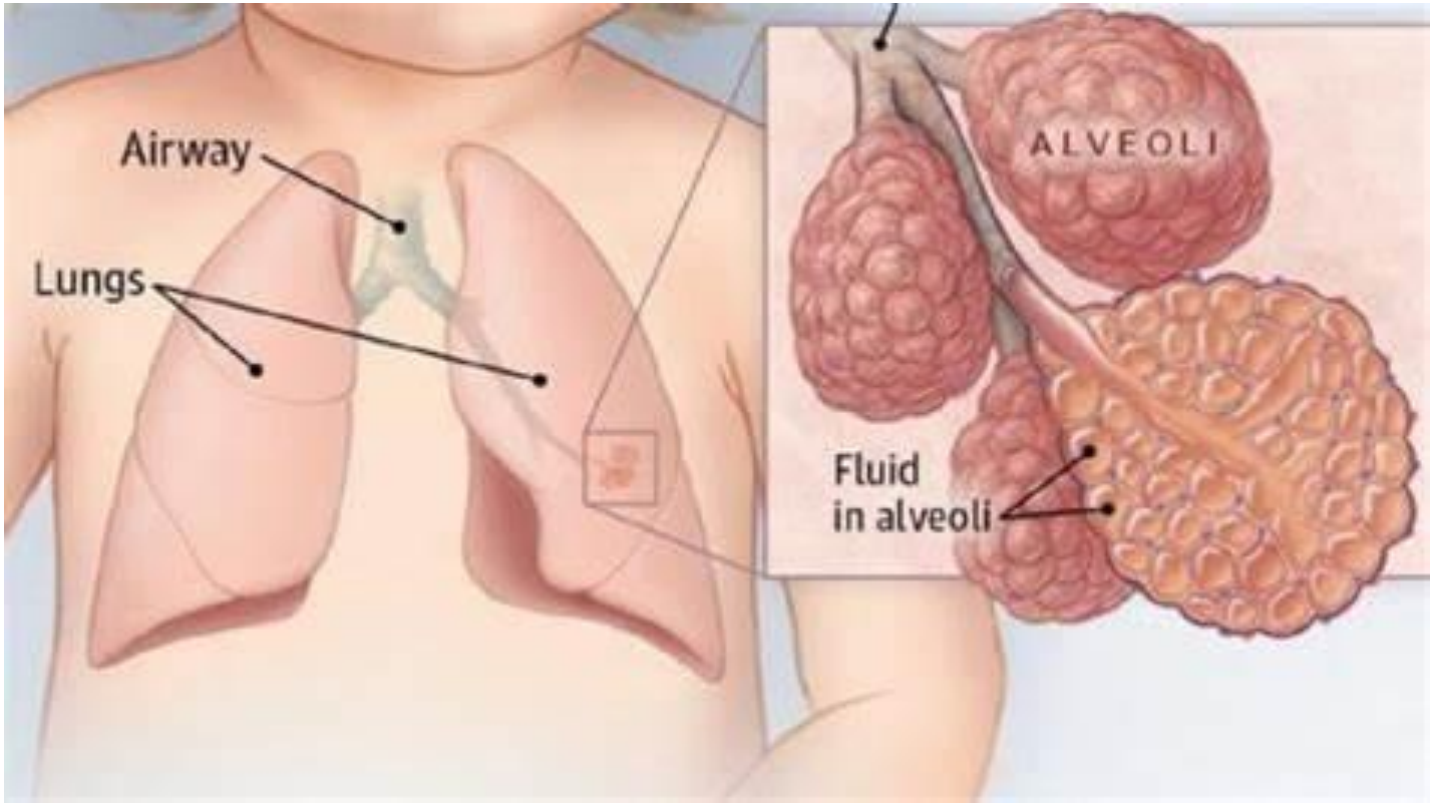

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Case review #6

18 month old with sudden onset of respiratory distress with stridor

History:

- Otherwise healthy toddler
- Mom heard gagging and choking from playroom
- Turned blue when mom found him
- Moderate respiratory distress

Assessment:

- Alert
- Audible stridor
- Pulse 192 Respirations 28 Pulse ox at 88%
- Severe retraction with minimal air entry

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Case review #6 discussion:

1. Sick or not sick?
2. ABC's
3. Clinical assessment
4. Diagnosis?
5. Interventions
6. Reassessment

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Foreign Body Ingestion

- Foreign body aspiration is a common cause of mortality and morbidity in children, especially in those younger than 2 years of age
- Most aspirated foreign bodies make it into the bronchi
- Presentation depends on degree of airway blockage and the location of the object, as well as the age of the child, type of object aspirated, and elapsed time since the event
- A witnessed episode of choking, defined as the sudden onset of cough and/or dyspnea and/or cyanosis in a previously healthy child, has a sensitivity of 76 to 92 percent for the diagnosis

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Foreign Body Ingestion

Location of the foreign body

- Laryngotracheal: Life-threatening; acute respiratory distress, stridor, wheezing, salivation, dyspnea, and voice changes
- Large bronchi: Coughing and wheezing are the most common symptoms, but respiratory distress, shortness of breath hemoptysis, dyspnea, choking, decreased breath sounds, fever, and cyanosis may also occur
- Lower airways: May have no symptoms after the initial choking episode

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Treatment of foreign body ingestion

- Supportive care
- If not moving any air, back blows / chest or abdominal thrusts
- Remove foreign body, if visible
- Transport as soon as possible

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RSA Review

RSA GUIDELINE (must be two qualified RSA providers at patient's side) [2]

- Indications:
  - Severe respiratory distress or failure
  - Persistent hypoxia after high-flow O_2
  - Airway management in a combative patient
  - Altered mental status with need to protect/secure airway
  - Airway compromise

- Absolute Contraindications:
  - Known allergy to RSA medications(use available alternatives)
  - Suspected epiglottitis

- Relative Contraindications (intubation should be considered high risk and reserved for those with inability to be ventilated with other means):
  - Severe oral, mandibular, or anterior neck trauma
  - Anatomic abnormalities that increase the risk of failed intubation
  - Pediatrics and bariatrics

- Prepare:
  - Wide open flowing IV/IO (IM Medications have slower onset and are emergency backup only)
  - Organize equipment, functional suction, etCO2 for waveform capnography, cardiac monitor, Bougie, video assist device, back up airway, and surgical airway
  - Select and prepare ET tube/stylet
  - Draw up RSA medications
  - Fluid bolus if hypotensive
  - If unresponsive to fluid bolus refer to section **5.42 Push Dose Pressors** to increase pre-intubation SBP>90

- Pre-Oxygenate:
  - Continuous SPO_2 and cardiac monitoring required
  - High-flow oxygen for 3-5 minutes prior to intubation or 8 vital capacity breaths
  - High flow oxygen should be provided via NC(15lpm) or NRB/BVM(25lpm)
  - Continuous high-flow oxygen via NC during entire procedure will reduce desaturation
  - If persistent hypoxia, consider using BVM with basic airway adjunct in addition to NC with PEEP valve attached to BVM.
  - Pre-oxygenation is not just about increasing O2 sat but also allowing time for the nitrogen in the lungs to be replaced with Oxygen, also prolonging the period before desaturation.

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RSA Review

- Protect and Position:
  - Position the head and neck for intubation
  - Place towels behind the back of pediatric patients to improve visualization
  - Use towels blankets to ramp up bariatric patients to improve visualization
  - Manual c-spine stabilization in trauma patients

- Pre-paralysis Sedation/Induction:
  - Give **Ketamine** 2 mg/kg IV/IO (max dose 200mg), or 5 mg/kg IM (max dose 500mg)
  - For patients with concern of cardiac ischemia, avoid **Ketamine** and use **Midazolam (Versed)** 0.1mg/kg(max 5mg bolus) IV/IO, or 0.2mg/kg(max 10mg bolus) IM.
  - **Etomidate** 0.3mg/kg IV/IO(max dose 40mg) may be used instead of **Ketamine** or **Versed.** Do not repeat any administration of **Etomidate** after initial sedation, use other agents for analgesia and sedation.

- Paralyze **(only after sufficient sedation/induction and 2 RSA trained providers at bed side [2]):**
  - **Succinylcholine Chloride (Anectine)** 2 mg/kg IV/IO/IM max 200 mg
    - **IM Succinylcholine has unreliable absorption and is only to be used in event of IV/IO failures**
  - Do not repeat dose for long term paralysis after intubation. If repeat dose of **Succinylcholine Chloride (Anectine)** is required for RSA, have **Atropine** available for bradycardia potential, use ACLS guidelines.

- Placement:
  - Insert the ETT until the cuff passes the vocal cords
    - Make only one (1) attempt [3]
    - If unsuccessful, proceed to the Difficult Airway Procedure below
  - Inflate the cuff
  - Immediately verify by viewing capnography waveform and print for verification
  - A waveform should be visible with each breath, if not assume intubation attempt was not successful
  - Auscultate bilateral breath sounds, negative gastric inflation, and equal chest rise
  - Check for condensation in the tube
  - Monitor SpO_2
  - Secure ET tube with commercial holding device, noting depth of tube placement

- Post-Intubation Management:
  - Secure ETT and place c-collar to reduce motion
  - Monitor vitals for tachycardia and hypertension, as the paralysis will outlast the sedation. Provide sedation and/or pain management per guideline.
  - ***DO NOT*** re-paralyze under the age of 5 yrs
  - Goal is to maintain SpO_2 95-99% and etCO2 35-45mm Hg
    - Acidotic patients(DKA, ASA/TCA tox, severe sepsis, crush) etCO2 goal is closer to 30mm Hg
  - **Vecuronium Bromide (Norcuron)** 0.1 mg/kg IV/IO max of 10 mg
    or
    Rocuronium Bromide (Zemuron) 1mg/kg IV/IO max of 100mg
  - Provide adequate sedation with ½ doses of initial sedation drug every 10 minutes as necessary. Long term paralysis may be unnecessary if adequately sedated and soft restraints utilized. Monitor vitals, as adjustment in sedation drugs may be necessary. If hypotensive, use **Ketamine** or **Fentanyl.** If possibility of ongoing seizures, use **Versed.**
  - If bradycardic, ensure adequate ventilation and recheck tube placement, see *Bradycardic Guidelines*
  - Place NG/OG for gastric decompression if trained
  - Services using ventilators will require ventilator specific training
  - Monitor closely for signs of pneumothorax
  - Utilize PEEP valve 5-10mm Hg if needed to maintain oxygen saturations, monitor blood pressure.

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RSA Review

- Removing the ETT in the field
  - In general, an ETT should not be removed in the field unless the below indications are met:
    - The patient wakes up, can maintain their own airway, and medical indication for intubation has been resolved
    - The ETT is not performing adequately
  - Procedure for removing an ETT
    - Place the patient in the recovery position (left side)
    - Deflate cuff and remove tube
    - Be prepared to suction the pharynx
  - Continue to monitor and re-assess the patient

- Difficult Airway Procedure
  - If rescuer cannot intubate the trachea after one attempt, a second attempt at intubation may be attempted. Ventilate between attempts. If the patient is unable to be ventilated or is hypoxic proceed directly to non-visualized airway. Utilize bougie, alternative visualization device, or additional bedside Paramedic to maximize chance of success.
  - **Failed Intubation:** If the second attempt to intubate is unsuccessful, proceed immediately to a non-visualized airway.
  - If the non-visualized airway fails consider the following options:
    - Let the succinylcholine wear off, while ventilating the patient with basic adjuncts
    - Consider a surgical airway bougie cricothyroidotomy[age>12], transtracheal jet ventilation, or Rüsch QuickTrach®

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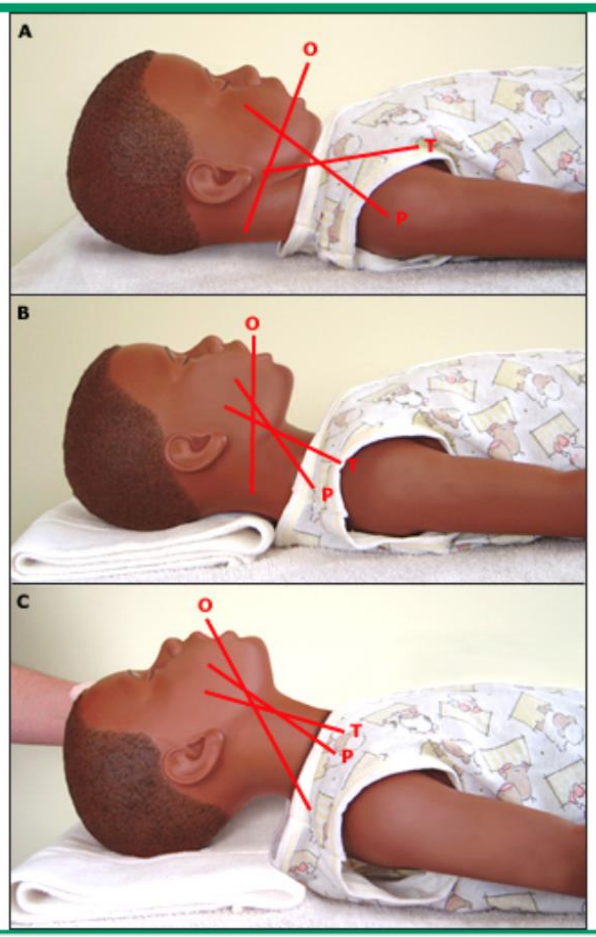
Pediatric Airway Positioning

Proper positioning for ventilation and intubation for children older than two years of age



(A) The oral (O), tracheal (T), and pharyngeal (P) axes are in divergent planes.
(B) A towel under the occiput brings the external auditory canal anterior to the shoulder, aligning the T and P axes.
(C) The extension of the head on the neck, with the mouth and nose facing the ceiling, aligns the O axis with the T and P axes.

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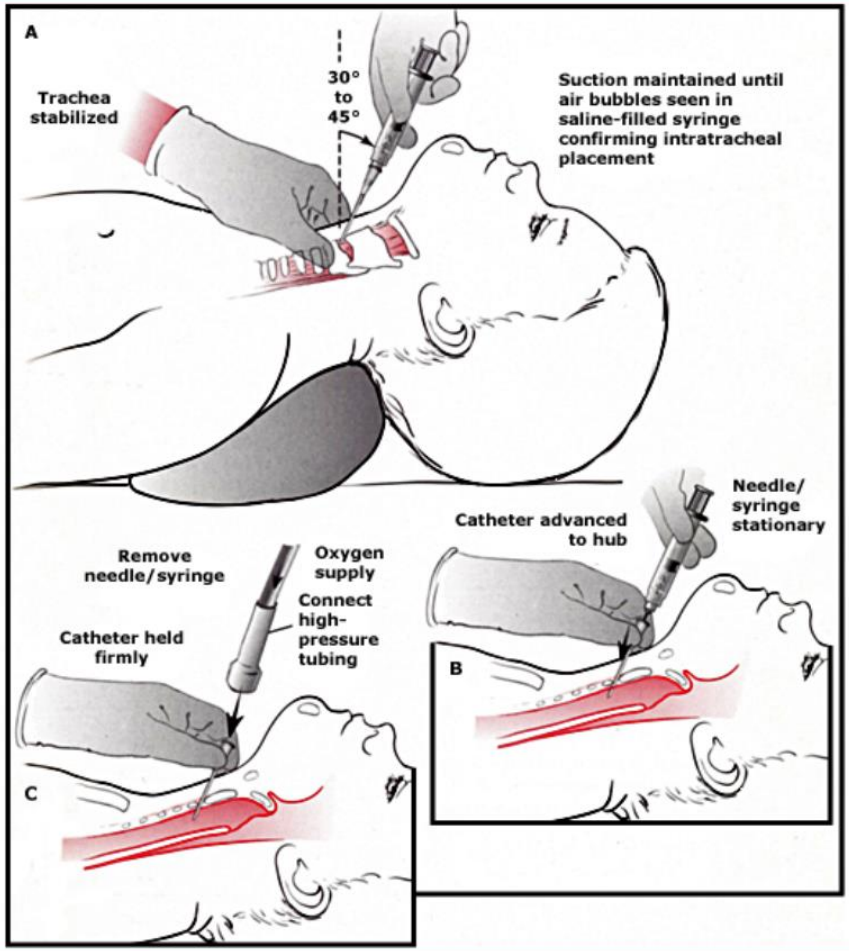
Needle Cricothyroidotomy

Needle cricothyroidotomy



Performing needle cricothyroidotomy:
(A) The needle is angled caudally at 30 to 45 degrees and inserted through the cricothyroid membrane until bubbles are seen in the fluid-filled syringe, indicating puncture of the trachea.
(B) The catheter is advanced to the hub as the needle and syringe are removed.
(C) The catheter is secured in place and connected to the oxygen delivery system.

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THANK YOU!

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