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 Bedsore”

- 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

- Tube in larynx
- Flaps of granulation tissue
- Intubation granuloma
- Interarytenoid adhesion
- Healed fibrous nodule
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

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.