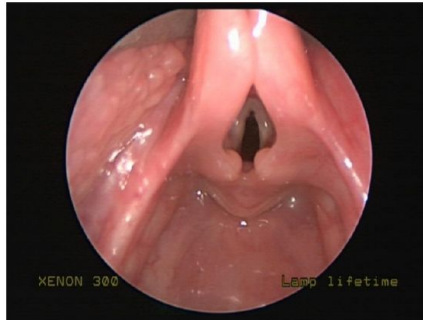


Noisy Breathing in Children

New Mexico Medical Society

Aug 17, 2023



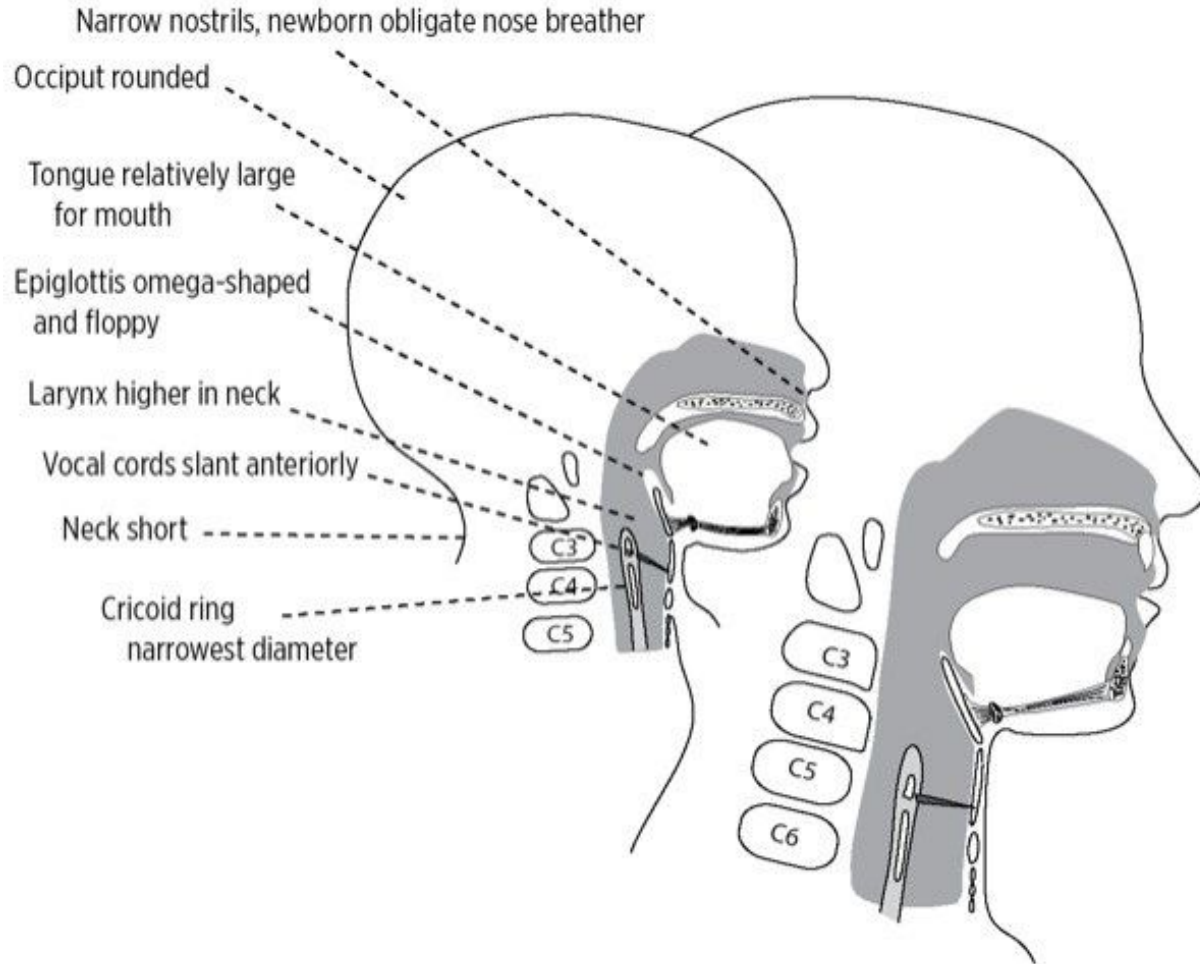
Karen Hawley, MD

Associate Professor - Pediatric Otolaryngology Head and Neck Surgery
University of New Mexico - Department of Surgery

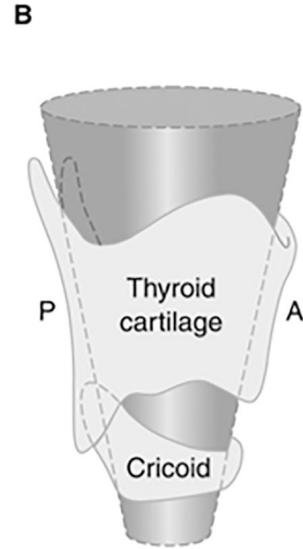
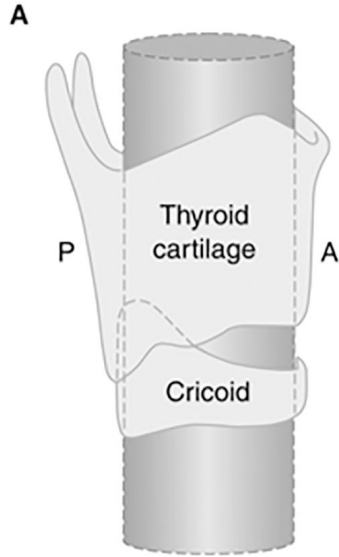
Outline

- Anatomy - pediatric and adult
- Ddx of noisy breathing in infants - children/adolescents
- Work up - fine tuning your exam and history
- Management
- When to refer to ENT

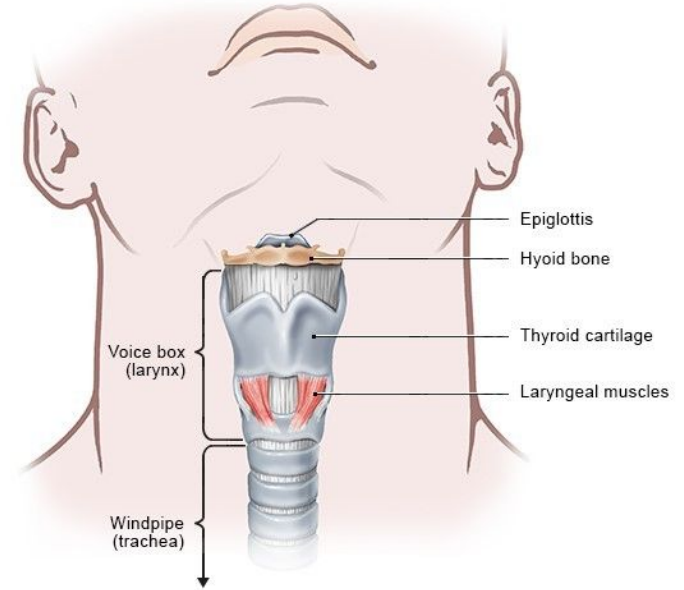
Anatomy

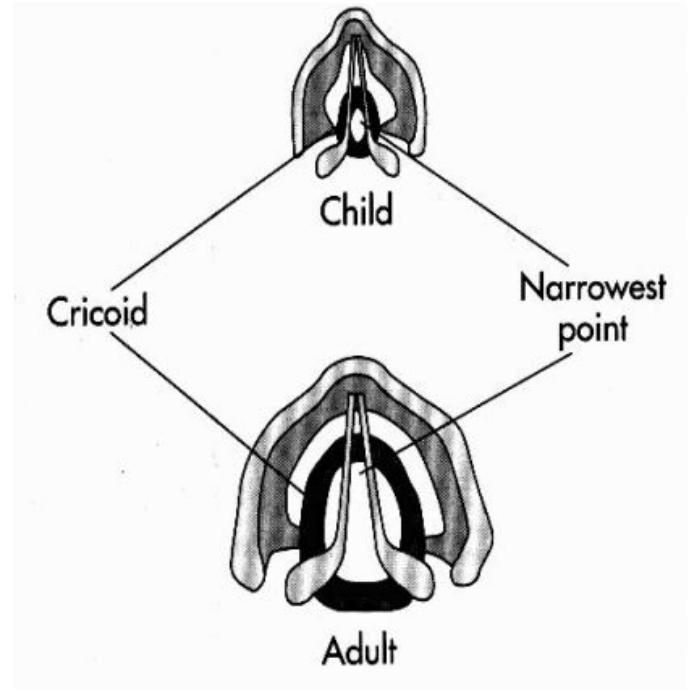
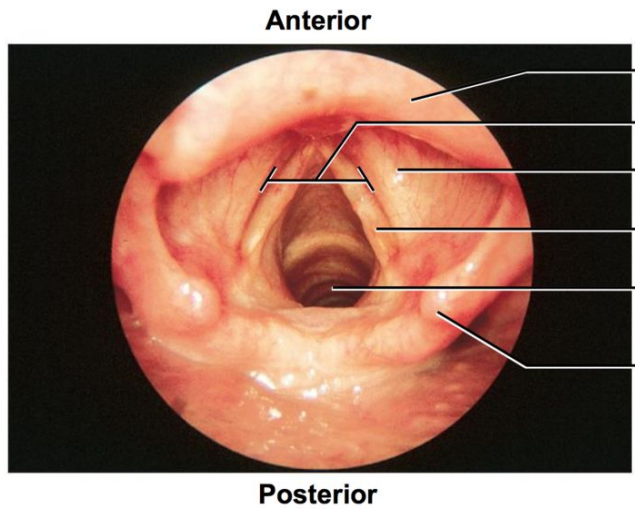


Anatomy



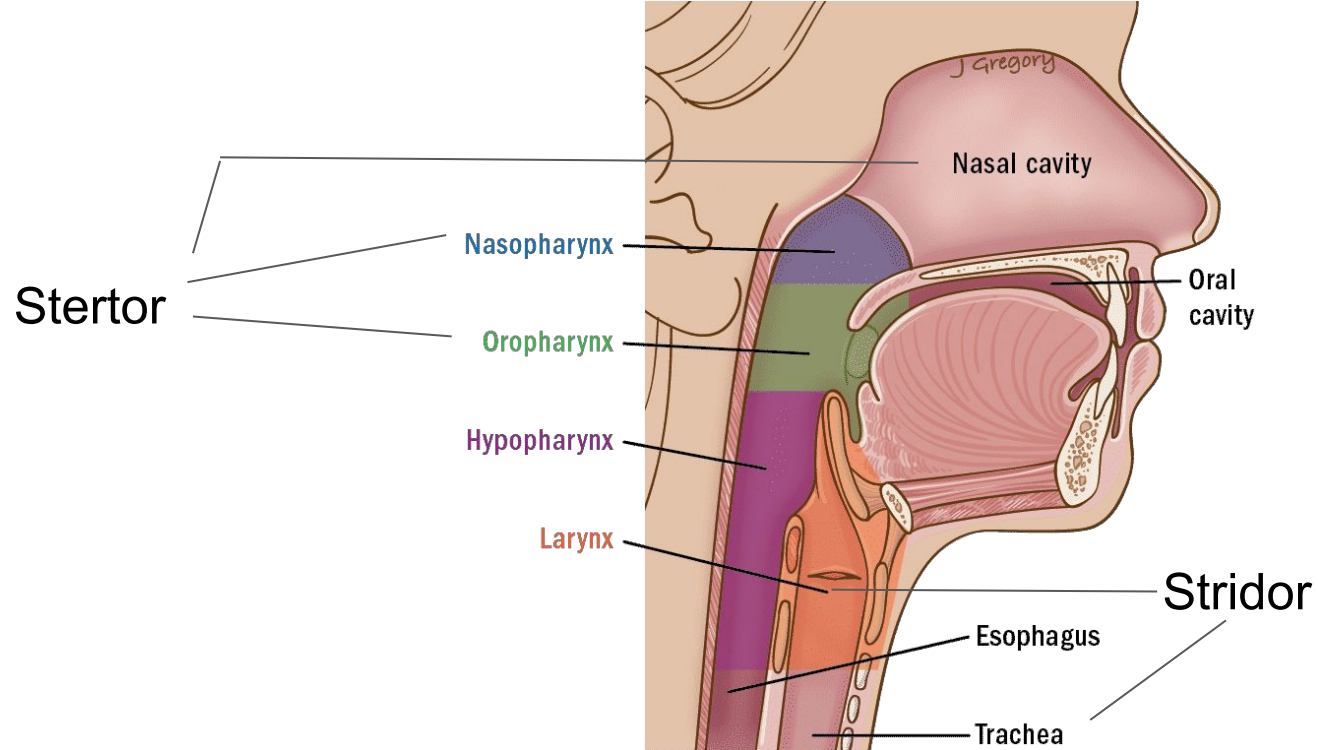
8-12 years of age



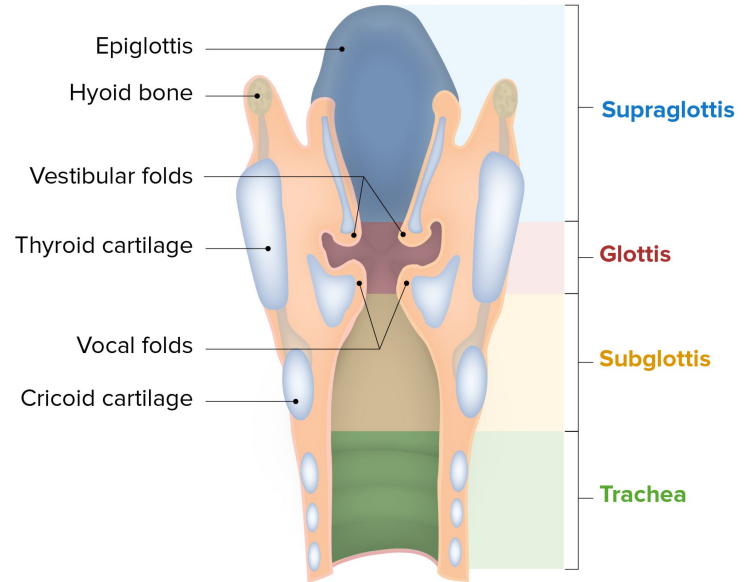
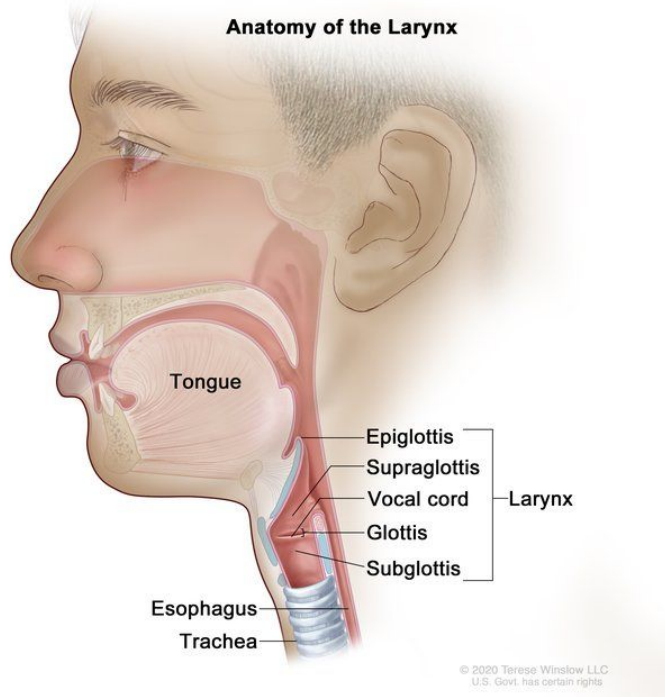


	Normal	Edema 1 mm	Resistance ($R \propto \frac{1}{\text{radius}^4}$)	X-sect area
Infant			↑ 16×	↓ 75%
Adult			↑ 3×	↓ 44%

Levels of the Airway and Noisy Breathing



Levels of the Airway and Noisy Breathing



Levels of the airway and stridor

- Inspiratory

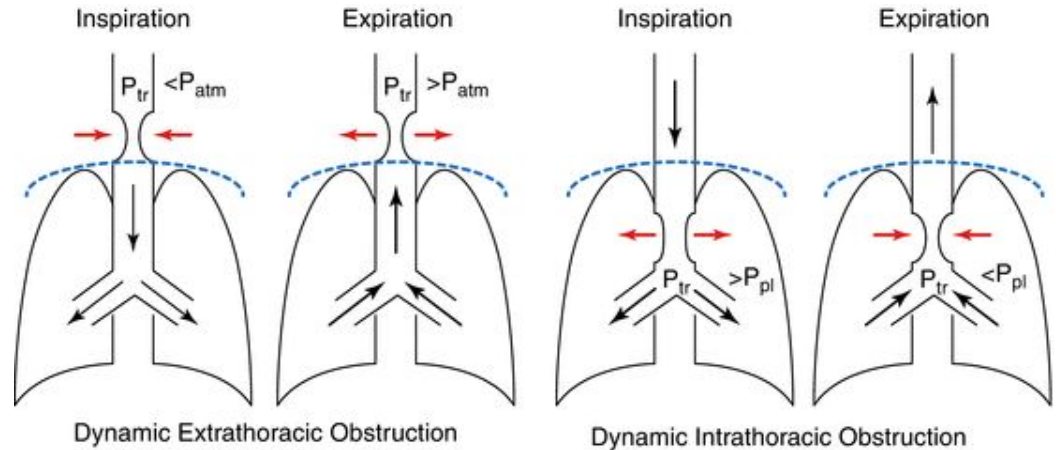
- Extrathoracic
- Supraglottic
- Glottic
- Upper Trachea

- Expiratory

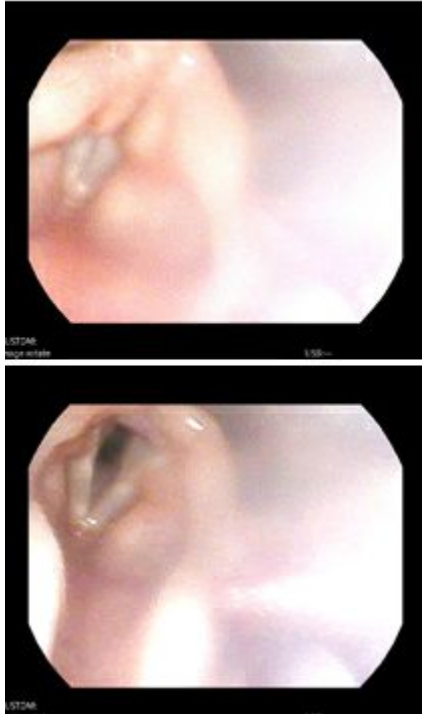
- Intrathoracic
- Expiratory Stridor \rightleftharpoons Wheeze

- Biphasic

- Fixed
- Glottis or below



Flexible Nasolaryngoscopy



Microlaryngoscopy with Rigid Bronchoscopy

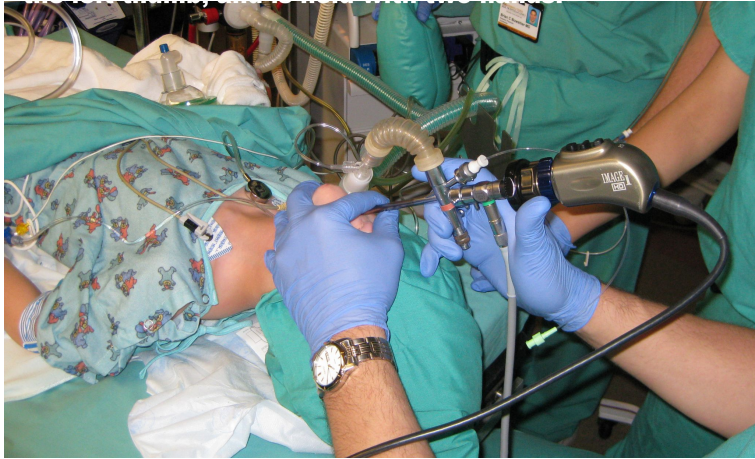


Image 1



Image 2



Image 3

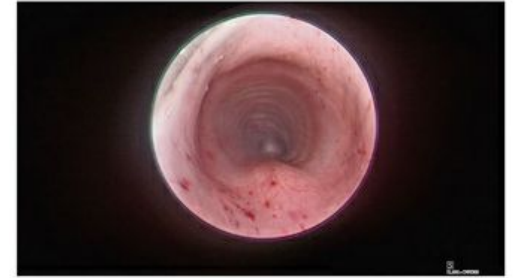
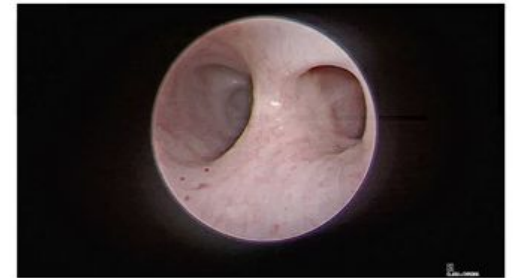
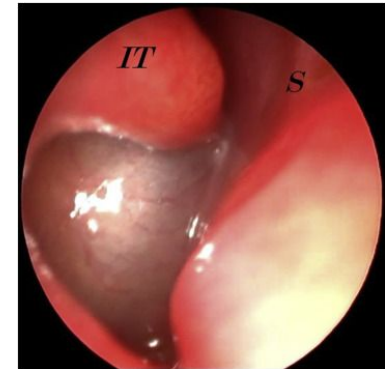


Image 4



Infants - Stertor - Nasal Cavity/Nasopharynx

- Common - inflammation
 - Reflux/CMA - worsens during/after feeds, when supine.
 - Infectious - fever or other signs up upper/lower respiratory disease
 - Neonatal rhinitis - NOS
- Rare - CONSTANT
 - Midface hypoplasia (syndromic)*
 - Choanal atresia (UL/BL*)
 - Pyriform aperture stenosis*
 - Congenital masses*
 - NLDC
 - Glioma/Meningioma/Encephalocele

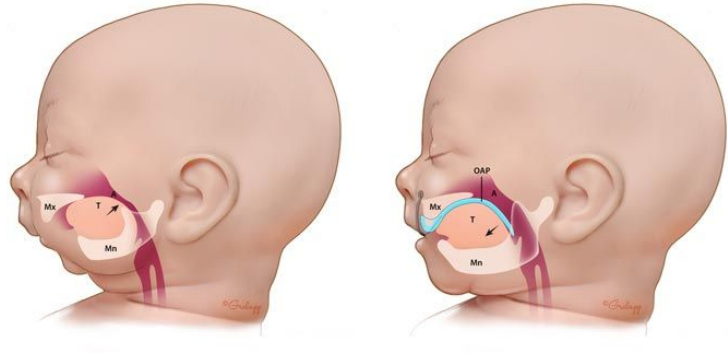


Salvatore et al. GERD and cow milk allergy: is there a link? *Pediatrics*. 2002. 110(5):972-84

* Diagnosed at birth

Infants - Stertor - Oral Cavity/Oropharynx

- Micrognathia
 - Alveolar ridge
- Cleft palate (submucous)
- Vallecular cyst
- Ankyloglossia*
 - Aerophagia/feeding difficulties
- Poor tone
 - Other neurologic signs?
 - Poor feeding



Infant - Stertor - Common things being common

- Thorough history and exam
- Consider managing reflux medically
- Medical management of rhinitis
 - Saline/suction
 - Neosynephrine: 2 drops BID x 3 days*
 - Dexamethasone ophth: 2 drops TID until improvement (4-6 weeks)

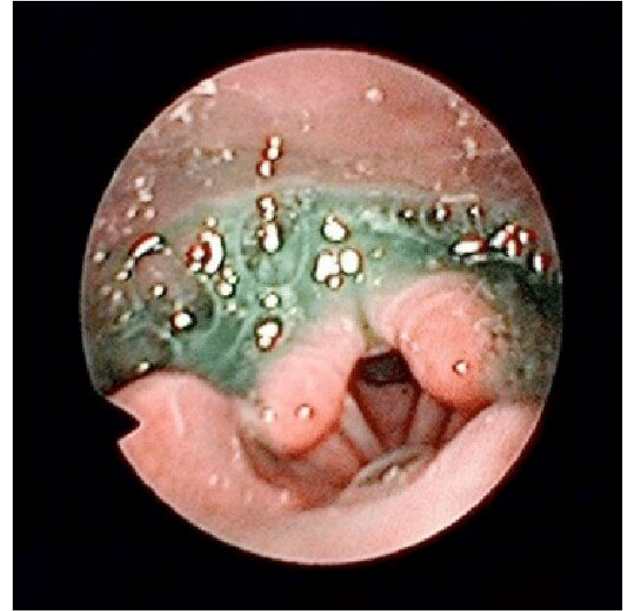


Need to refer

- Consistent unilateral nasal obstruction
- Epistaxis (after ruling out nasal aspirator abuse)
- Difficulty feeding/gaining weight (can frequently start with an SLP referral)
- Failure of conservative management/never clears with saline/suction
- Associated obstructive apneas (generally will be with feeding/supine)
- True signs of respiratory distress (with or without feeding difficulty/failure to thrive) should go to ED/urgent care

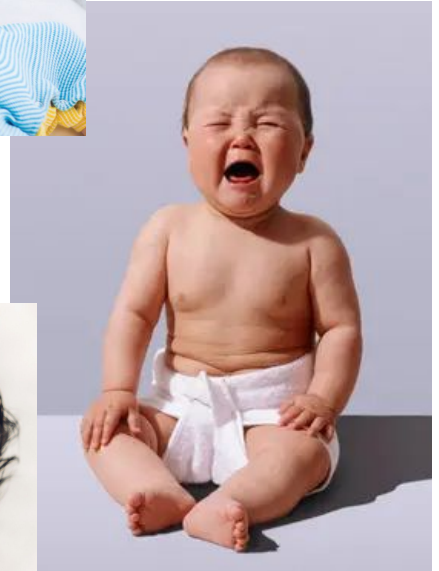
UNM Pediatric Speech Language Pathology

- In clinic with pediatric otolaryngology faculty
- Clinical feeding exam
- Flexible laryngoscopy
- FEES (Fiberoptic endoscopic evaluation of swallowing)



Infants - Stridor - Inspiratory

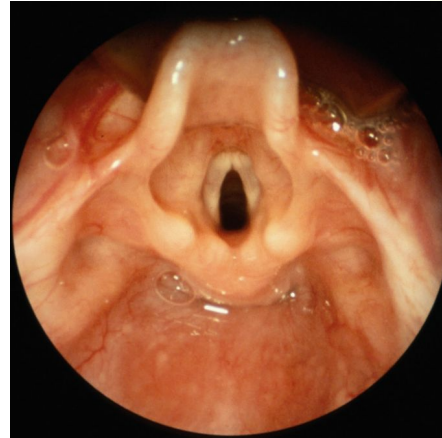
- Supraglottic
 - Laryngomalacia**
 - Papillomatosis (HPV)
- Glottic^
 - Paradoxical vocal fold mobility*
 - Vocal cord paralysis
 - Bilateral vs unilateral
 - Laryngeal web/congenital cyst
 - Papillomatosis (HPV)
- Subglottic
 - Stenosis (congenital or acquired)
 - Cyst
 - Hemangioma
 - Papillomatosis (HPV)



Laryngomalacia

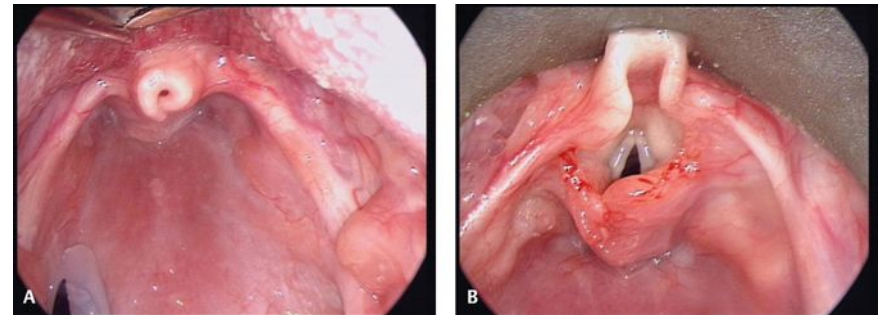
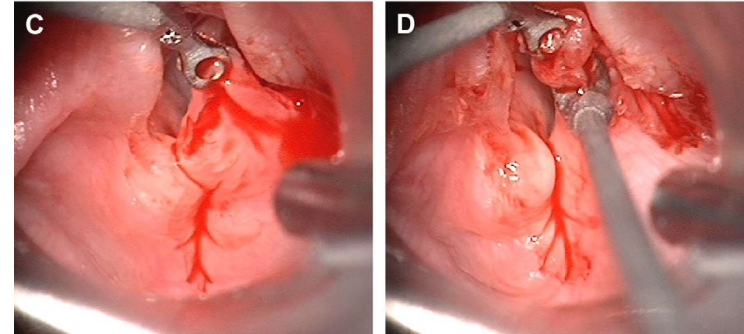
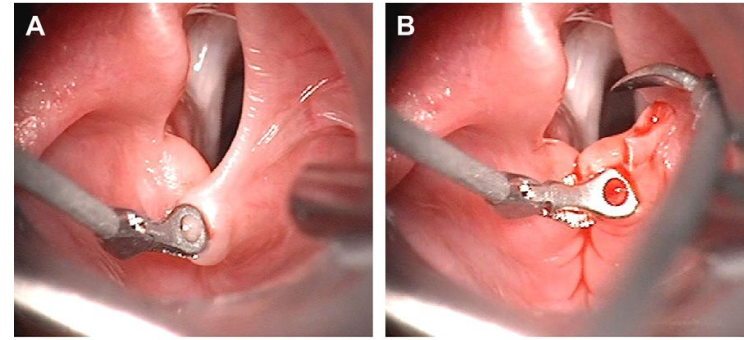
- History
 - **Inspiratory stridor within 2 weeks of life**
 - Sounds a bit more “wet”
 - Generally intermittent
 - Difficulty feeding/aspiration
 - **Resolves between 6-18 months of age**
- Cause
 - Neuromuscular hypotonia / sensorimotor integration
- Work up
 - Rule out other causes of stridor*
 - Feeding assessment
- Management
 - Time
 - Reflux?
 - Surgery

<https://youtu.be/IYHg--J1iKw>



Supraglottoplasty

- Red flag symptoms
 - Poor weight gain
 - Difficulty feeding/aspiration
 - Increased caloric expenditure
 - Apneas - cyanosis/desaturations
 - Not “happy noisy”
- Overnight stay in hospital
- Stridor will often persist!
- Revision rate: 5-40%
 - Higher in infants < 2 months of age or other comorbid conditions



Paradoxical vocal cord mobility

- “Vocal cord dysfunction” or “ILO - Inducible laryngeal obstruction”
 - More commonly refers to adolescents/adults
- Refers to adduction of the vocal cords upon inspiration
- Hallmark history
 - Almost always associated with feeding
 - Comes and goes quite quickly
 - Never really present at rest/sleeping
 - Can have associated laryngospasm - short periods of time when cords actually “slam shut” (ILO)
- Work up involves laryngoscopy/FEES
- Supportive care
 - More common and worse outcomes for babies with neurologic abnormalities

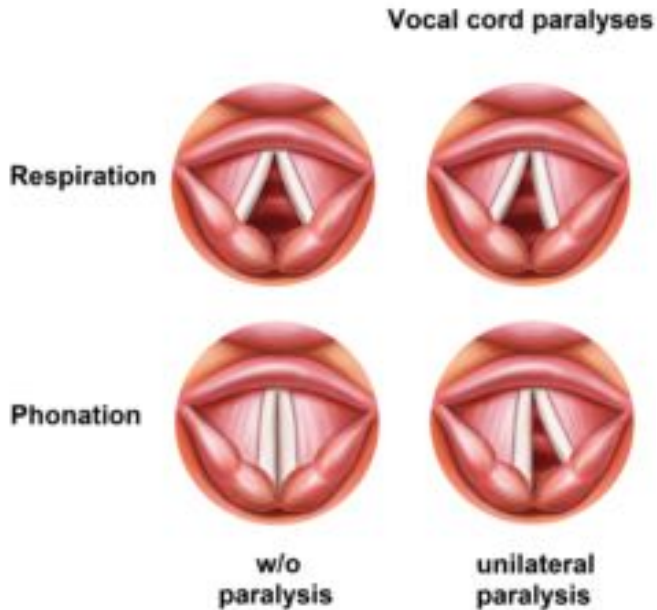
Vocal cord paralysis/immobility

Vocal cord paralysis



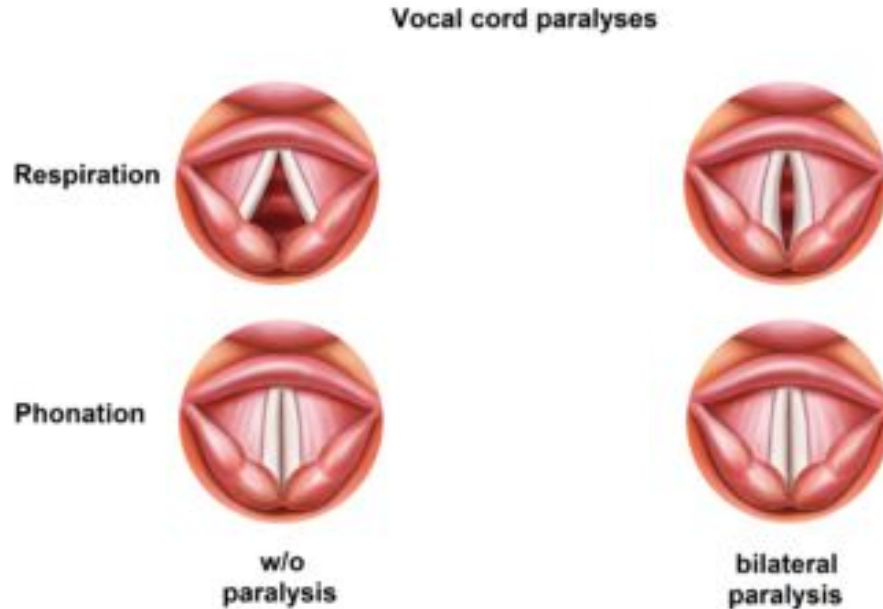
w/o
paralysis

Vocal cord paralysis/immobility



- History
 - **Aspiration**
 - Weak cry
 - +/- inspiratory stridor (not likely at rest)
- Cause
 - Acquired (PDA most common)
 - Congenital
- Work up
 - Rule out mass along the nerve
 - MBS
- Management
 - Time
 - Supportive measures for swallowing
 - Surgery

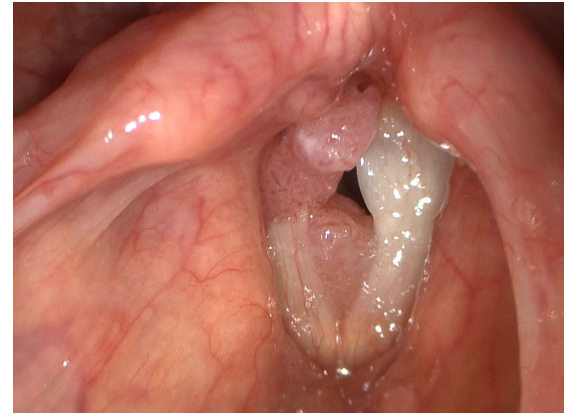
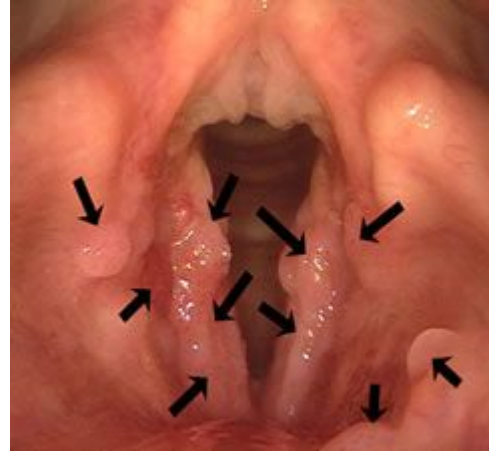
Vocal cord paralysis/immobility



- History
 - **Inspiratory stridor**
- Cause
 - Congenital
- Work up
 - Rule out brainstem mass/Chiari
 - MBS
- Management
 - Time
 - Supportive measures for swallowing/breathing
 - Surgery

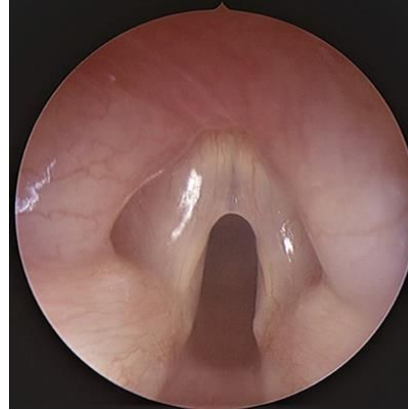
Papillomatosis

- History
 - **Consistent stridor (inspiratory or biphasic)**; infancy/early childhood but not likely at birth
 - **Hoarseness/weak cry**
 - Known maternal history
- Cause
 - HPV
- Work up
 - Flexible laryngoscopy
- Management
 - Surgery
 - Adjuvant
 - Vaccine, cidofovir, interferon



Infants - Stridor - Biphasic

- Fixed laryngeal obstruction can cause biphasic stridor
 - Hoarse voice/weak cry
 - HPV
 - Web/cyst
- Subglottic pathology
 - Hemangioma
 - Stenosis
 - Congenital
 - Acquired



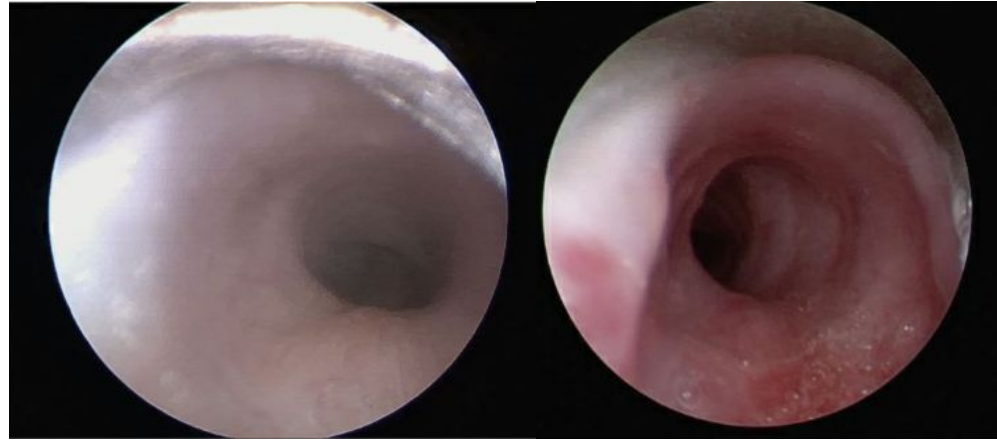
Subglottic Hemangioma

- History
 - Onset around 2-6 months of age
 - **Improves temporarily with steroids**
 - “Beard distribution” or other hemangiomas (50% of the time)
- Cause
 - Vascular malformation (infantile hemangioma)
- Work up
 - Bronchoscopy for diagnosis
 - Assess for associated syndrome
- Management
 - Propanolol
 - ENT/Vascular anomalies clinic



Subglottic Stenosis

- History
 - **Biphasic high pitched stridor that is not episodic***
 - Congenital
 - Associated syndromes (T21)
 - Acquired
 - History of intubation
- Cause
 - Congenital - malformed cricoid
 - Acquired - intubation trauma
- Work up
 - Bronchoscopy for diagnosis
 - Assess for associated airway lesions
- Management
 - Time
 - Endoscopic/Open surgical treatment



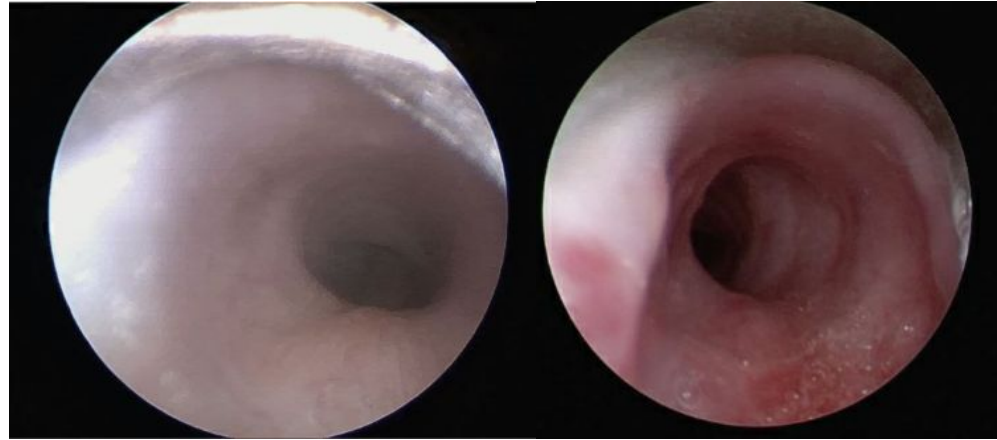
1 month of age

14 months of age

3.0 ETT

Subglottic Stenosis

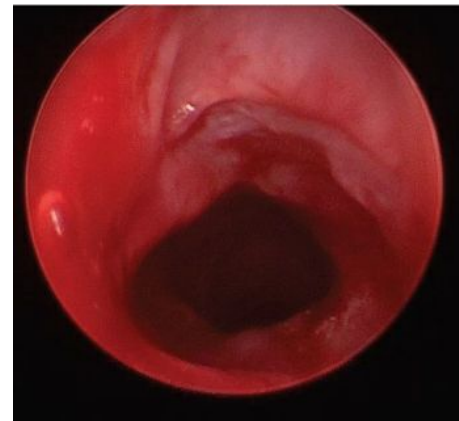
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1 month of age

14 months of age

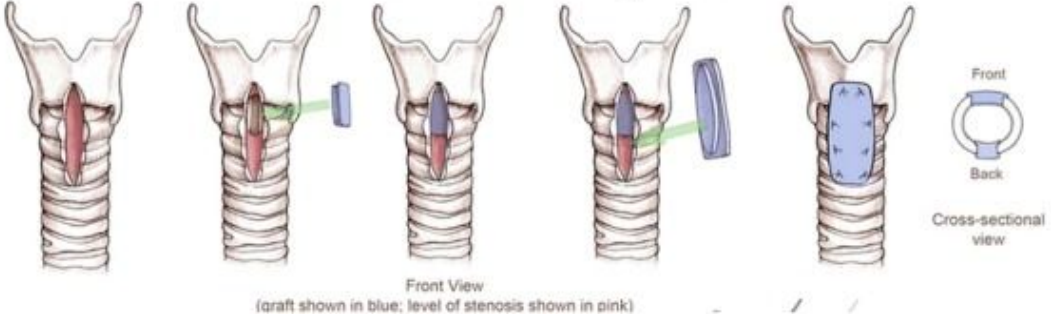
3.0 ETT



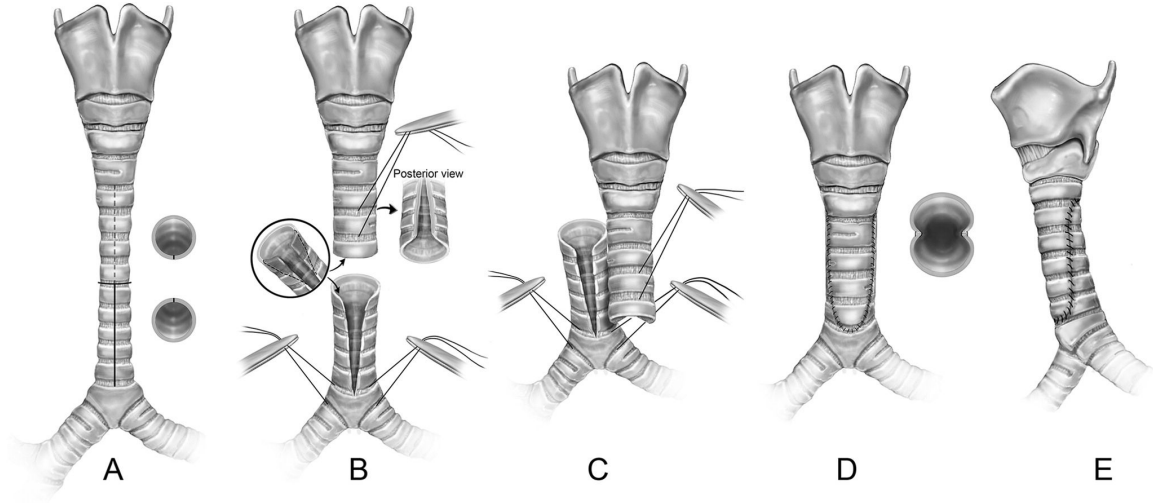
Laryngotracheal reconstruction



Anterior and Posterior Costal Cartilage Grafts

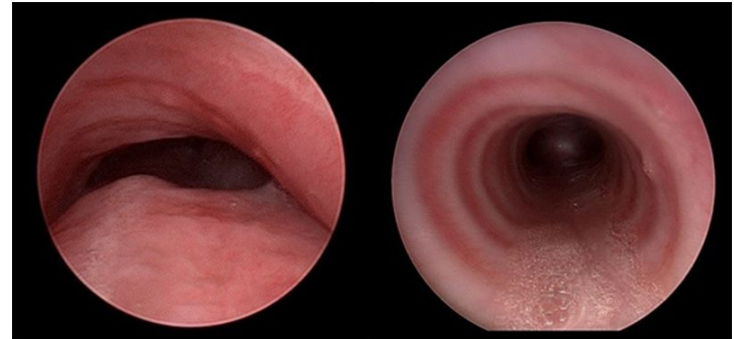
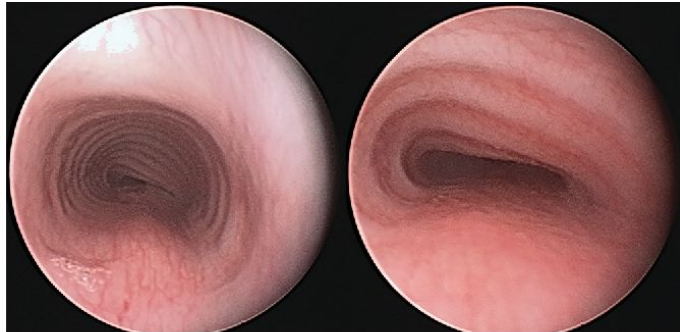
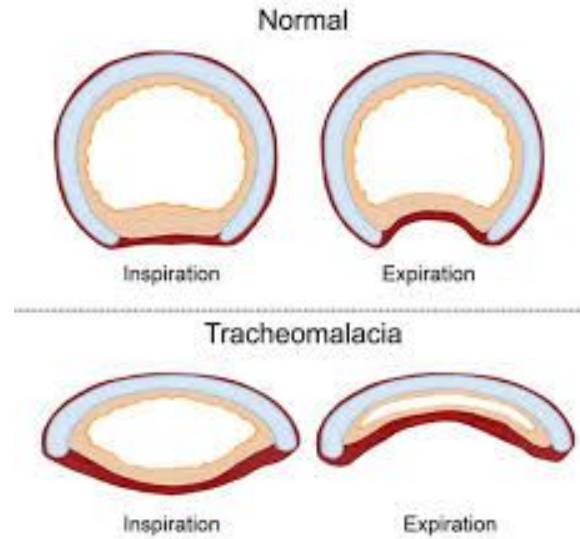
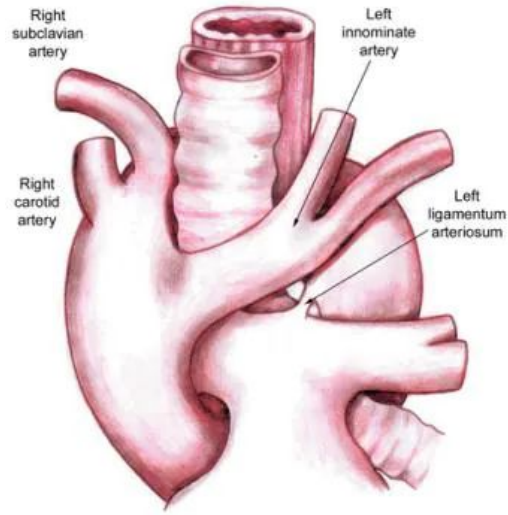


Complete Tracheal Rings



Infant - Stridor - Expiratory

- Tracheomalacia
 - Severe can be associated with recurrent PNA (post obstructive)
- Vascular ring
 - Can affect swallowing
 - Diagnosed with CTA +/- Echo
- Intrathoracic mass
- Associated “barky cough”
- May be worse supine (mass effect)
- Generally constant but quieter when still/calm
- More severe can be biphasic (or when associated with other pathology like laryngomalacia)



Tracheomalacia: Management - time/surgical (depends on the cause)

Need to refer

- Biphasic or expiratory stridor (not wheezing or stertor)
- Inspiratory stridor that is constant or worsening
 - Red flags: Weak cry, failure to thrive/feeding difficulties
- Consider UNM SLP referral if feeding is the bigger concern
 - Occasional or mild stridor but with feeding difficulties: FEES
- Difficulty feeding/gaining weight, FTT
- History of cyanosis/apneas
- Respiratory distress with significant retractions/tachypnea - urgent care/ED

Noisy Breathing in Children

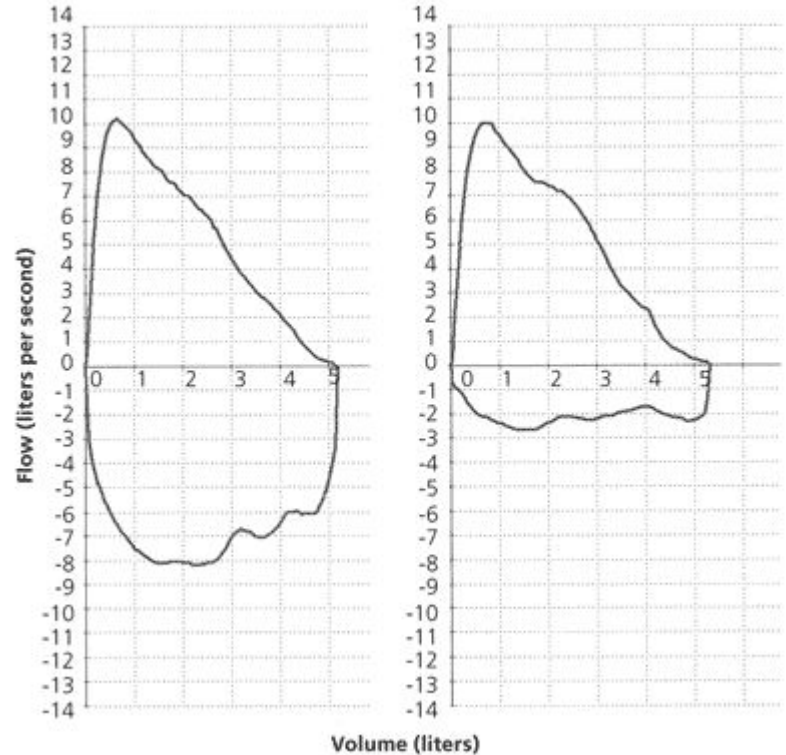


Stridor in Children/Adolescents

- Laryngomalacia...what, what?!
 - OSA
- Acquired/secondary subglottic stenosis
 - Granulomatosis Polyangiitis
- Recurrent respiratory papillomatosis
- Vocal cord dysfunction*
- Recurrent croup*
- Airway foreign body*

Vocal cord dysfunction

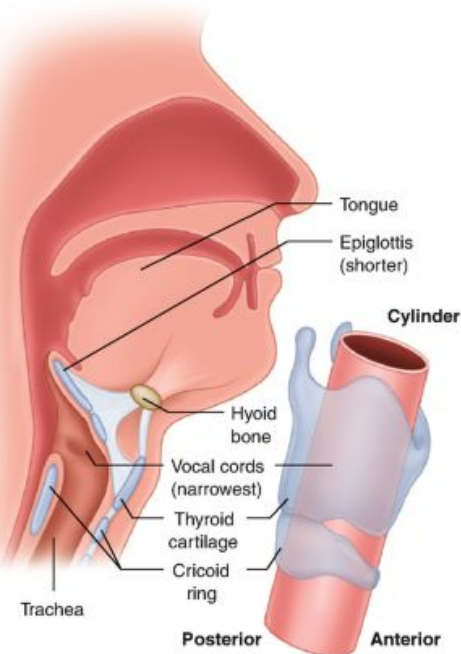
- Induced laryngeal obstruction or paradoxical vocal cord mobility
- Inspiratory stridor
- 2-12% of patients with diagnosis of “asthma”
- Inducible: exercise, reflux, strong smells, stress, asthma, PND
- Associated behavioral health
- Dx mostly based on history, +/- volume flow loops
- Treatment: Therapeutic breathing maneuvers/vocal cord relaxation
 - SLP referral - pursed lips/straw, belly/diaphragmatic, tongue out/on upper gingiva
 - Botox



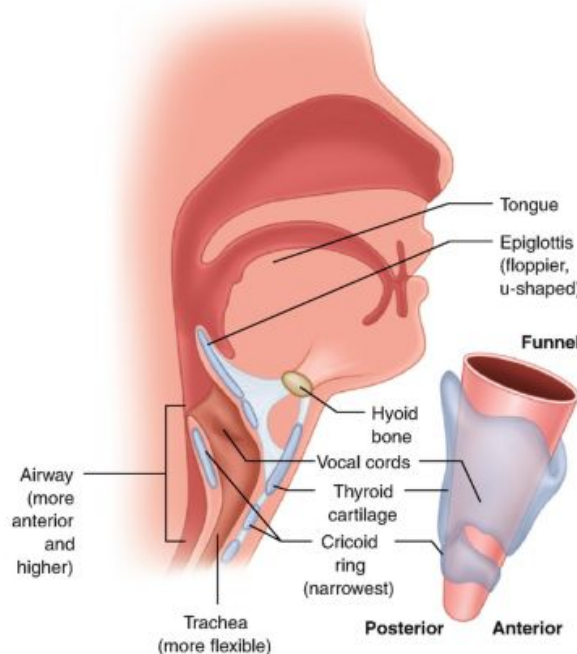
Recurrent Croup

Adult vs pediatric airway

Anatomy of adult airway



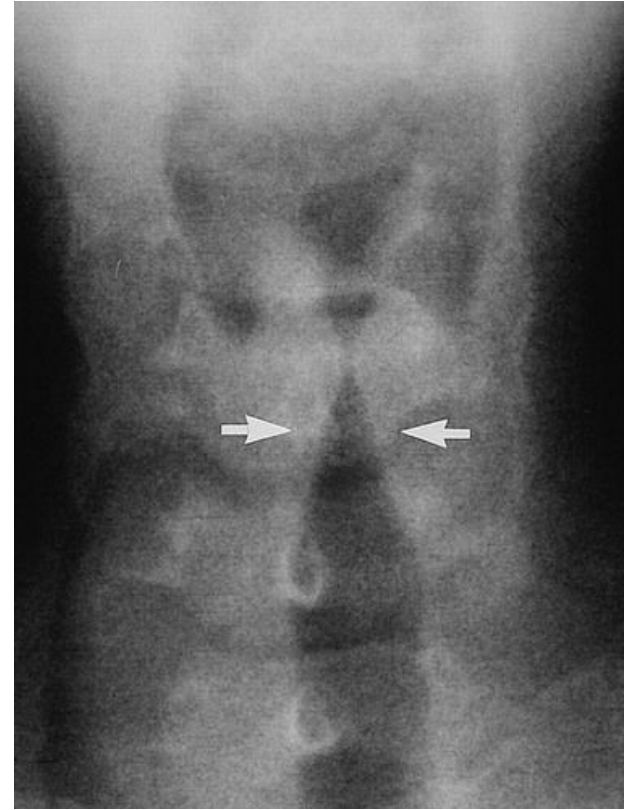
Anatomy of pediatric airway



8-12 years of age

Recurrent Croup

- Croup: laryngotracheobronchitis
 - 48 hr - 1 week
 - Viral
- “Spasmodic croup...” VFD?
- > 2-3 episodes or more of croup like episodes
- Associated with asthma, allergies, GERD



Recurrent croup: systematic review/meta-analysis

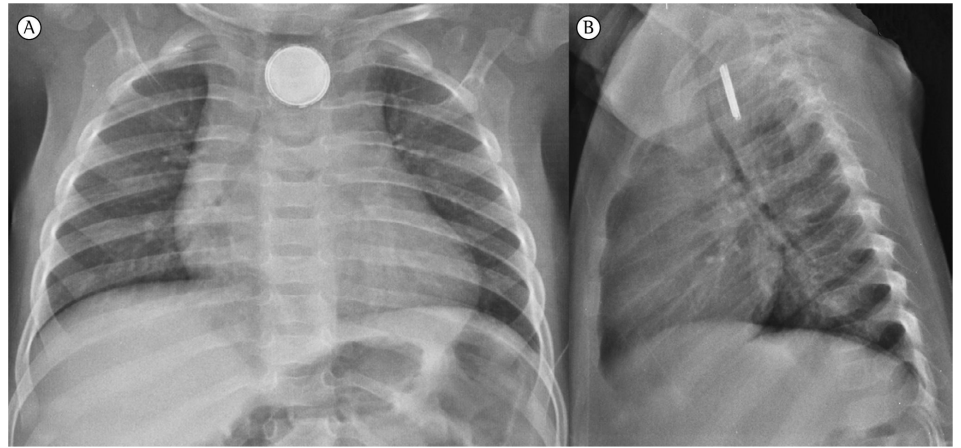
- 11 articles: 885 patients who underwent MLB for recurrent croup
- Findings
 - 30.6% had subglottic stenosis (25% of these grade I and 4.1% grade II)
 - 24.6% had reflux changes
 - 4.6% broncho/tracheomalacia
 - 3.7% with vocal cord pathology*
- 8.7% of patients had “clinically significant findings”
 - Alters clinical management: grade II stenosis or higher, surgical intervention or repeat bronch for surveillance
 - Associated with history of intubation, prematurity, age less than 1 and/or less than 3 years*, inpatient consultation*

Recurrent Croup

- Think about VCD
- Identify and treat underlying cause(s)
 - 50% have GERD (hx of GERD is not associated with clinically relevant findings on MLB)
 - Atopy: asthma, allergies, eczema, EoE
 - “Unified airway”
 - Lower expiratory flow loops - predicts asthma?
 - Nasal steroid/antihistamine, oral antihistamine, consider montelukast or allergy referral
- When to refer
 - Any symptoms of chronic cough after above dx have been assessed/treated
 - Stridor between episodes of croup - chronic stridor
 - History of intubation (ask about heart surgery)
 - Age less than 1
 - Consider age less than 3 if no other factors above have been identified

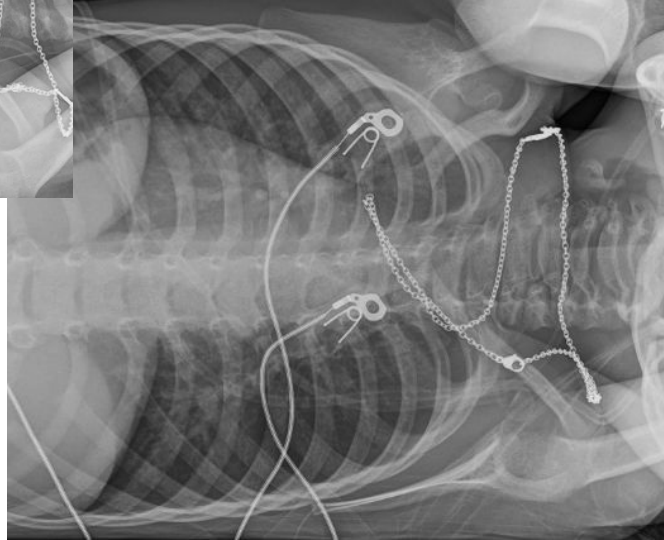
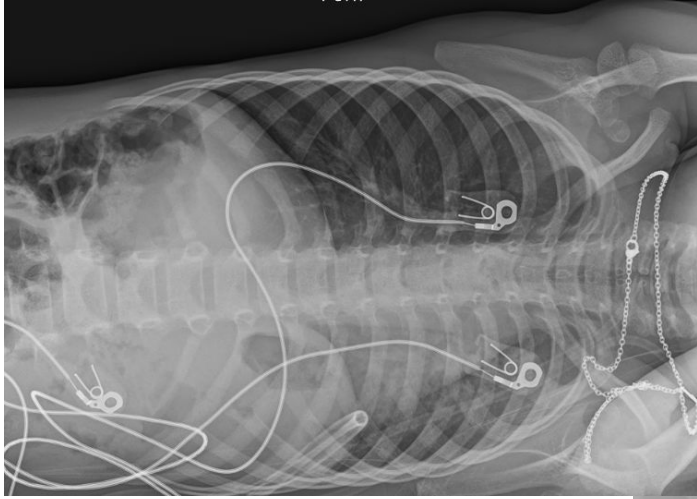
Airway foreign Body

- Inspiratory, expiratory or biphasic stridor/wheezing
- History/X-ray/Exam
- Systematic review/Meta-analysis
 - 1577 patients (1.5-2.6 years)



	Odds Ratio	Sensitivity	Specificity
Radiopaque finding	18.5	7.5%	100%
Focal hyperinflation	8.3	57.5%	84.2%
Unilateral auscultation findings	4.8	58.1%	69.4%
Wheezing	2.5	33.1%	77.5%
Witnessed choking	3.1	45.9%	53.1%

2 weeks...cough and then fever



Review/Summary

- Stertor - **Stridor** - Wheezing
 - Infants with stertor often have nasal congestion secondary to inflammation
 - Reflux/feeding difficulties
 - Tongue tie/palate
- Inspiratory - **Expiratory** - **Biphasic**
- Laryngomalacia - most common cause of stridor in infants
 - Intervene when noted to have signs of apneas/feeding difficulties/poor weight gain
 - 18 months
- Reassurance when baby is growing and thriving
- Think about SLP referral for babies with concerns directly related to feeding
- Vocal cord dysfunction - SLP
- Recurrent croup - treat possible underlying conditions, >8-12 years of age

Thank you!

kahawley@salud.unm.edu

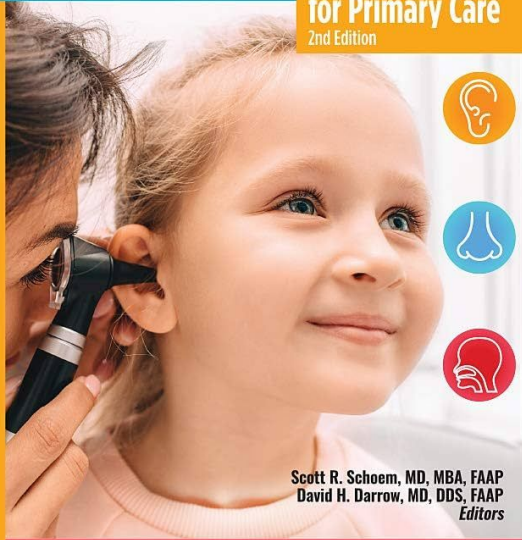
Peds ENT Clinic #

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Pediatric Otolaryngology

for Primary Care
2nd Edition



Scott R. Schoem, MD, MBA, FAAP
David H. Darrow, MD, DDS, FAAP
Editors

American Academy of Pediatrics

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