

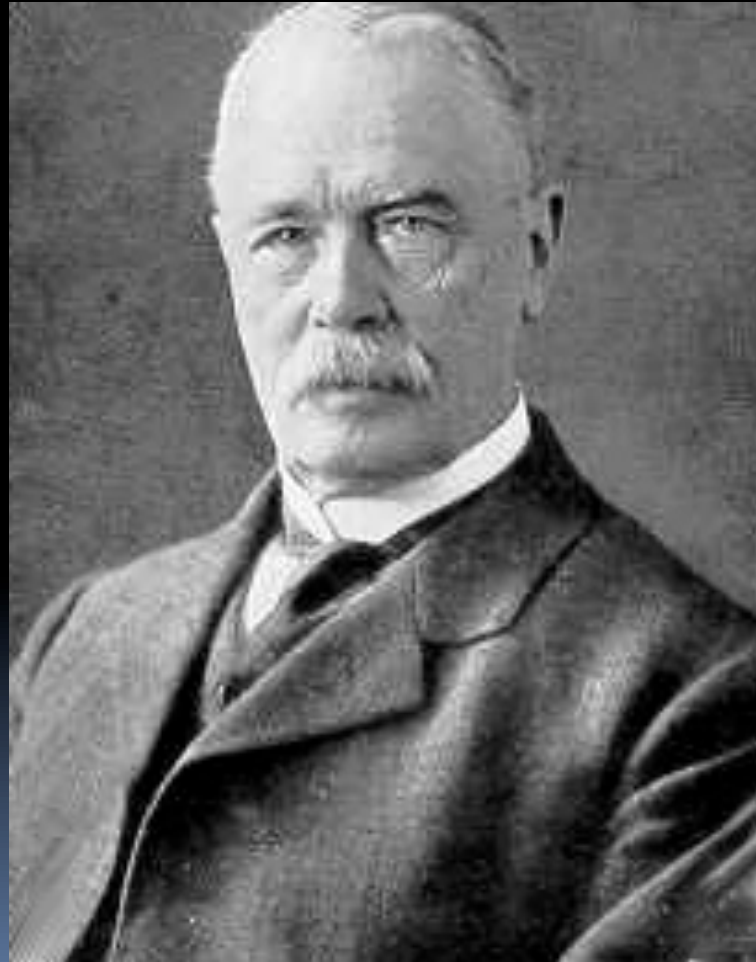


UCLA Head & Neck Surgery Resident Lecture Series
Marc Cohen, M.D.



LARYNGEAL COMPLICATIONS OF ENDOTRACHEAL INTUBATION

A little history...



Video tutorial



A little history...



A little history...

- By 1910, intubation for anesthesia had become an accepted practice
- During WWI, Magill and Macintosh made profound improvements
- In 1970, high-volume, low pressure cuffs were introduced

Prolonged intubation vs. tracheotomy?

- In the 1960's, long term intubation for the management of premature LBW infants was recommended
- Until.... Subglottic stenosis was recognized

Indications for endotracheal intubation

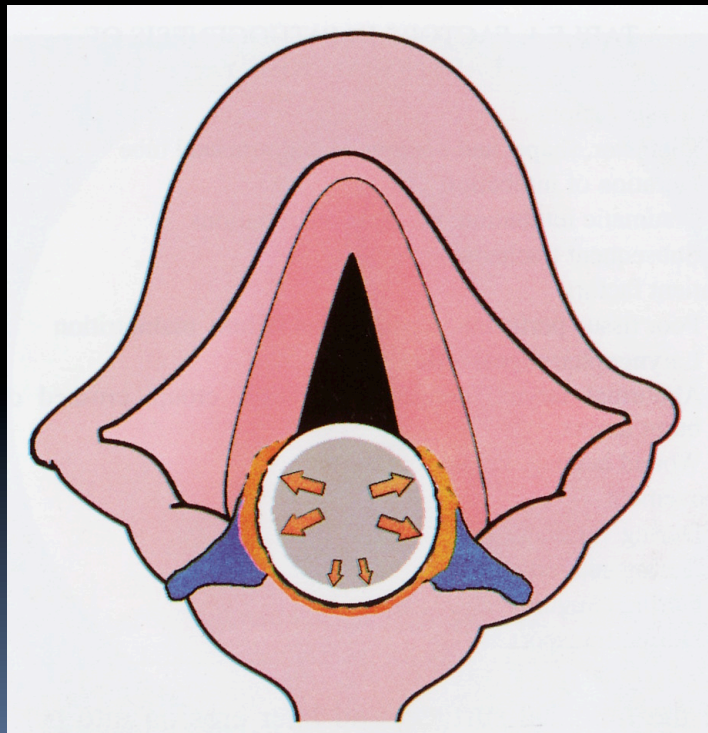
- 1. Temporary relief of upper airway obstruction
- 2. Assisted ventilation for respiratory failure
- 3. Pulmonary toilet

What are the potential complications of endotracheal intubation?

- Edema
- Granuloma
- Healed fibrous nodule
- Interarytenoid adhesion
- Posterior glottic stenosis
- Subglottic stenosis
- Healed furrows
- Ductal cysts
- Hematoma
- Laceration
- Subluxation of arytenoid cartilage
- Loss of mobility of cricoarytenoid joint
- Vocal cord paralysis
- Nasogastric tube syndrome

Pathogenesis

Pressure-Induced Injuries



Vulnerable structures

- Medial surfaces of arytenoids
- Vocal processes
- Cricoarytenoid joints
- Cricoid cartilage
- Posterior glottic/Interarytenoid region

Pathogenesis

- Supraglottic structures may become edematous, but *rarely* sustain serious damage
- Tracheal injuries have also become less significant due to low pressure cuffs
 - Although there is potential for injury if the cuff is inflated too high

Pathogenesis

- The microcirculation of the mucosa and mucoperichondrium is interrupted when pressure from the ETT exceeds capillary pressure
- Ischemia → Necrosis → Edema, Hyperemia, Ulceration, and Erosion

Factors for susceptibility

- Extrinsic factors
 - Diameter of ETT
 - Duration of intubation
 - Traumatic or multiple intubations
- Patient factors
 - Poor tissue perfusion (i.e. sepsis, organ failure, etc)
 - LPR
 - Abnormal larynx
 - Wound healing, keloid
- Movement
 - During ventilator use
 - During suctioning
 - During coughing
 - During transport

“Laryngeal Bed sore”

- Superficial ulceration can occur within hours of intubation
 - Usually heals without scarring
- As ETT pressure continues, migration of inflammatory cells ensues
 - If epithelial erosions are incomplete, epithelium may be replaced by squamous metaplasia
- Further pressure causes ulceration through mucosa to cartilage
 - Causes perichondritis and destructive chondritis
 - As opposed to superficial damage, deeper ulceration heals by secondary intention and fibrosis

Edema

- 3 locations

1. Reinke's space

Usually persists after extubation

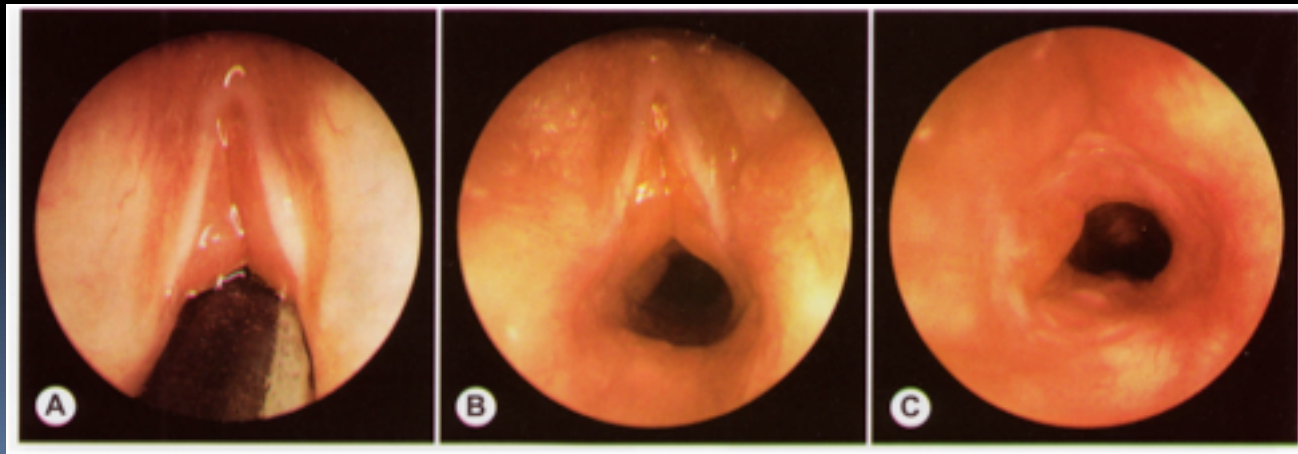
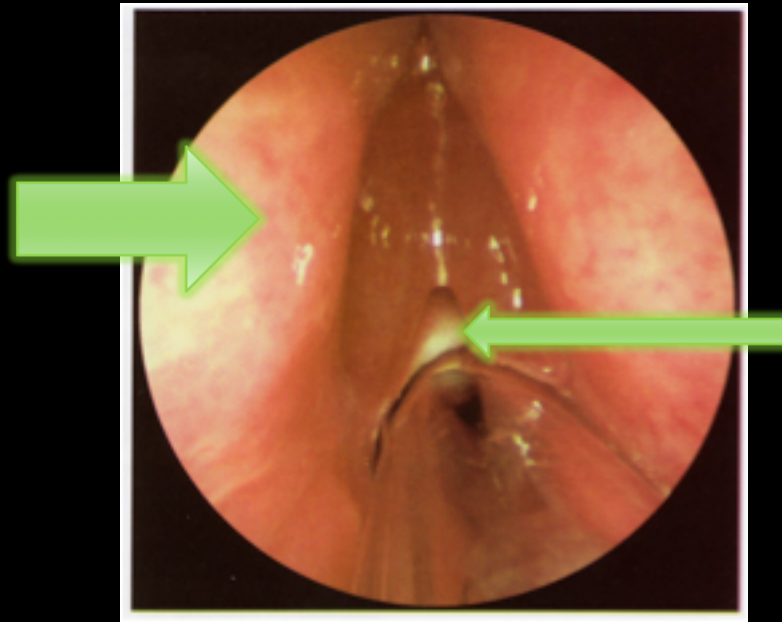
2. Ventricular mucosa, seen as "protrusion"

Usually resolves after extubation

3. Subglottis

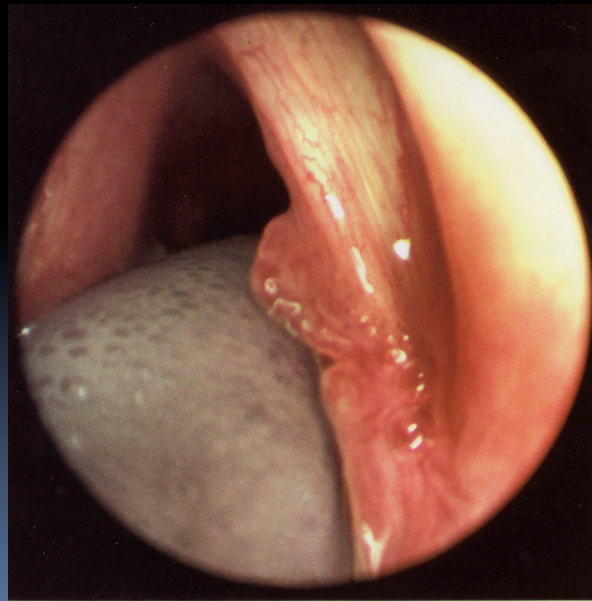
Usually resolves after extubation

Edema

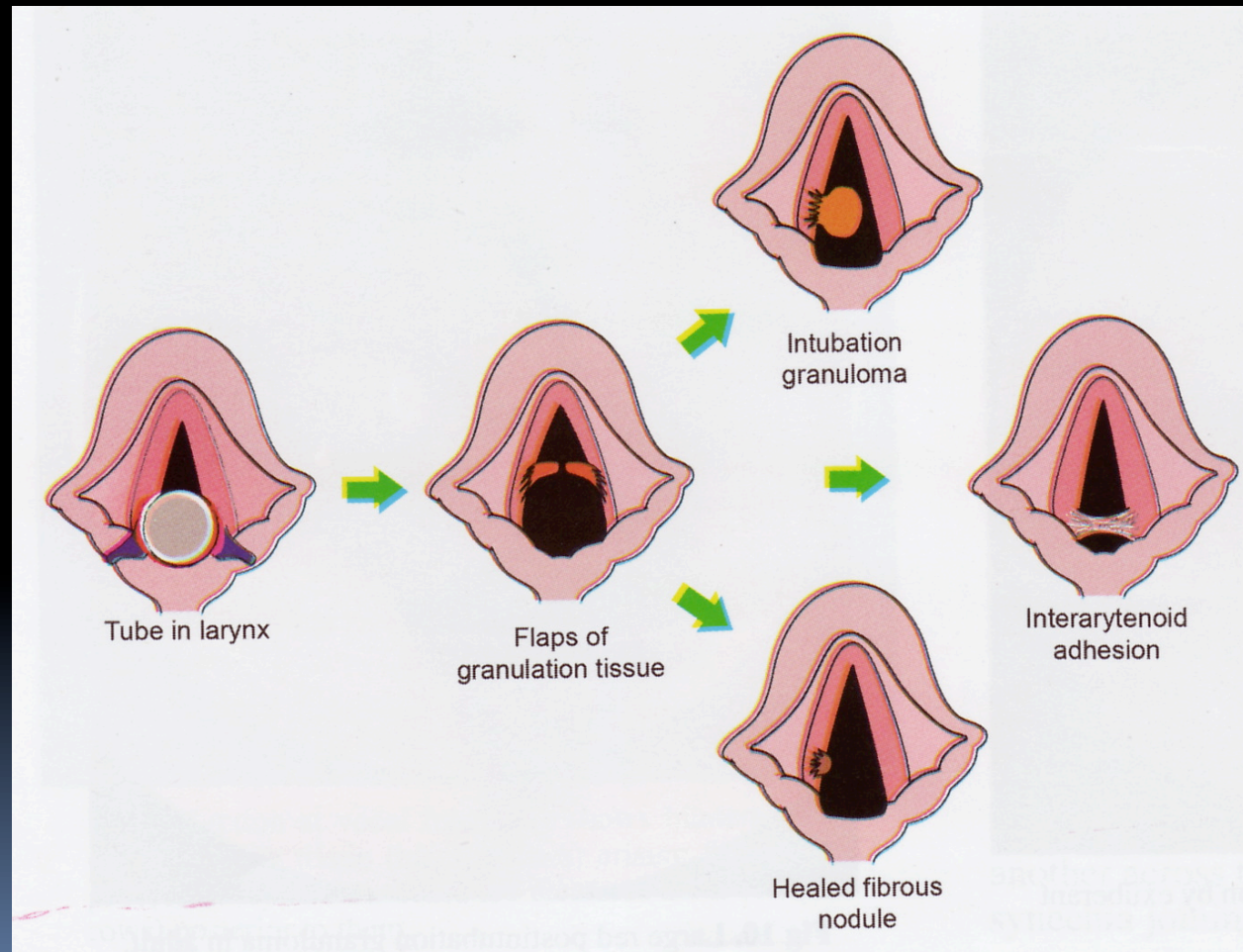


Granulation tissue

- Seen within 48 hours
- Proliferate at periphery of ulcerated areas



Pathogenesis



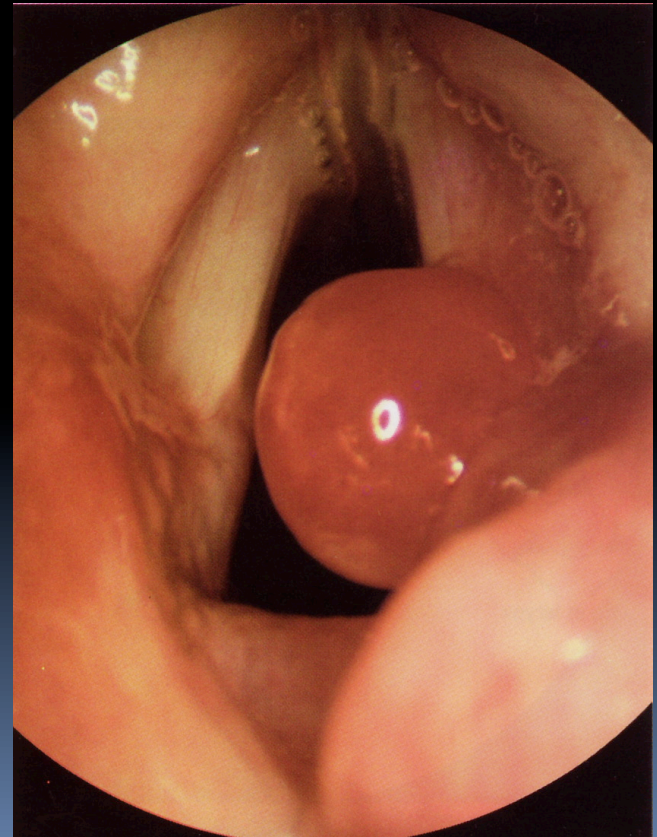
Granulation tissue

- Flaps of granulation tissue
 - Can move with inspiration/expiration
 - Inspiratory stridor
 - Not recommended to excise both sides
 - Most cases will resolve without any intervention once ETT is removed

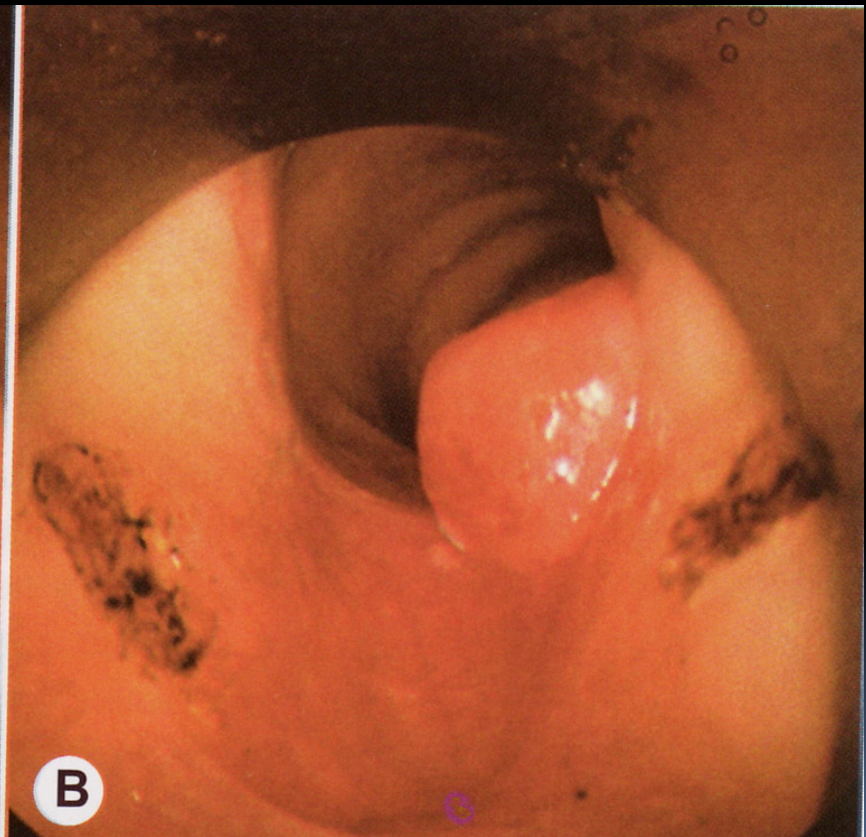
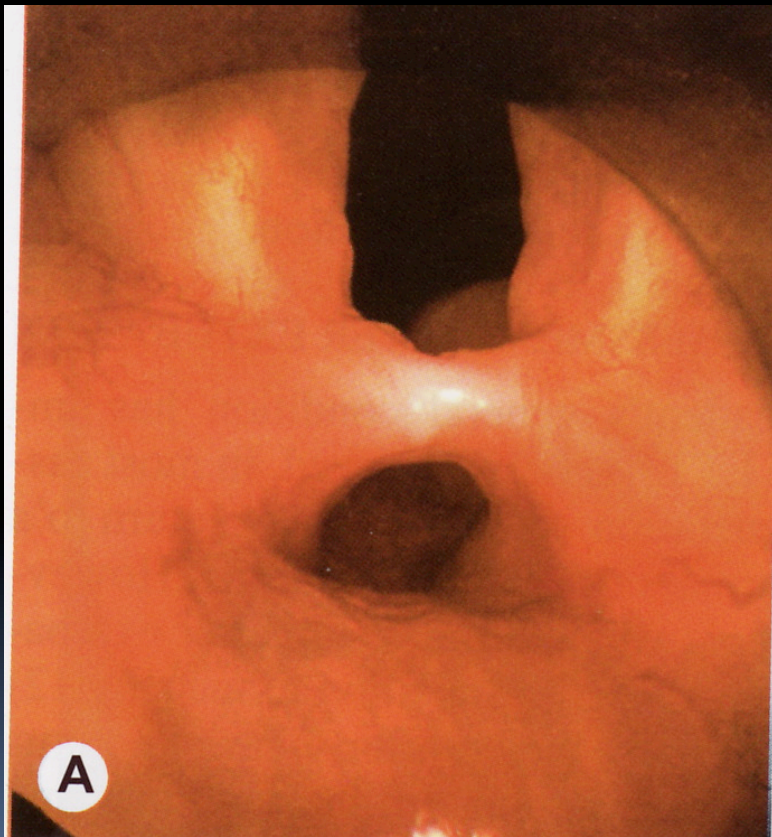


Granulation tissue

- Incomplete resolution of granulation tissue can yield:
 - Postintubation granuloma
 - Healed fibrous nodule



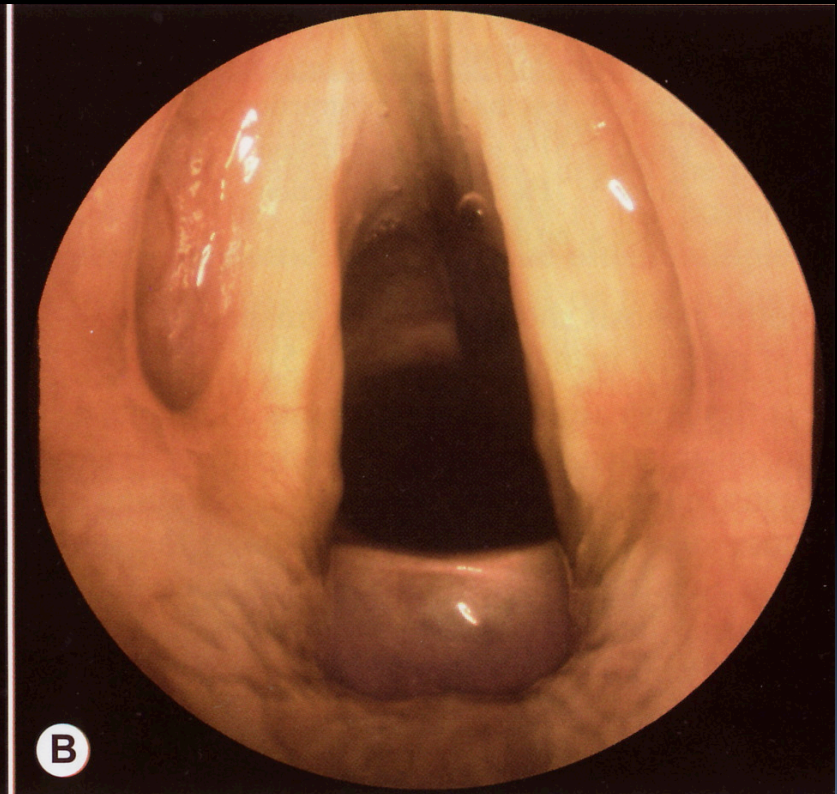
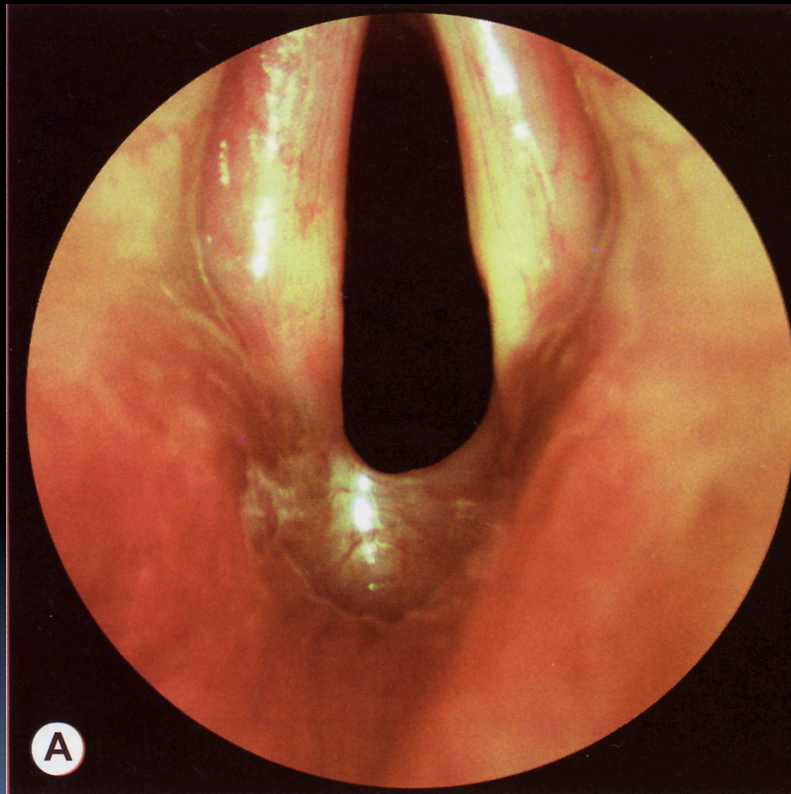
Interarytenoid adhesion



Posterior glottic stenosis

- Forms when scar contracts after wide ulceration **with no intact median strip of mucosa**
- Vocal cords unable to abduct
- Glottis remains partly closed
- Inspiratory stridor
- Voice is usually unaffected
- Treatment: deep vertical division with laser or 11 blade down to level of cricoid
 - Re-stenosis is likely
 - Costal cartilage graft may be necessary (endoscopically or open)

Posterior glottic stenosis



Subglottic stenosis

- Many causes
- In infants, most common factors related to acquired SS are ETT size and LPR during long-term intubation
- Presentation in an infant:
 - Failed extubation
 - Recurrent or atypical croup
 - Slowly progressive airway obstruction
 - Difficulty passing ETT
 - Postanesthesia stridor

Cotton-Myer Grading System

- Grade I - < 50 % obstruction
 - Grade II – 51-70% obstruction
 - Grade III – 71-99% obstruction
 - Grade IV – No detectable lumen
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- Rule of thumb:
 - Subglottic diameter < 4.0 mm in a full-term infant is the lower limit of normal (< 3.0 mm in a preterm infant)

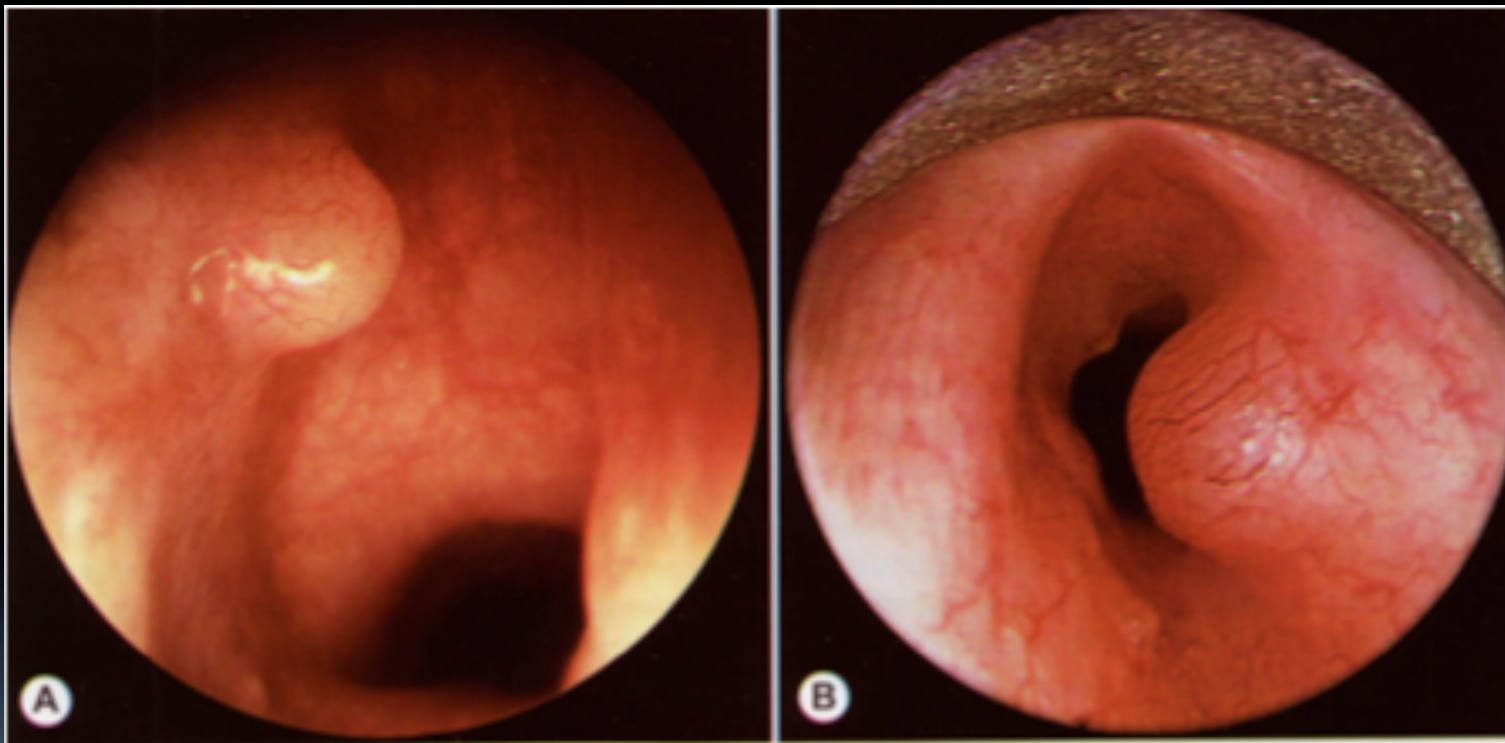
Subglottic stenosis

- When repeated attempts at extubation fail:
 - Reintubate with smaller ETT
 - Racemic epinephrine
 - Dexamethasone
 - If these maneuvers fail:
 - Cricoid split with/without cartilage graft
 - Tracheostomy

Ductal Cysts

- Result from retention of mucus in obstructed, dilated ducts of submucosal mucous glands
- Most are small and require no treatment
- When large and cause obstruction, endoscopic removal is required

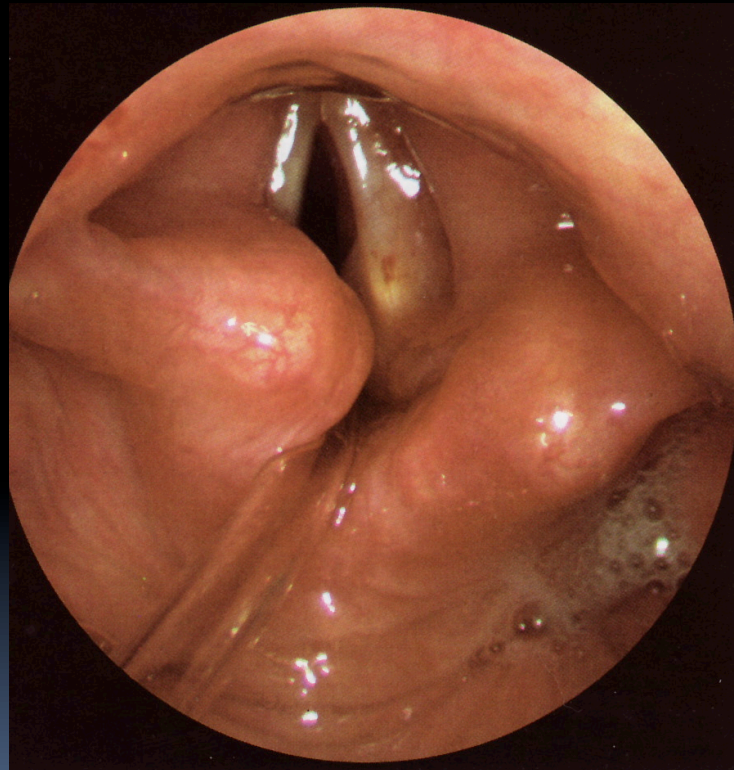
Ductal cysts



Arytenoid dislocation

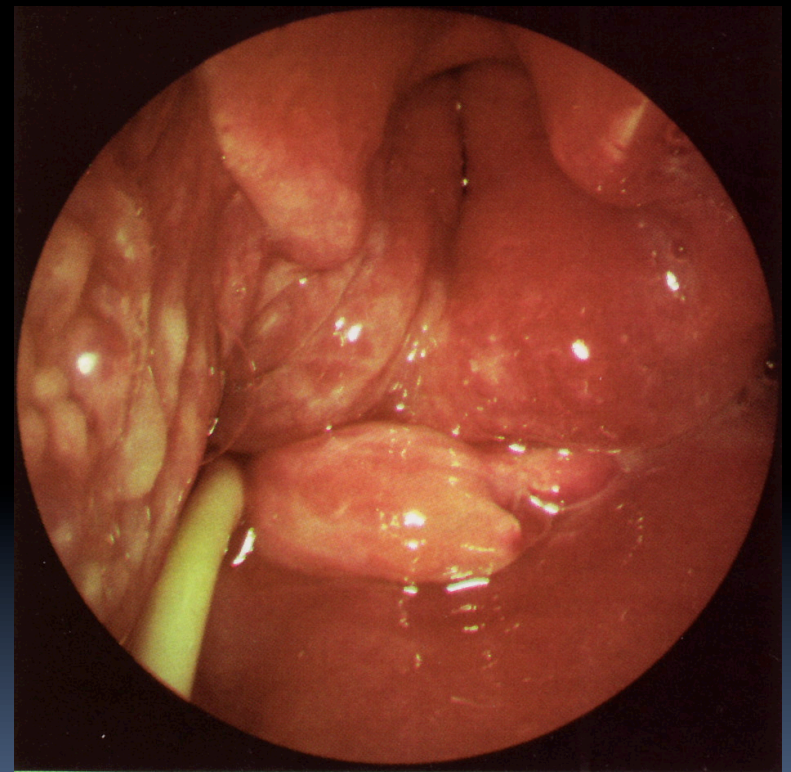
- May occur during passage of an ETT
- Left arytenoid is usually affected since intubation occurs from right side of mouth
- Patient will complain of hoarseness, throat discomfort, odynophagia, and cough
- Microlaryngoscopy and closed reduction should be performed early

Arytenoid dislocation



Nasogastric tube syndrome

- Occurs when NGT rests centrally, rather than laterally
- Anterior wall of hypopharynx/posterior wall of cricoid becomes ulcerated
- Results in perichondritis, chondritis, necrosis
- Can progress to sudden, life-threatening bilateral vocal cord paralysis due to myositis of PCA muscles
- Diabetics and renal transplants who are in renal failure are especially vulnerable
- Warning signs: hoarseness, otalgia, and odynophagia
- Treatment: remove NGT, abx, G-tube, and possible tracheostomy



Timeline of postextubation obstruction

- Immediate: flaps of granulation tissue, laryngeal spasm
- Minutes to hours: flaps of granulation tissue, subglottic edema, granulation tissue, LPR
- Days to weeks: persistent edema or granulation tissue, granuloma
- Months: posterior glottic stenosis, subglottic stenosis

To trach or not to trach?

- One school of thought is that anyone who is intubated longer than 7 days should undergo tracheotomy
- Newer recommendations are for DL after 7 days – if no evidence of significant laryngeal pathology, keep the patient intubated unless plan for long-term tracheostomy