Neonatal Airway Disorders, Treatments, and Outcomes

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Disclosure

• I have nothing to disclose
Neonatal and Pediatric Tracheostomy

• Tracheostomy first described in adults in 100 BC
• High mortality at the beginning (25%) significantly reduced over 20th century
• Advent of better ventilation for premature infants associated with increased need for tracheostomy
Decision to Perform Trach

• Care conference of providers prior to discussion of trach
• Care conference with family to discuss trach
• Trach educator specialist has in depth meeting with family to go over taking care of child with trach
• Family identifies two care givers who will learn all of the trach care items
Neonatal Tracheostomy

- 1% mortality per year trach is in
- Likely higher in patients with other underlying co-morbidities (cardiac, vent, poor support)
- Not typically performed until child is 2kg
- Sedation vs paralysis after tracheostomy needs to be discussed between surgeon and ICU
- Trach change done at post op day 3-7
NSQUIP DATABASE REVIEW

• 61 hospitals, 206 children < 2 for trach
  – 25% experienced complication in first 30 days
    • 8% Pneumonia
    • 6% Sepsis
    • 6% death

• Risk factors: neonatal age, IVH, Cardiac dz

Procedure
Questions to Ask your Surgeon

• Can the patient be intubated from above?
• When will you change the trach?
• Does the patient need to be sedated/paralyzed?
• How long for sedation/paralyzation?
• How far is the trach above the carina?
Complications of Trach

- **Immediate**
  - Pressure ulcer
  - False tract

- **Ongoing**
  - Accidental decannulation
  - Plugging from secretions or granulation tissue

- **Delayed**
  - Tracheoinnominate fisula
  - Tracheal stenosis or distal obstruction (granulation tissue)
Pressure Ulcer
False Tract
Stomal Maturation
Plugging
Granulation Tissue
Tracheoinnominate Fistula
Humidification

• Critical, as upper airway typically humidifies air before it enters the airway
• Reduces the incidence of lower airway plugging
• Trach collar, vent circuit, or HME (heat and moisture exchanger) used all the time
Suctioning

• Suctioned on a regular basis and if:
• Measured suctioning with appropriate size suction catheter
• Avoid suction pressure of greater than 120 mmHG
• Not needed to use saline routinely
• Repeated deep suctioning will cause trauma
Trach Change and Care

• Change trach on at least a weekly basis after first change
• Trach change should be done by 2 people who are experienced in trach care
• Same size and one size smaller trach should be available
• Trach dressing can be changed everyday
Indications for Tracheostomy

- Subglottic Stenosis
- Laryngeal Developmental Anomalies
- Tracheal Compression
- Tracheal Stenosis (if fails repair)
- Bronchomalacia
- Failure to extubate due to chronic lung disease
Subglottic Stenosis

• Difficult to discern whether it is congenital or acquired
• Present as persistent or worsening stridor, recurrent croup, or inability to extubate
• First diagnostic exercise is flexible fiberoptic laryngoscopy
• Further investigation with diagnostic bronchoscopy
  – Newborn subglottis=4mm
  – Premature subglottis=3mm
Subglottic Stenosis
Intubation Consequences

- Can occur even after short times of intubation
- Results in fronds of granulation tissue or furrows in the mucosa over the arytenoids
- Intubation may also cause mucosal retention cysts
- Fusion of concentric narrowing (SGS), posterior scarring (posterior glottic stenosis), or laryngeal webbing
Intubation Complications
Airway Pressure Ulcers
How Do You Avoid This?

- Always use the smallest tube possible
- Do not use a cuff unless absolutely necessary
- Manage any reflux disease aggressively
- Recognize that some patient may have smaller subglottic area (ie Down syndrome)
- If there is no leak with a tube, it is too big, even for a short period of time
How do you fix it?

• **Subglottic Stenosis**
  – Need to augment the airway after expansion
  – In neonatal period can do if otherwise healthy using thyroid alar cartilage
  – In older patients costal cartilage is used to expand the airway in order to decannulate the patient

• **Tracheal Stenosis**
  – Usually resection and re-anastomosis
Cricoid Split

- Extubation failure on two occasions or more due to laryngeal pathology
- Patient weight > 1500 grams
- Minimal supplemental oxygen requirements
- No active respiratory infection
- Good pulmonary and cardiac function
Thyroid Alar Grafting
Cartilage Grafting of Subglottic stenosis
Posterior Grafting
Tracheal Resection
Endoscopic Posterior Grafting
Laryngeal Webs

• Laryngeal Web
  – Represents a failure of airway recanalization
  – Associated with VCFS
  – May be isolated anomaly, or have cardiac and distal airway problems
  – May require simple lysis, or trach
  – There are 4 grades with progressive airway narrowing, with grade 4 representing complete laryngeal atresia often with associated TEF
Laryngeal Webs
Laryngeal Clefts

- Uncommon
- Universally associated with tracheomalacia and other defects
- May extend from the larynx to the carina
- Suffer recurrent aspiration
- Repair endoscopically if accessible, otherwise open surgical procedure which may require bypass
Laryngeal Cleft
Tracheomalacia

- Treatment based on related anatomy
- Often associated with other airway pathology (TEF, laryngeal cleft)
- Must address extrinsic compression
- If intrinsic or unable to address compression trach may be necessary
- Most children will become asymptomatic after 2
- May need customized trach with appropriate length
Tracheomalacia
Innominate Artery Compression

• Most common vascular compression
• Can be diagnosed on bronchoscopy by placing pulse oximeter on right hand and occluding innominate
• If symptoms are recurrent or severe, aortapexy may be indicated
• Bronchoscopy at time of aortapexy ensures relief of obstruction
Innominate Artery Compression
Complete Tracheal Rings

• Tracheal cartilages are usually 4-5:1 ratio with pars membranosa
• Normally the only complete cartilagenous ring is the cricoid
• Also known as the “stove pipe” trachea
• Often associated with pulmonary artery sling
• May be associated with pulmonary agenesis
Complete Tracheal Rings
Surgical Repair of Tracheal Rings
Bronchomalacia

- Abnormal collapsability of the bronchus
- Must determine if intrinsic or extrinsic
- Presentation may be with recurrent pneumonias with persistent secretions
- If severe enough may cause respiratory compromise and air trapping
- Treatment
  - CPAP
  - Trach
  - Stent
Bronchomalacia
Going Home

• Ensure that two care givers who can change the trach have done this and been checked off
• Care givers need to complete CPR
• Home health medical device company identified with trach expertise
• Home health nursing for what period of time
• Rooming in for 2 days prior to discharge
Going Home
Trach Surveillance

- Best care seen in multidisciplinary setting with speech, RT, ENT and Pulmonary
- Assess trach needs, feeding status and vocal status
- Upsize trach as patient grows, on a yearly basis
- Perform yearly airway surveillance in the OR
Removal of Trach

• Depends on primary reason for trach
• For airway stenosis likely needs airway reconstruction prior to removal
• For pulmonary reasons will need to be off oxygen on the ventilator for a period of time
• Vocal cord function and airway patentcy should be assessed PRIOR to decannulation
Decannulation

- Must go through winter cycle with URI but no need to admit or get oxygen
- Tolerate trach capping, with or without sleep study
- Be able to be intubated from above
- Undergo airway surveillance and then removal of the trach with observation in the hospital overnight
Summary

**our accomplishments**

**AS OF OCTOBER 2015:**

- 30 hospitals on four continents have joined GTC
- Member hospitals include adult and pediatric institutions
- Academic centers and community/district hospitals
- Many others in process of joining
- > 750 patients in world-wide, HIPAA compliant database
- First data report due in November 2015
- Second North American kickoff scheduled on April 29, 2016 at Johns Hopkins Hospital

**our team**

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**join us**

1. Implement or expand upon best practices at your institution.
2. Participate in the Global Tracheostomy Collaborative (GTC) Database, allowing you to track your institution's tracheostomy care.
3. Benchmark with other centres.
4. Monitor adverse events.
5. Track changes in outcome as you implement interventions.
6. Receive support and education from international experts.
7. Learn directly from world leaders in tracheostomy care.

**THE GLOBAL TRACHEOSTOMY COLLABORATIVE**

“Within 12 months of joining the GTC, our institution and 3 local hospitals saw significant reductions in the nature, frequency and severity of harm resulting from the care of nearly 300 tracheostomy patients. Rapid adoption of GTC best practices saw new multidisciplinary initiatives contribute to reductions in hospital and ICU length of stay, reflecting better, more coordinated care.”

- Dr. Brendan McGrath, ICU Consultant, Manchester, UK
  - NHS England Tracheostomy Lead Clinician

All centres, regardless of level of expertise or coordination, will benefit from joining the GTC to allow their centre to benchmark.