

Stridor, Stertor and Snoring- Common Pediatric Airway Problems

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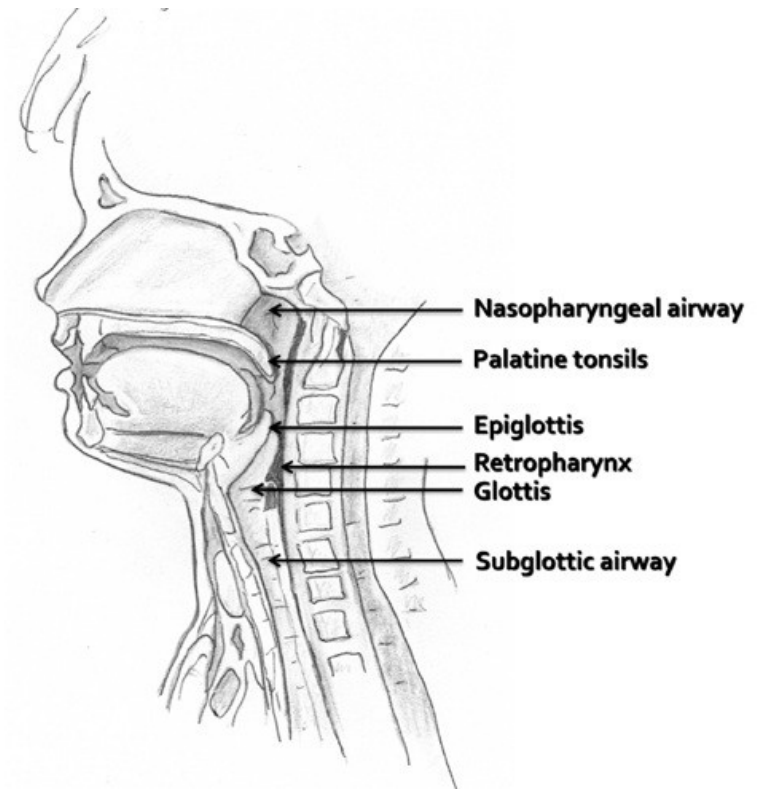
McLane Children's Hospital
SCOTT & WHITE

I have no financial relationships to disclose.



Pediatric Airway Problems

- Stridor
- Stertor
- Snoring

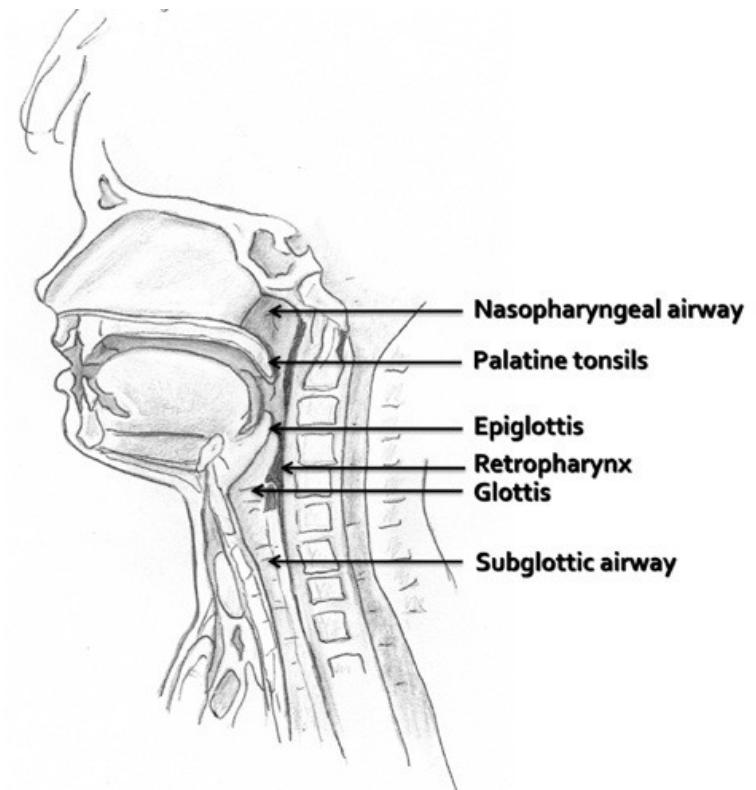


Stridor

- Definition
 - sound produced by turbulent airflow from obstruction in the upper aerodigestive tract
 - laryngeal
 - tracheobronchial
 - sound and pitch dependent on air flow dynamics

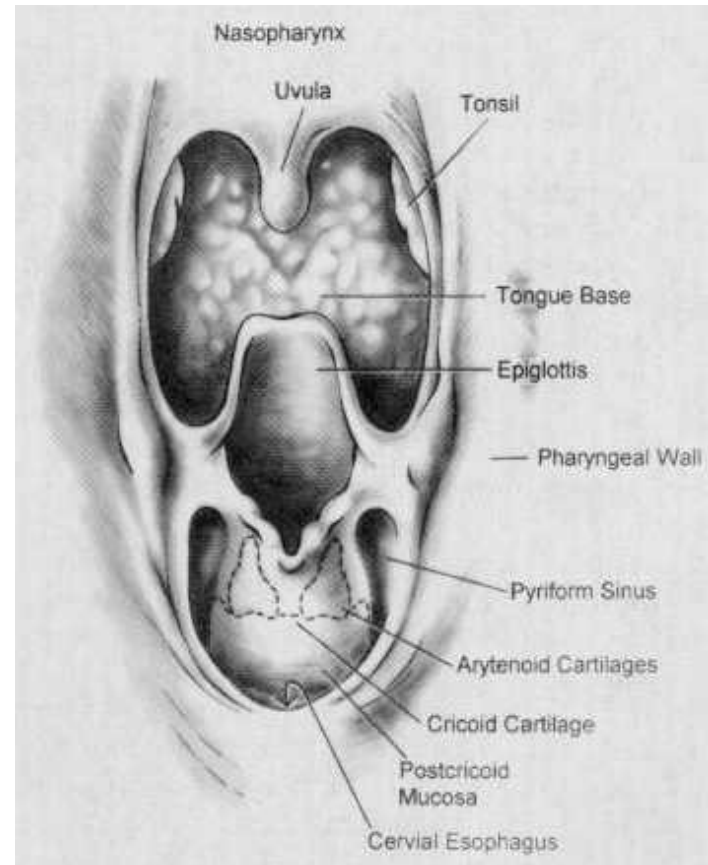
Stridor

- Timing in respiratory cycle determines anatomic location of airway lesion
 - Inspiratory
 - Biphasic
 - Expiratory



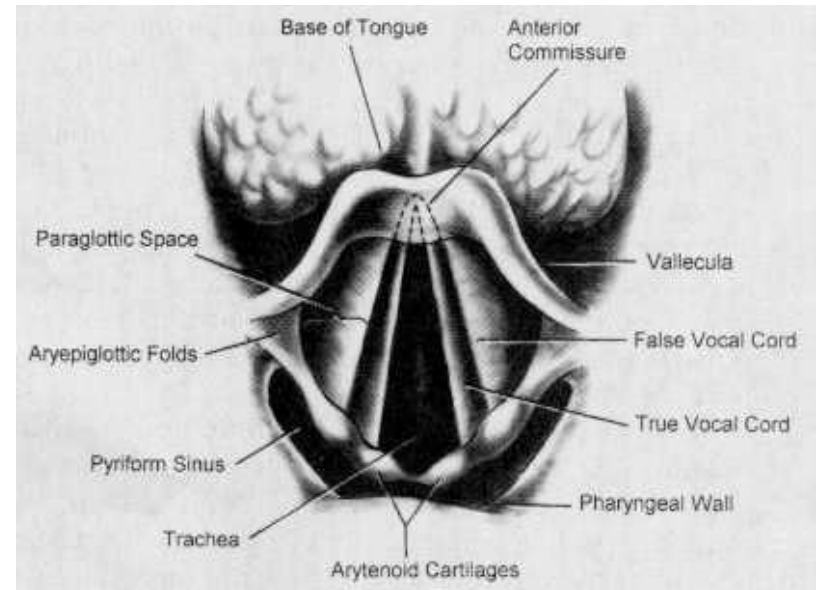
Inspiratory Stridor

- Partial supraglottic airway obstruction
- Other aerodigestive tract symptoms
 - suprasternal and intercostal retractions
 - feeding difficulties
 - muffled cry



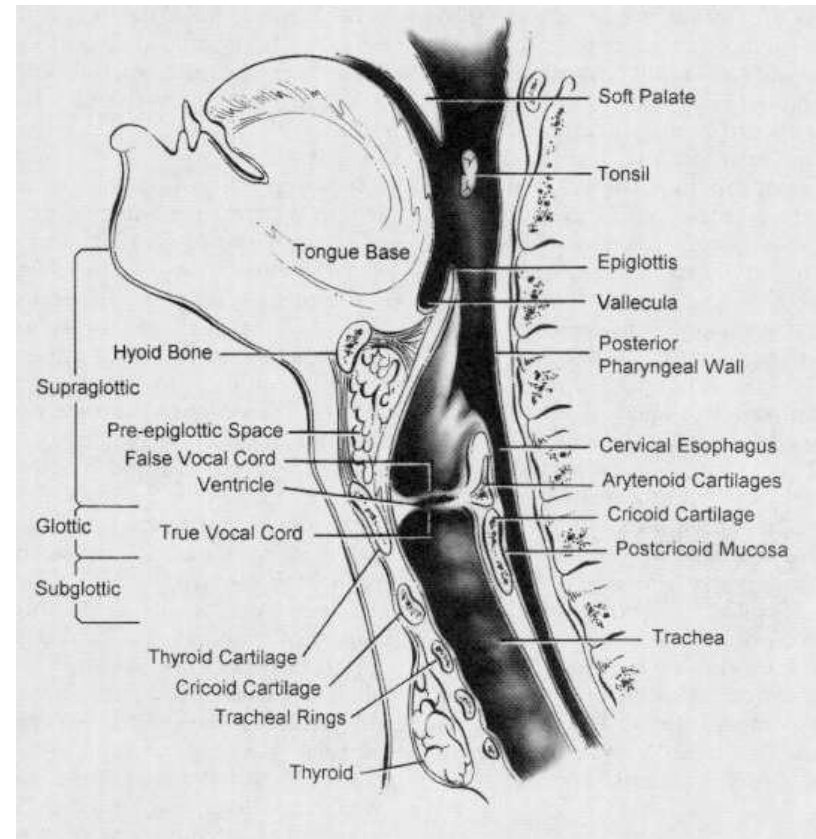
Biphasic Stridor

- Partial obstruction at the level of the glottis
- Primarily inspiratory stridor
- Other aerodigestive tract symptoms
 - hoarseness
 - aphonia
 - nasal flaring
 - retractions



Expiratory Stridor

- Partial obstruction at the level of the subglottis or proximal trachea
- Other aerodigestive tract symptoms
 - xiphoid retractions
 - barking cough
 - nasal flaring



Stridor

- Congenital
 - 85%
 - anatomical anomalies
 - present by 4 months of age
- Acquired
 - 15%

Stridor: Diagnosis

- History
- Flexible fiberoptic laryngoscopy
- Direct laryngoscopy with rigid bronchoscopy
- Barium esophagram
- CT neck and chest

Congenital Stridor

#1 Laryngomalacia

#2 Bilateral True Vocal Fold (Cord) Paralysis

#3 Laryngotracheal Stenosis (Subglottic Stenosis)

- Laryngeal webs
- Laryngotracheal esophageal clefts
- Tracheoesophageal fistulae
- Laryngeal and subglottic cysts
- Subglottic hemangioma
- Tracheomalacia
- Tracheal stenosis
- Tracheal compression
- Complete vascular rings
- Anomalous innominate artery
- Pulmonary artery sling

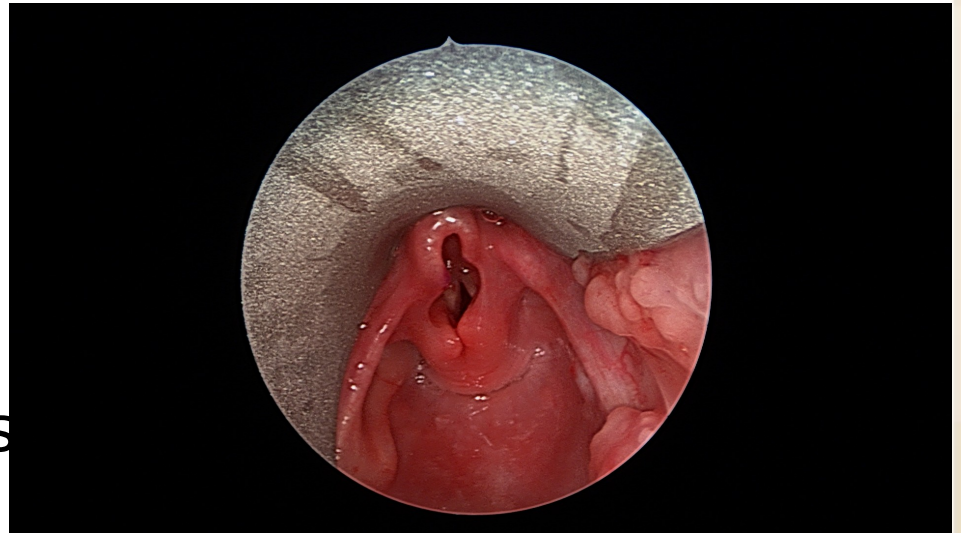
Laryngomalacia

- #1 cause of newborn stridor
- 58% congenital laryngeal anomalies
- males 2:1
- inspiratory stridor
- presents shortly after birth
- worsens by 6-8 weeks of age
- “omega-shaped” epiglottis
- usually self-limited
 - resolves by 12-15 months of age



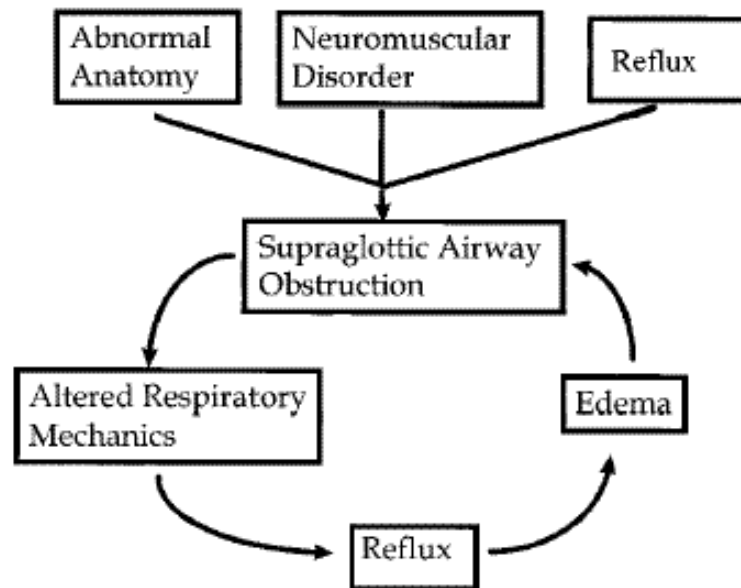
Laryngomalacia

- Symptoms:
 - stridor with:
 - agitation
 - feeding
 - supine position
 - feeding difficulties
 - failure to thrive
 - rare:
 - cyanosis
 - pectus excavatum



Laryngomalacia

- Etiology



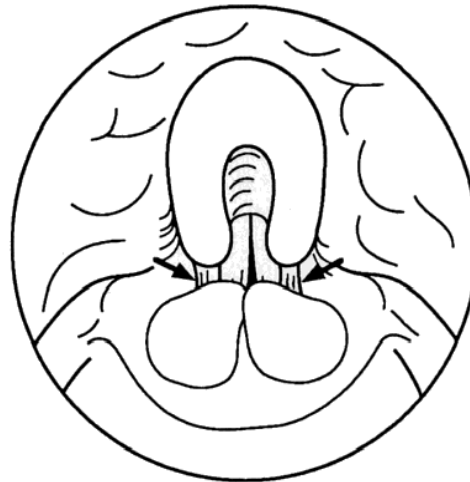
Laryngomalacia



Type 1

Type 1

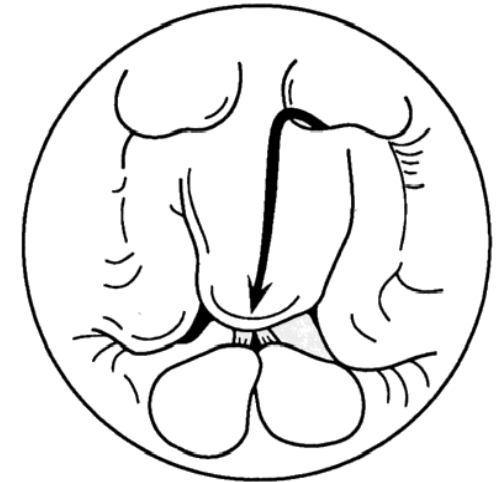
prolapse of mucosa
overlying the
arytenoid
cartilages



Type 2

Type 2

foreshortened
aryepiglottic folds



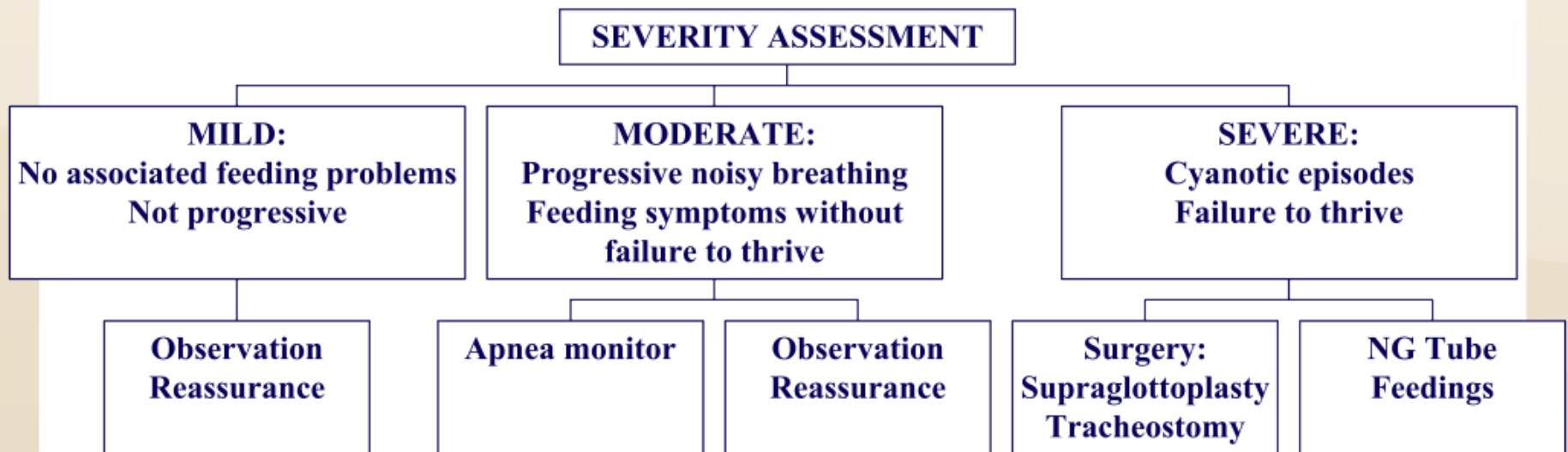
Type 3

Type 3

posterior
displacement of
the epiglottis

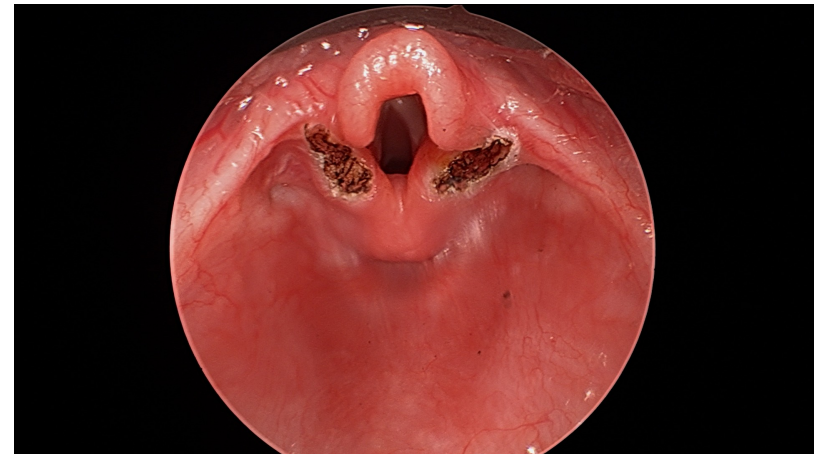
Laryngomalacia

Management of Laryngomalacia



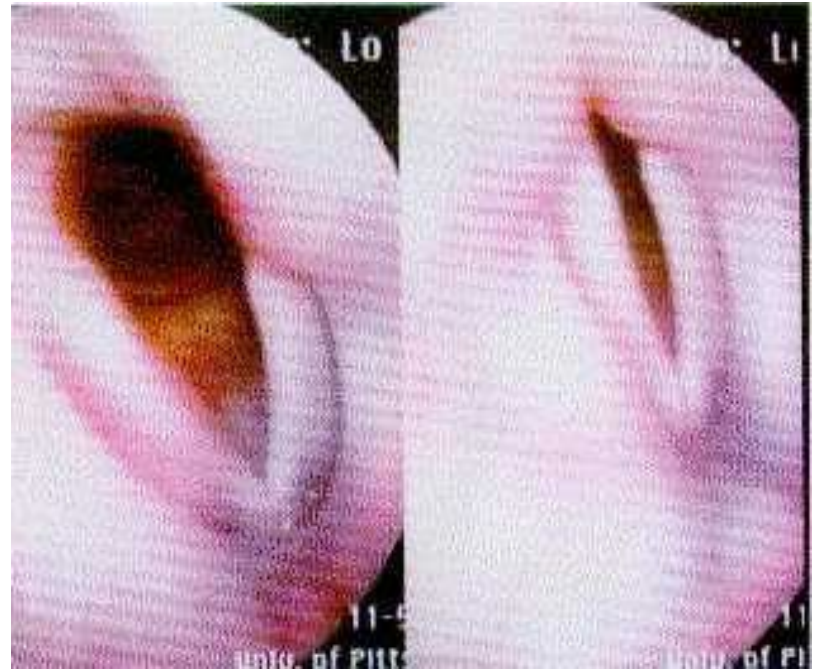
Laryngomalacia

Supraglottoplasty



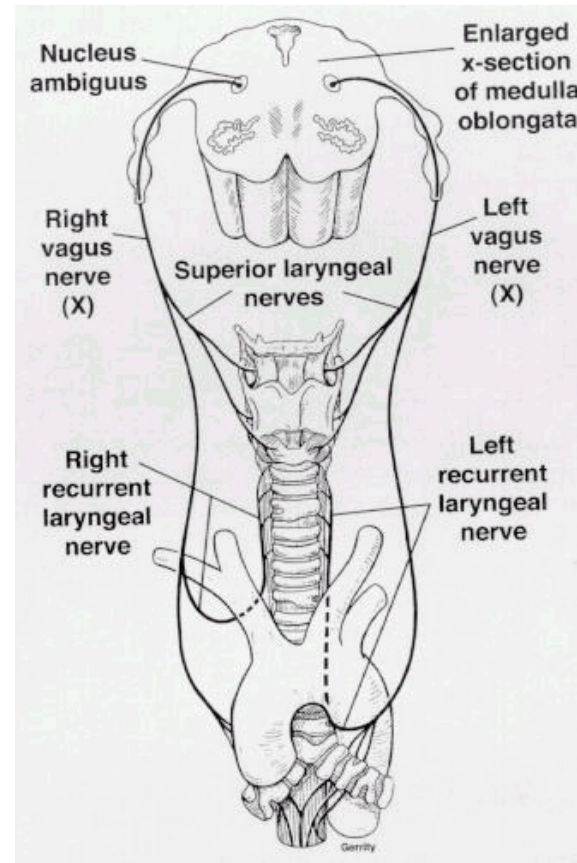
True Vocal Fold Paralysis

- #2 Etiology of newborn stridor
- 10% all congenital laryngeal lesions
- no gender predilection
- biphasic stridor
- 58% present within first 12 hours of birth
- unilateral or bilateral
 - unilateral: left > right



True Vocal Fold Paralysis

- Idiopathic
- Anatomic
- Neurologic
 - congenital
 - acquired



True Vocal Fold Paralysis

- Congenital
 - CNS
 - Arnold-Chiari malformation I & II
 - Leukodystrophy
 - Encephalocele
 - Hydrocephalus
 - Cerebral or nuclear dysgenesis
 - Perinatal asphyxia



True Vocal Fold Paralysis

- Acquired
 - Thoracic surgery
 - PDA ligation
 - ETT trauma
 - Recurrent laryngeal nerve compression
 - LMA
 - Arytenoid dislocation
 - Recurrent laryngeal nerve compression

True Vocal Fold Paralysis

Signs and Symptoms

- Bilateral
 - biphasic stridor
 - apnea
 - cyanosis
 - aspiration
 - dysphagia
 - ineffective cough
- Unilateral
 - stridor
 - hoarseness
 - abnormal cry
 - aspiration
 - dysphagia
 - ineffective cough

True Vocal Fold Paralysis Management- Airway

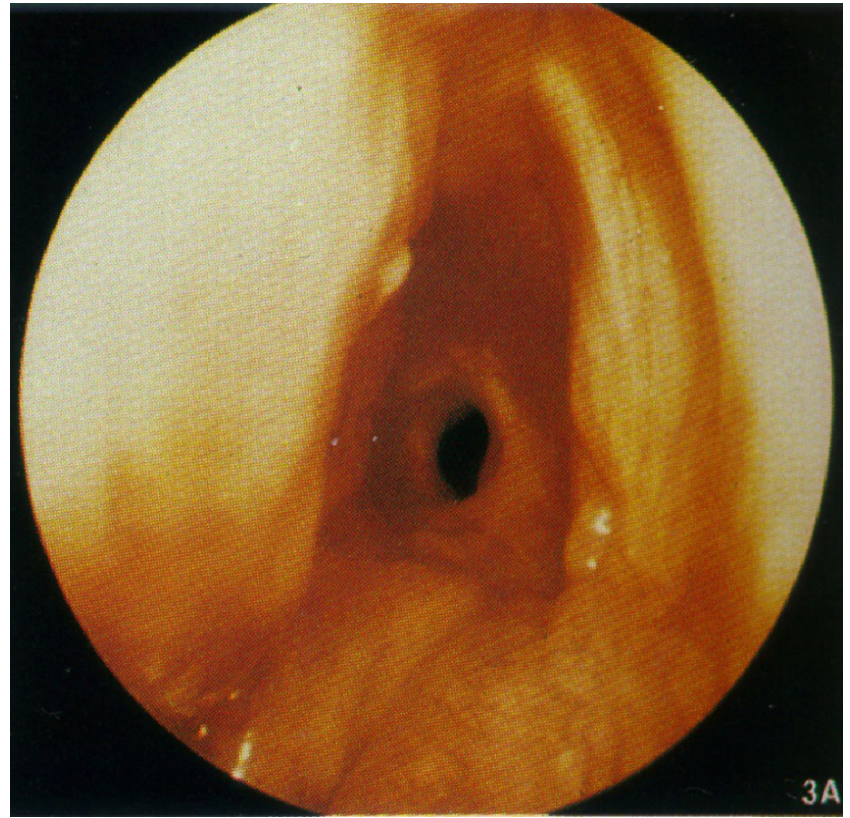
- Respiratory distress
 - Endotracheal intubation
 - Laryngoscopy
 - Direct
 - Tracheostomy
 - Posterior cordotomy
 - Swallowing evaluation
- Stable
 - Flexible fiberoptic laryngoscopy
 - Swallowing evaluation

True Vocal Fold Paralysis Management- Feeding

- Normal MBSS
 - Oral feeding
- Aspiration
 - NG tube feeding for 6 weeks
 - Repeat MBSS
 - Normal
 - Oral feeding
 - Aspiration
 - G-tube

Subglottic Stenosis

- #3 most common congenital laryngeal anomaly
- no gender predilection
- congenital or acquired
- narrowed airway 2-3mm below true vocal folds
- subglottic diameter of 4mm or less in a full-



Subglottic Stenosis

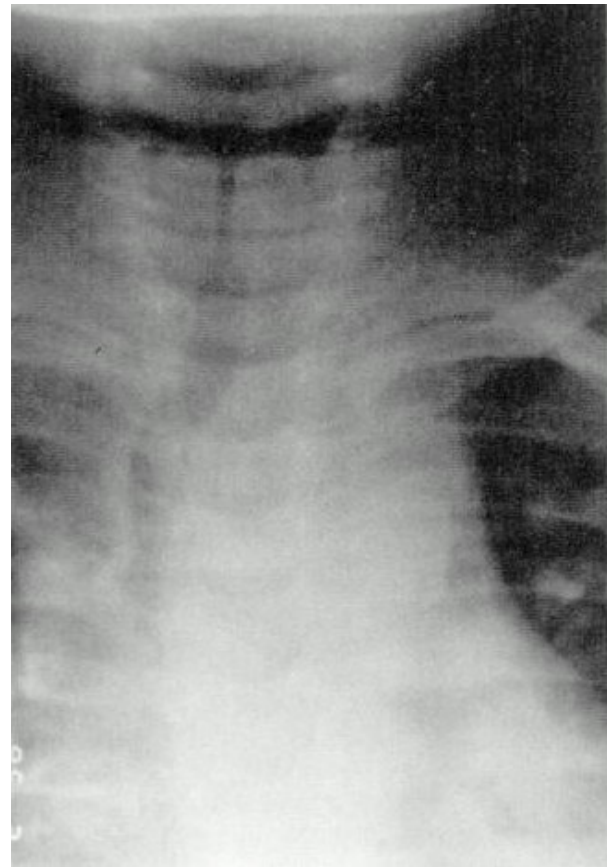
- Symptoms
 - stridor
 - may be biphasic
 - dyspnea
 - cough
 - brassy or barky
 - hoarseness
 - weak or unusual cry

Subglottic Stenosis

- Congenital
 - Stenosis without prior intubation, or extrinsic compression
 - Presentation
 - after upper respiratory infection
 - “recurrent croup”
 - Age
 - birth to few months
- Acquired
 - Prior intubation or trauma
 - Presentation
 - failed extubation
 - recurrent croup after extubation
 - Age
 - 2wks - 10 yrs
 - Majority < 1

Subglottic Stenosis

- Radiographic findings
 - long segment of subglottic narrowing

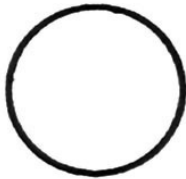




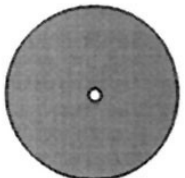


Subglottic Stenosis

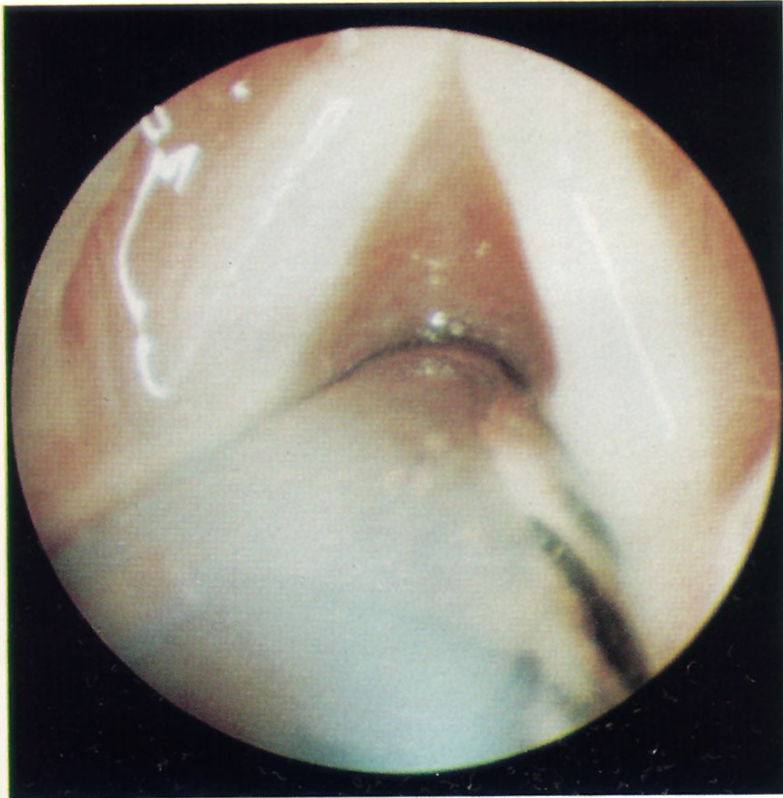
Meyer-Cotton Grading System

- most frequently used system
- grade correlates with prognosis

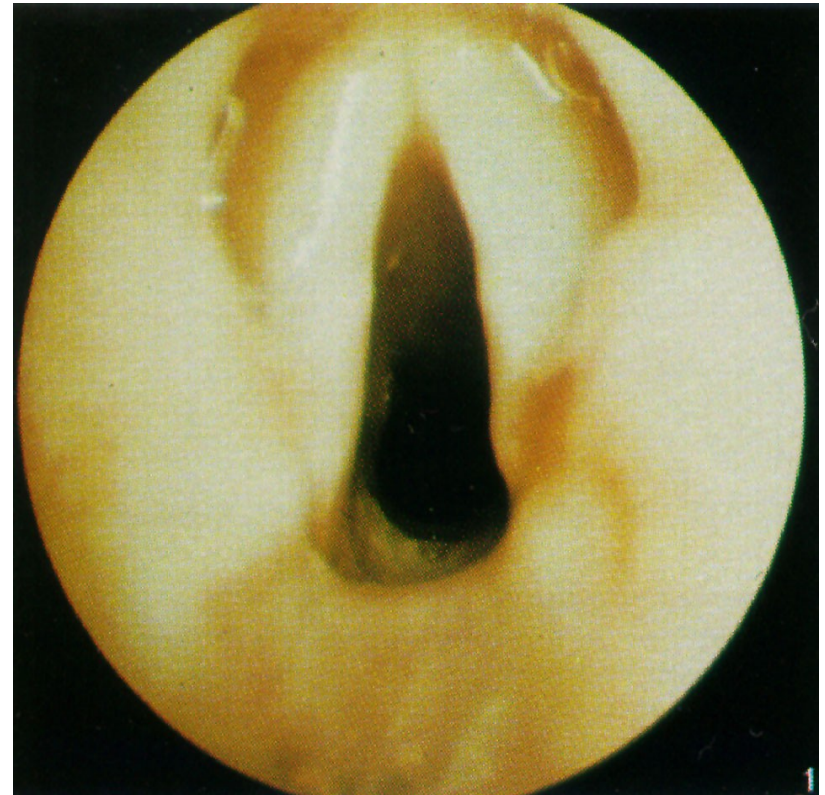
Myer, et al. (1994)

Classification	From	To
Grade I	 No Obstruction	 50% Obstruction
Grade II	 51% Obstruction	 70% Obstruction
Grade III	 71% Obstruction	 99% Obstruction
Grade IV	No Detectable Lumen	

Subglottic Stenosis Grading

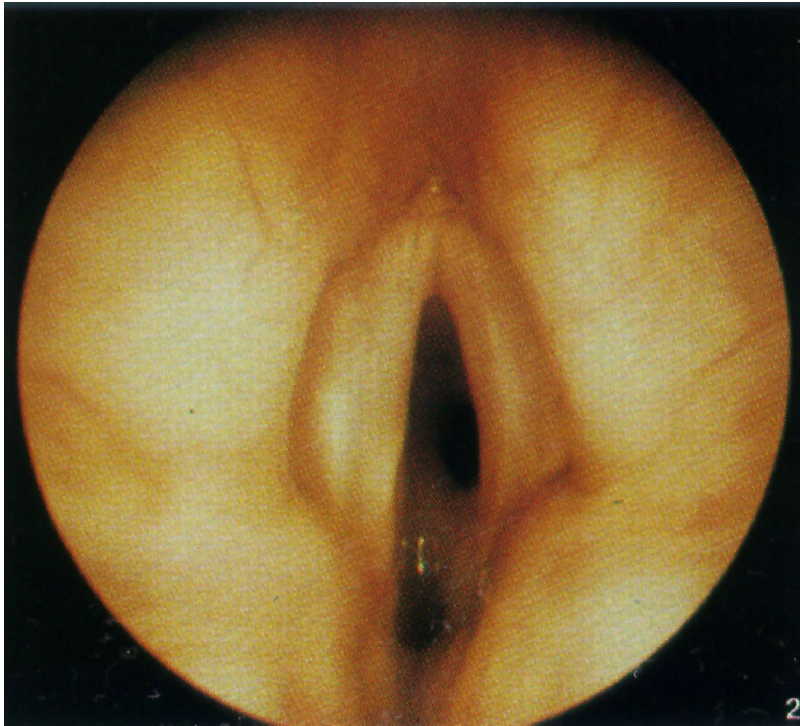


Endoscopic view of laryngeal stenosis with endotracheal tube in place for the purpose of sizing.

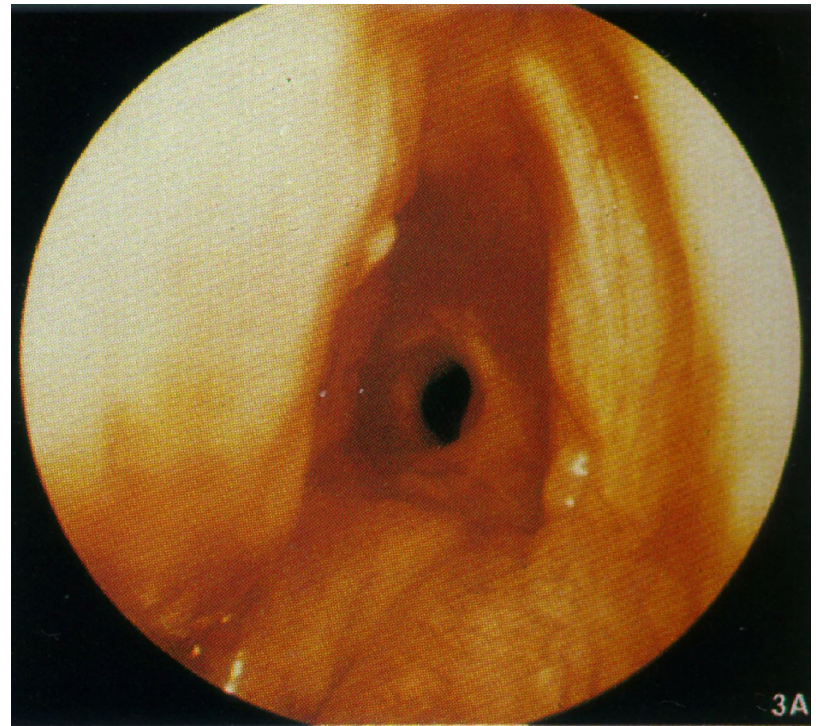


Grade 1

Subglottic Stenosis Grading



Grade 2



Grade 3



Subglottic Stenosis-

Management of suspected SGS

- Stable airway
 - History
 - Flexible fiberoptic laryngoscopy
 - Direct laryngoscopy with rigid bronchoscopy
- Unstable/unsafe airway
 - Intubation or tracheostomy
 - Direct laryngoscopy with rigid bronchoscopy



Subglottic Stenosis- Surgical Management

- Evaluate overall medical condition
 - BPD, poor neurologic status, LBW
- Tracheostomy
- Airway reconstruction
 - Open surgical management
 - LTR- laryngeal tracheal reconstruction
 - Single or double stage
 - Endoscopic surgical management
 - Balloon dilation

Subglottic Stenosis

Laryngeal tracheal reconstruction

Posterior
cricoidotomy

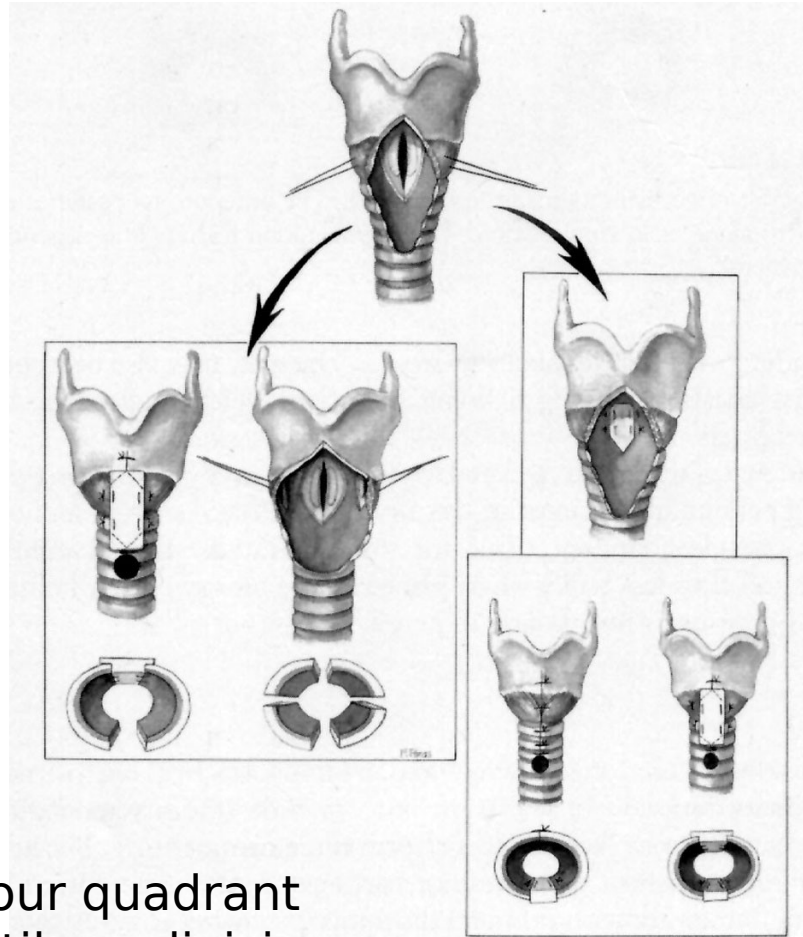
Anterior costal
cartilage graft
Posterior
cricoidotomy

Four quadrant
cartilage division

Anterior costal
cartilage graft

Posterior costal
cartilage graft

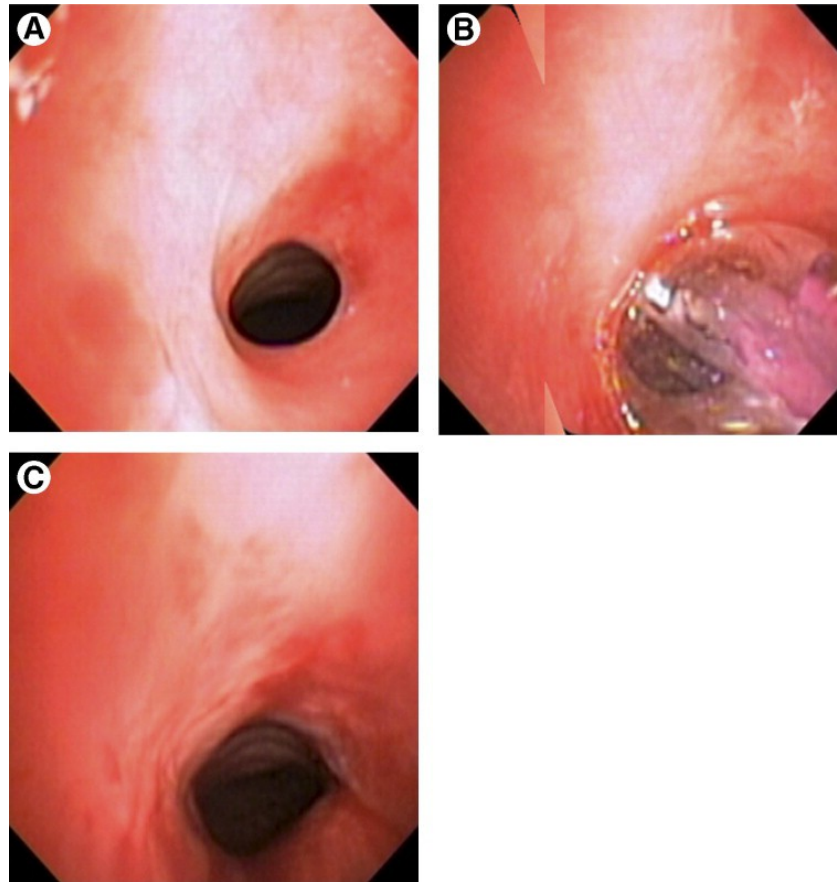
Anterior and
posterior cartilage
grafts



Subglottic Stenosis

Endoscopic management

- Balloon Dilation



Acquired Stridor

- Croup
 - Laryngotracheobronchitis
- Epiglottitis
 - Supraglottitis
- Foreign body
 - Laryngeal or tracheal
 - Esophageal
- Laryngeal papilloma

Laryngotracheobronchitis- Croup

- Most common cause of upper airway obstruction
 - 6 months to 6 years of age
 - Most commonly 1-2 years of age
 - Barky cough
 - Biphasic stridor
 - Viral prodrome



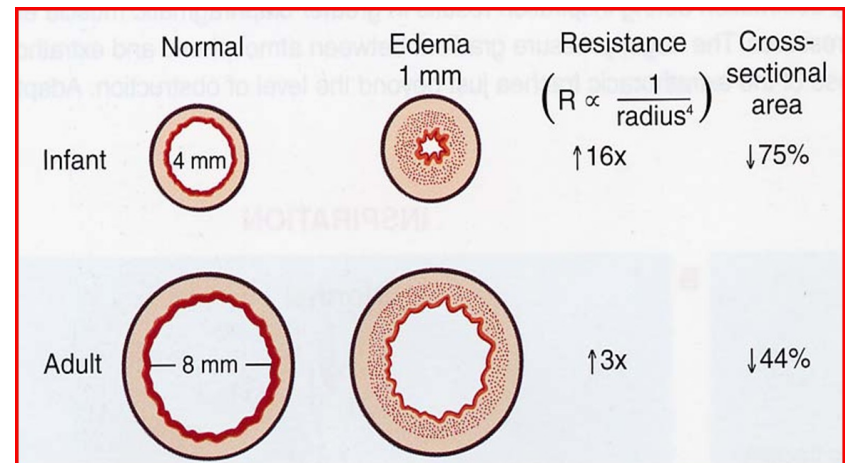
Laryngotracheobronchitis- Croup

- Causes
 - Parainfluenza
 - Influenza
- Diagnosis
 - History
 - AP and lateral neck x-rays
 - Steeple sign
 - Flexible laryngoscopy
 - DLB



Laryngotracheobronchitis- Croup

- Management
 - Oral corticosteroids
 - Inhaled racemic epinephrine
 - Possible intubation



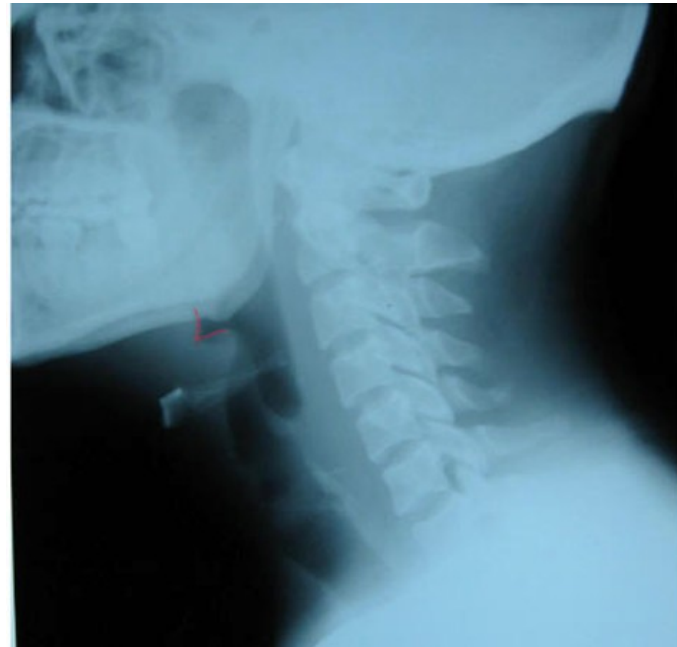
Epiglottitis- Supraglottitis

- Swelling of epiglottis and supraglottic structures
- Presentation
 - Triad of drooling, dysphagia and distress
 - Fever
 - Tripod position



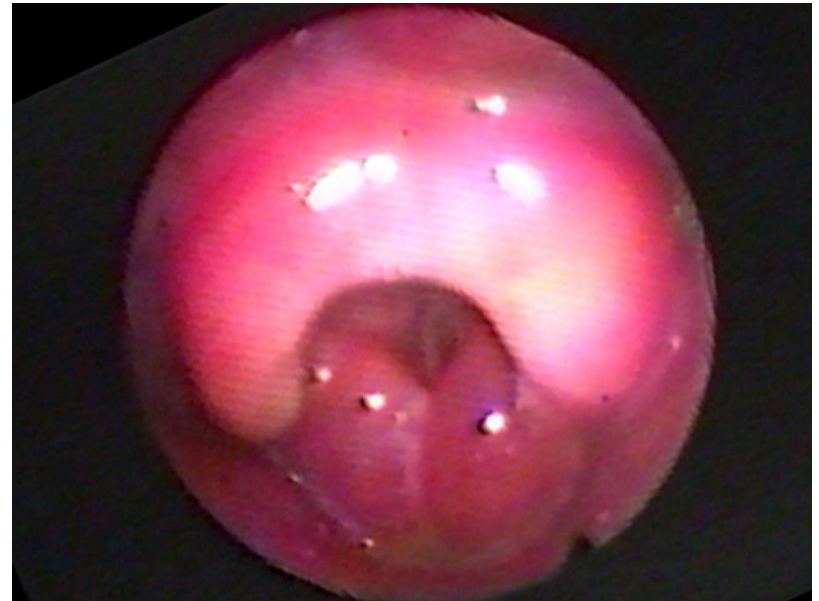
Epiglottitis

- Causes
 - Haemophilus influenzae type B
 - Blood cultures
- Diagnosis
 - History
 - Lateral neck x-ray
 - Thumb print sign



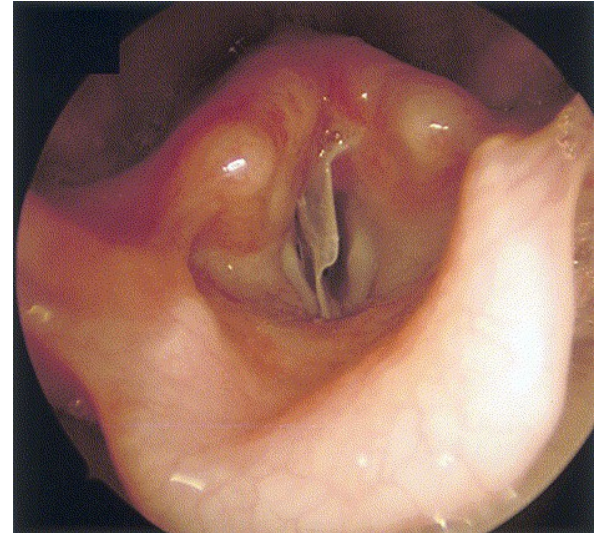
Epiglottitis- Supraglottitis

- Management
 - Intubation in the OR
 - PICU
 - 24-72 hours
 - ceftriaxone, cefuroxime or cefotaxime



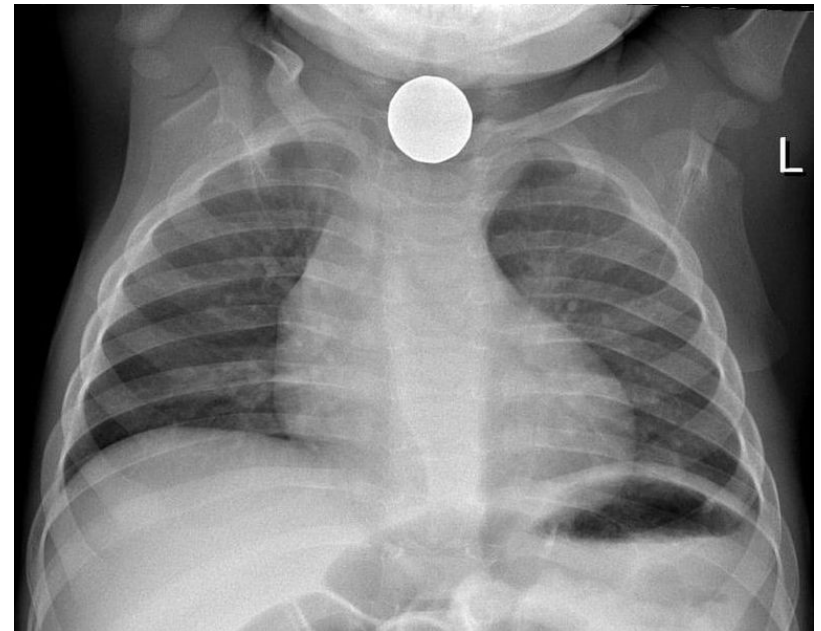
Laryngeal Foreign Body

- Biphasic stridor
- Flexible laryngoscopy
- Direct laryngoscopy with removal



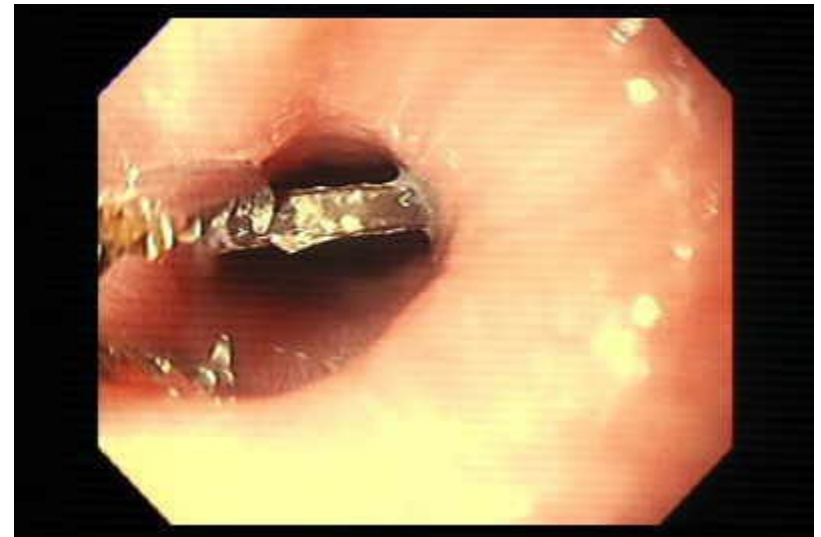
Esophageal Foreign Body

- Drooling
- Stridor
- X-ray
 - AP chest



Esophageal Foreign Body

- Endoscopic esophagoscopy for removal



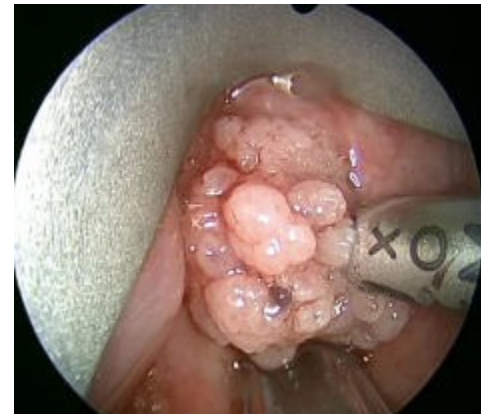
Laryngeal papilloma- Juvenile Recurrent Respiratory Papillomas

- JRRP
- HPV
 - Types 6,11
- 2-5 years of age
 - Most commonly diagnosed by age 5
- Inspiratory stridor
- Hoarseness
- Diagnosis
 - Flexible laryngoscopy



JRRP

- Management
 - Surgical
 - Microlaryngoscopy
 - CO2 laser
 - Microdebrider
 - Intralesional
cidofovir



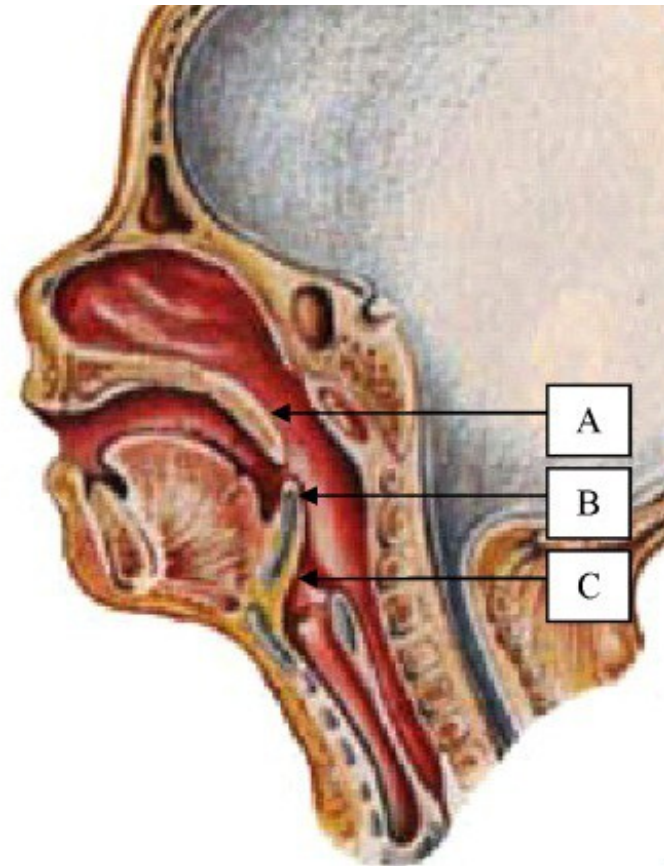
JRRP

- Management
 - Medical
 - Alfa-interferon
 - Indole-3-carbinol
 - Proton pump inhibitors
 - Beta mannan
 - Celebrex-
celecoxib



Stertor

- Airway obstruction above the level of the larynx
- Snoring-like noise from nasopharyngeal or oropharyngeal obstruction
- Awake patient



Stertor

- Congenital
 - Choanal atresia
 - Congenital pyriform aperture stenosis
 - Nasal lacrimal duct cyst(s)
 - Juvenile nasopharyngeal angiofibroma
 - Craniofacial abnormalities
 - Pierre Robin Syndrome
 - Down Syndrome
 - Treacher Collins Syndrome
 - Crouzon Syndrome

Choanal Atresia

- Persistence of the buccopharyngeal membrane
- 1 in 5000-8000 live births
- Respiratory distress at birth relieved by crying
 - Paradoxical cyanosis
- Feeding difficulties
- Unilateral > bilateral
- 29% bony
- 71% mixed bony and membranous
- Males < females



Choanal Atresia

- CHARGE Syndrome
 - C Coloboma of eye
 - H Heart abnormality
 - A Atresia of choanae
 - R Retarded growth/development
 - G Genital hypoplasia
 - E Ear anomalies/deafness

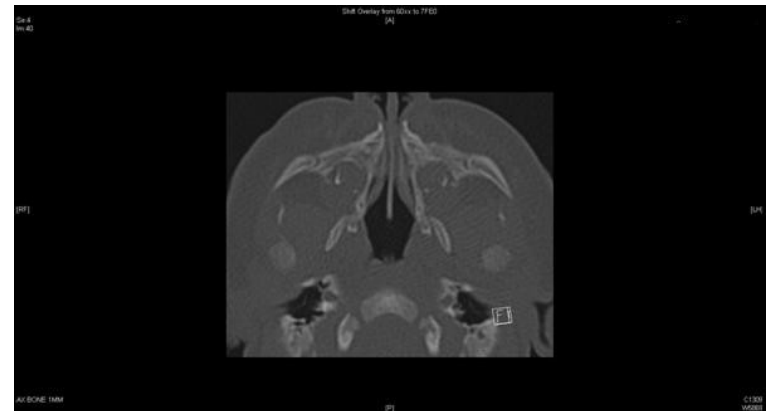
Choanal atresia

- Management
 - Nasal endoscopy
 - CT
 - Surgery
 - Transpalatal
 - Maldevelopment of dental arch and cross-bite
 - Endoscopic
 - Mitomycin-C



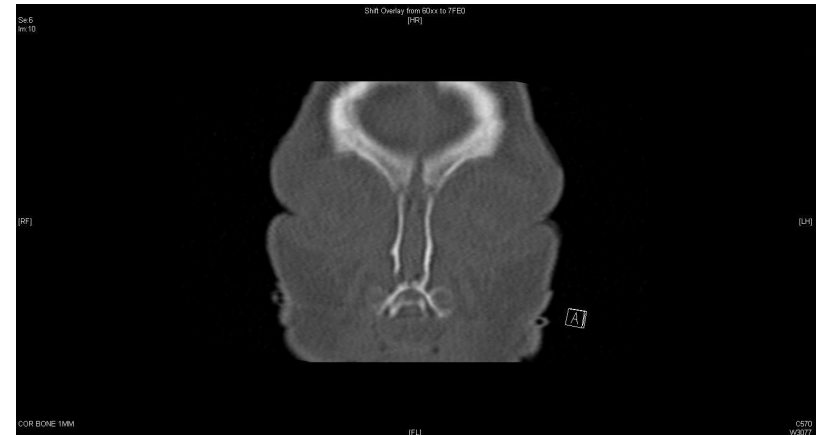
Congenital Pyriform Aperture Stenosis

- Bony overgrowth of the nasal process of the maxilla at occurs at 4 months gestation
- Pyriform aperture with $<11\text{mm}$
- Newborn with respiratory distress, poor feeding, FTT and recurrent cycles of cyanosis and apnea



Congenital Piriform Aperture Stenosis

- Associates abnormalities
 - Holoprosencephaly
 - Midline nasal cavity defects
 - Microcephaly
 - Cleft lip/palate
 - Hypopituitarism
 - Hypotelorism
 - Esophageal or duodenal atresia
 - Central megaincisor



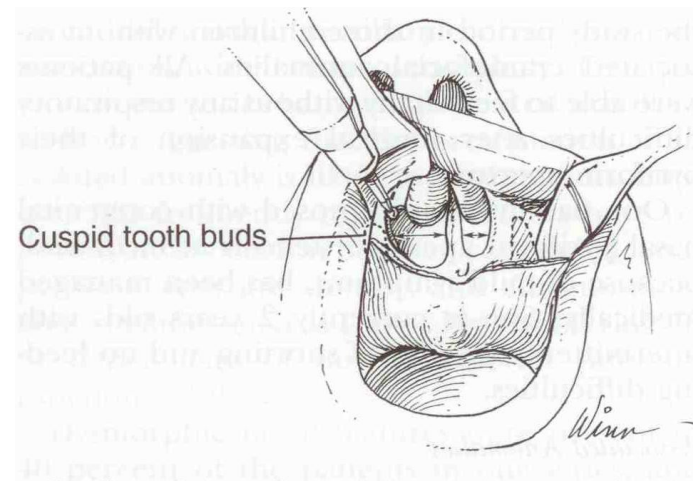
Congenital Pyriform Aperture Stenosis

- Management
 - Nasal endoscopy
 - CT
 - Medical
 - Steroid drops and topical decongestants



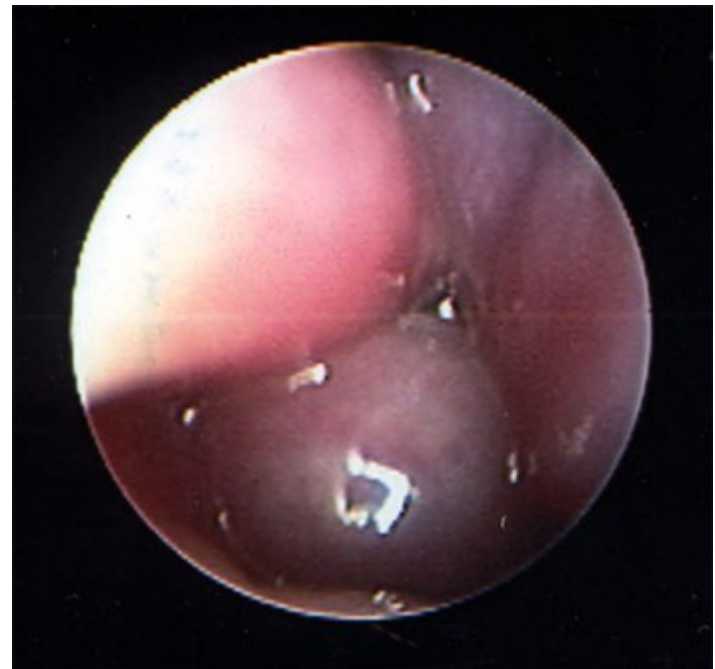
Congenital Pyriform Aperture Stenosis

- Management
 - Surgical
 - Bony removal floor of nose-sublabial approach with nasal stents



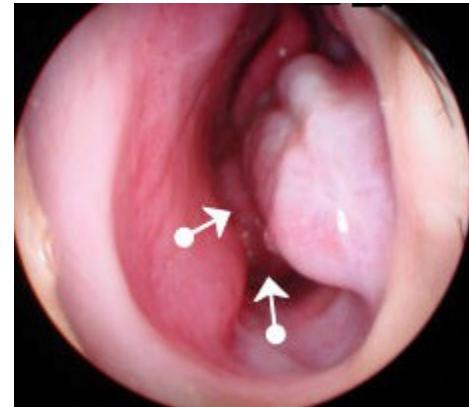
Nasolacrimal Duct Cysts

- Distal nasolacrimal duct obstruction
 - Incomplete canalization
 - Obstruction of the valves of Hasner
- Endoscopic resection or fenestration



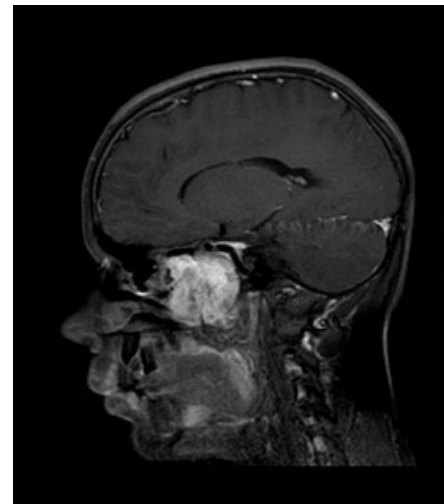
JNA

- Benign vascular tumor
- Arises from pterygopalatine fossa
- Presentation
 - Unilateral epistaxis
 - Nasal obstruction
 - Adolescent male
- Nasal endoscopy for diagnosis



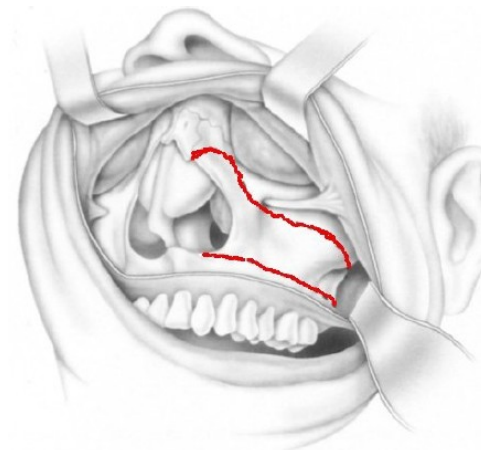
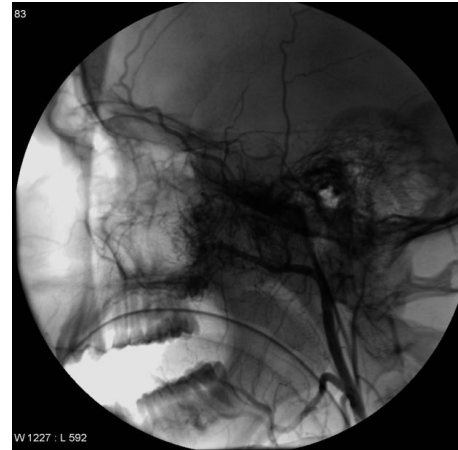
JNA

- Management
 - CT for extent of bony destruction and involvement of adjacent structures
 - MRI size of tumor



JNA

- Management
 - Arterial embolization
 - Open resection
 - Endoscopic resection
 - Radiation therapy
 - Hormone therapy



Pierre Robin Syndrome

- Retrognathia
- Micrognathia
- Glossoptosis
- Management
 - Airway
 - Feeding
 - Surgery
 - Tongue-lip adhesion
 - Mandibular distraction osteogenesis



Down Syndrome

- Midface hypoplasia
- Relative macroglossia
- Hypotonia
- High incidence of OSA



Treacher Collins Syndrome

- Midface abnormalities
 - Maxillary hypoplasia
 - Choanal atresia/stenosis
- Mandibular hypoplasia
- Tongue base abnormalities



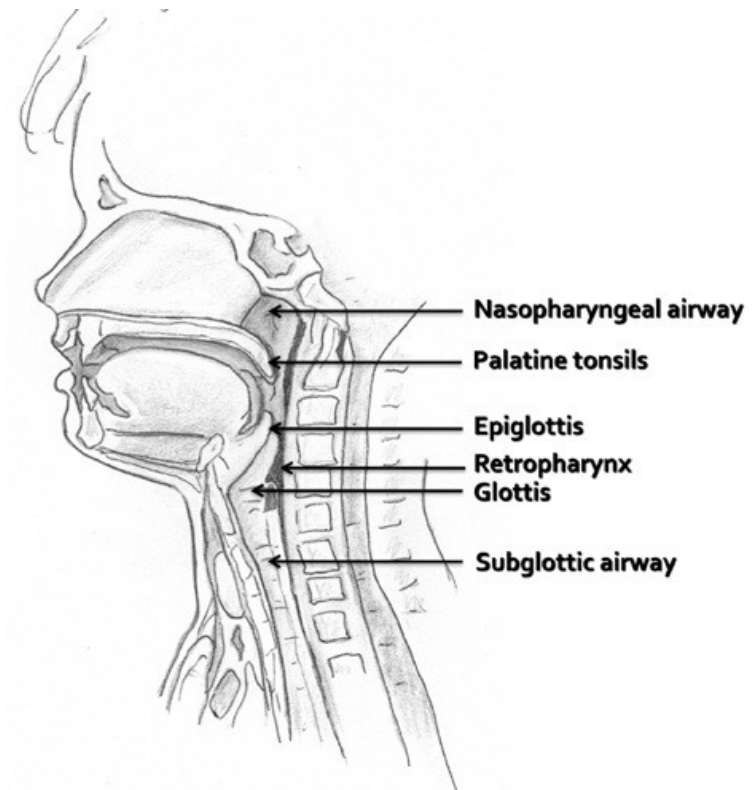
Crouzon Syndrome

- Midface hypoplasia
 - Choanal atresia/stenosis
- Tongue base abnormalities



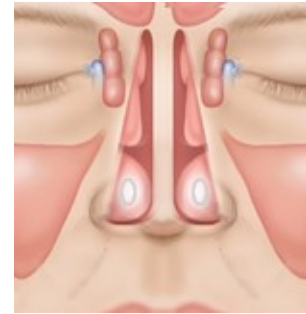
Stertor

- Acquired
 - Swollen turbinates
 - Adenoid hypertrophy
 - Foreign body
 - Nasal polyps
 - Peritonsillar abscess
 - Retropharyngeal abscess



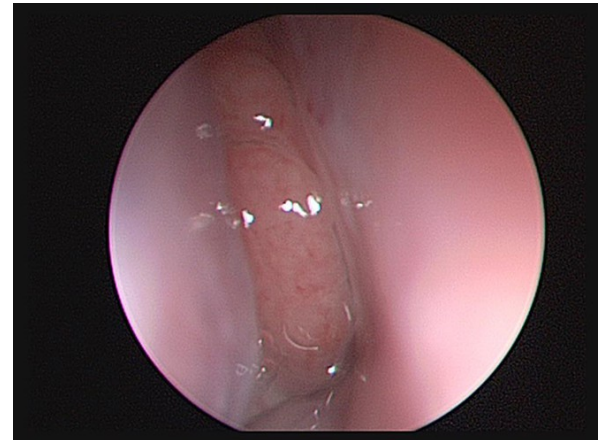
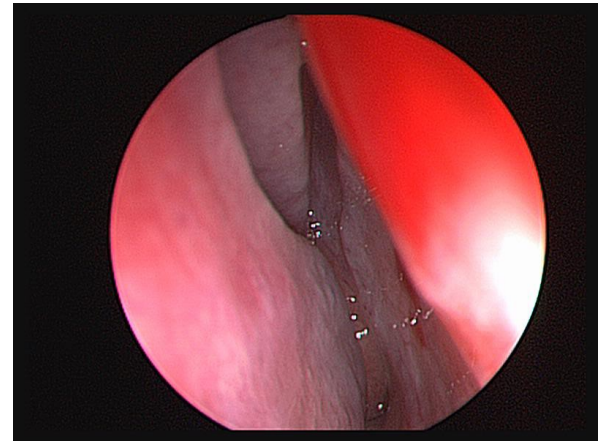
Swollen Turbinates

- Inferior turbinates
 - Allergy
 - Infection
- Treatment
 - Nasal steroids
 - Antihistamines
 - Oral
 - Topical
 - Surgery
 - Usually reserved for adults



Adenoid Hypertrophy

- Nasal obstruction
 - Mouthbreathing
 - Darth Vader
 - Hyponasal speech



Adenoid Hypertrophy

- Evaluation
 - Nasal endoscopy
 - CT- only when evaluating chronic sinusitis
 - Lateral neck x-ray not useful
- Treatment
 - Adenoidectomy
 - Nasal steroids



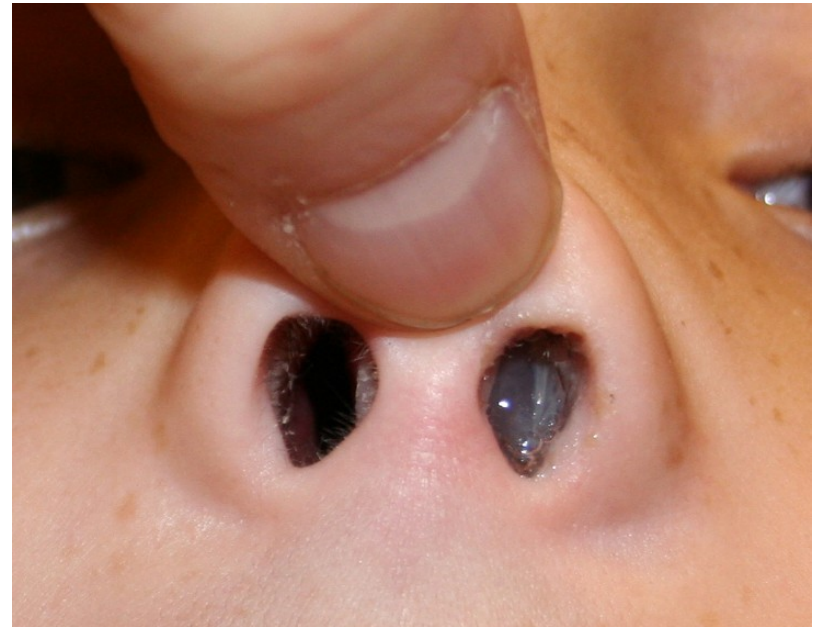
Nasal Foreign Body

- Persistent unilateral nasal drainage and obstruction



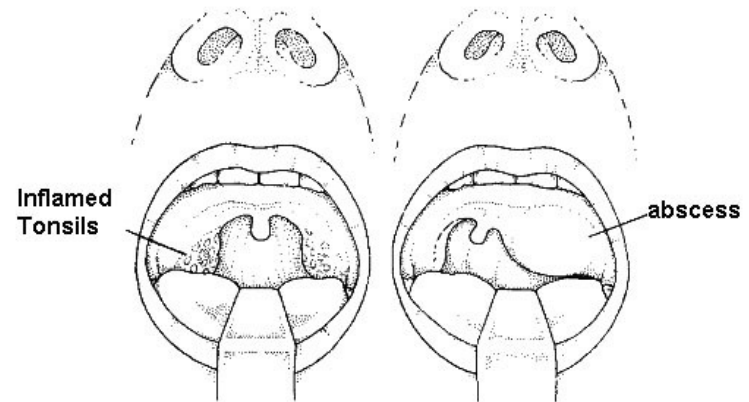
Nasal Polyps

- Cystic fibrosis
- Antrochoanal polyp
- Severe allergic rhinitis
- Samter's triad
 - Nasal polyps
 - Aspirin sensitivity
 - Asthma



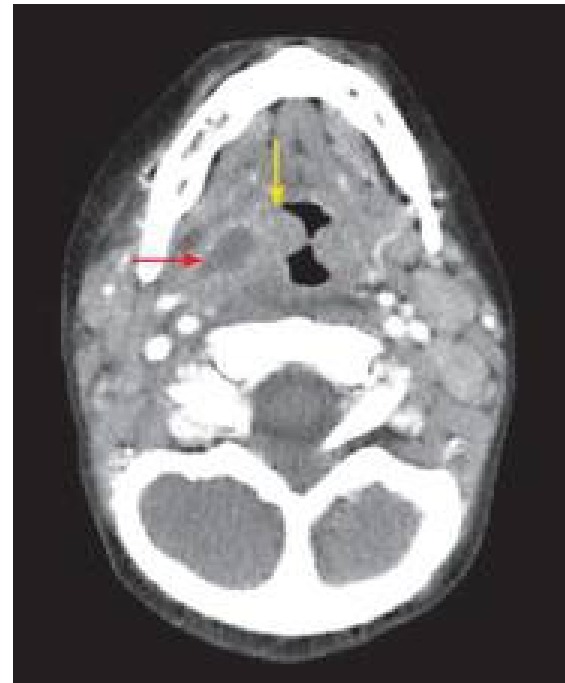
Peritonsillar Abscess

- Throat pain
- Dysphagia
- Trismus
- Uvular deviation
- Palatal edema



Peritonsillar Abscess

- Diagnosis
 - Physical exam
 - CT neck



Peritonsillar Abscess

- Management
 - Needle aspiration
 - Incision and drainage
 - IV antibiotics and steroids without surgery if only peritonsillar cellulitis



Retropharyngeal Abscess

- Abscess bulging on one or both sides of midline pharyngeal raphe
- Throat pain
- Dysphagia
- Pain with neck extension



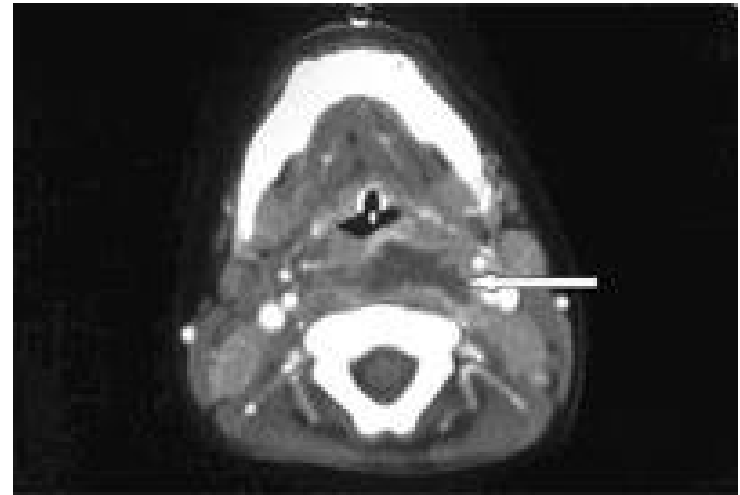
Retropharyngeal Abscess

- Diagnosis
 - History
 - Physical Exam
 - Soft tissue neck x-ray
 - Widening of prevertebral space
 - CT neck



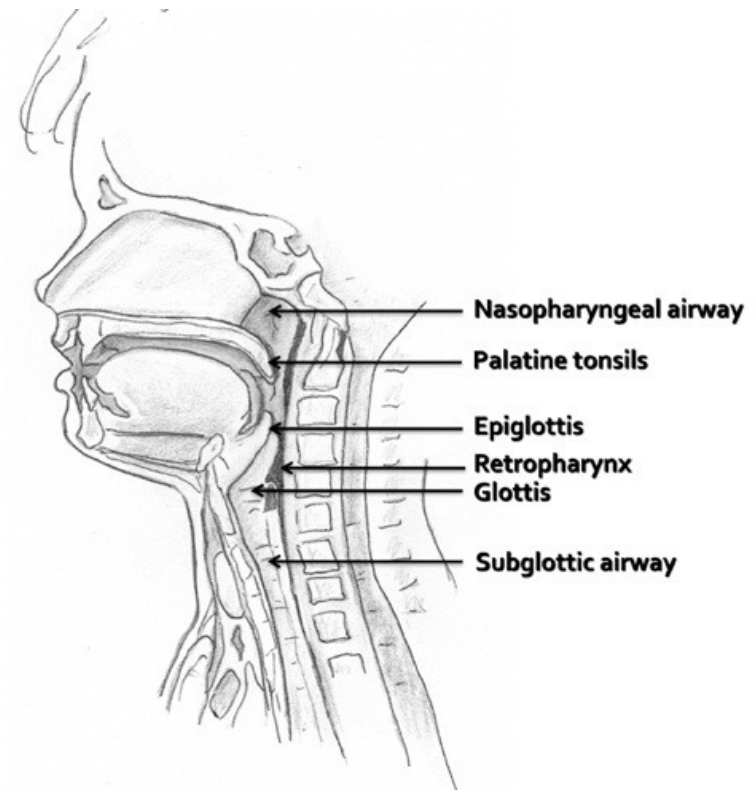
Retropharyngeal Abscess

- Management
 - Incision and drainage
 - Danger space 5
 - IV antibiotics



Snoring

- Turbulent airflow through the nasopharynx and oropharynx while sleeping.



Snoring

- Common pediatric causes
 - Adenoid hypertrophy
 - Tonsillar hypertrophy
 - Palatal abnormalities



Adenoid Hypertrophy

- Snoring
- Hyponasal voice
- Mouth breathing

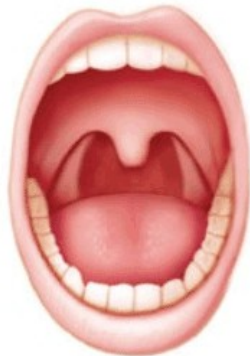


Tonsillar Hypertrophy

- “Kissing tonsils”
- Snoring
- Muffled voice
- Drooling
- Sleep disordered breathing
- Dysphagia



Tonsillar Hypertrophy



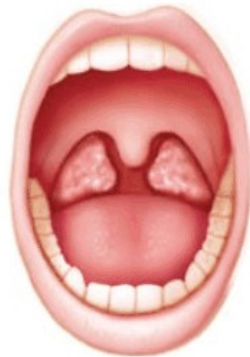
0
Surgically removed tonsils



1
Tonsils hidden within
tonsil pillars



2
Tonsils extending to the
pillars



3
Tonsils are beyond the
pillars

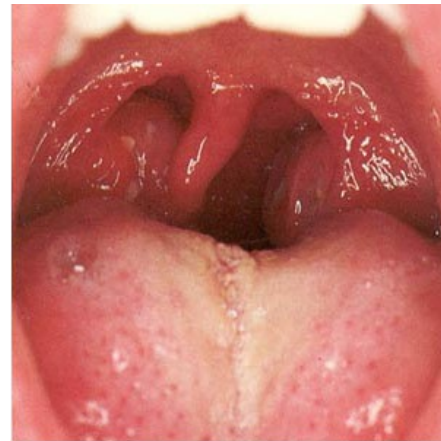


4
Tonsils extend to midline



Tonsillar Hypertrophy

- Acute strep pharyngitis
- Infectious mononucleosis
- Management
 - CPAP
 - Tonsillectomy if persistent upper airway obstruction or recurrent infection



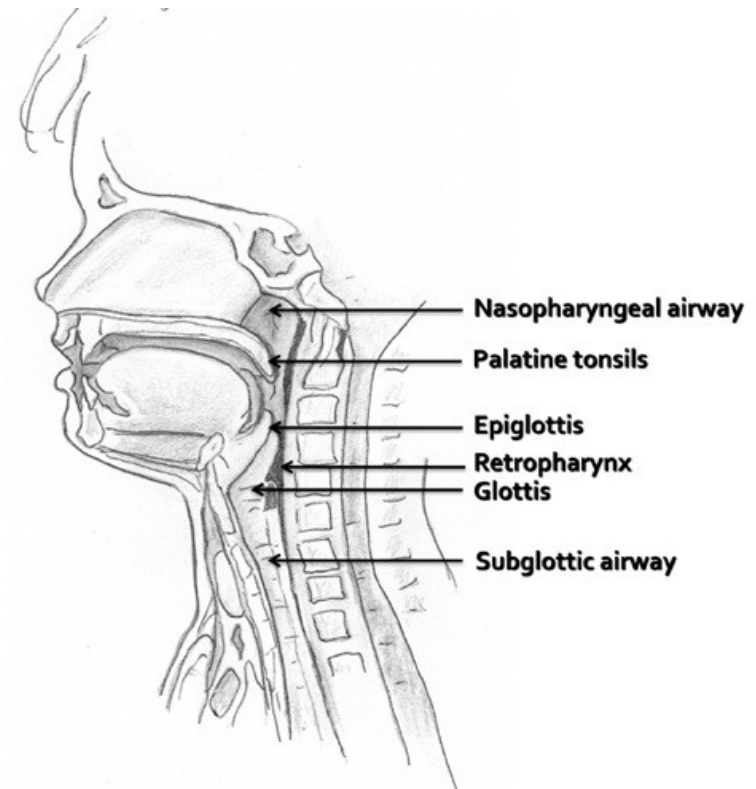
Palatal Abnormalities

- Elongated uvula
- Redundancy of soft palate
- Narrowing of the oropharynx
- Treatment
 - Tonsillectomy
 - CPAP
 - UP3



Pediatric Airway Problems

- Stridor
- Stertor
- Snoring





Thank you!



Questions?

