THE UNIVERSITY OF TENNESSEE HEALTH SCIENCE CENTER

Treatment Options for Laryngotracheal Stenosis

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Disclosures

Scientific Advisory Board	CryOSA
Consulting	HuMannity; LivaNova
Research Funding	Nyxoah; CryOSA (Department)

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Case

- It is Friday afternoon and your partner is out of town
- You are asked to see one of his patients who is having difficulty breathing.
- 47-year-old man with a history of MVA with blunt neck trauma and prolonged intubation.
- He has posterior glottic stenosis with fixation of the bilateral arytenoid
- Your partner has performed several laser procedures to open airway; patient has refused trach tube.
- He is now in your office with stridor, chest wall retraction, and cannot lay flat.

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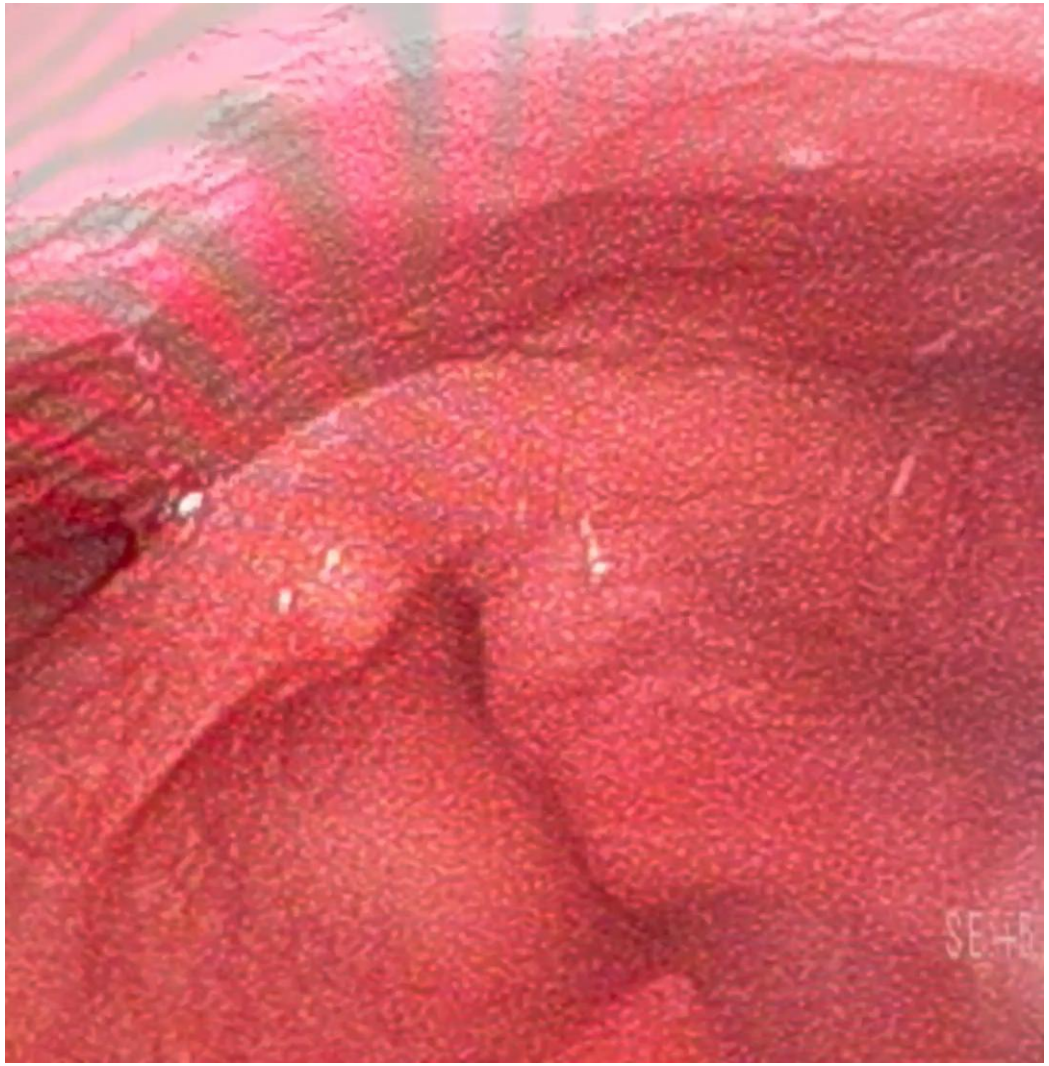

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Case

- Emergent airway management
- Awake tracheotomy (temporary)
- Resection of redundant soft tissue, false fold, left partial arytenoid, left posterior vocal fold

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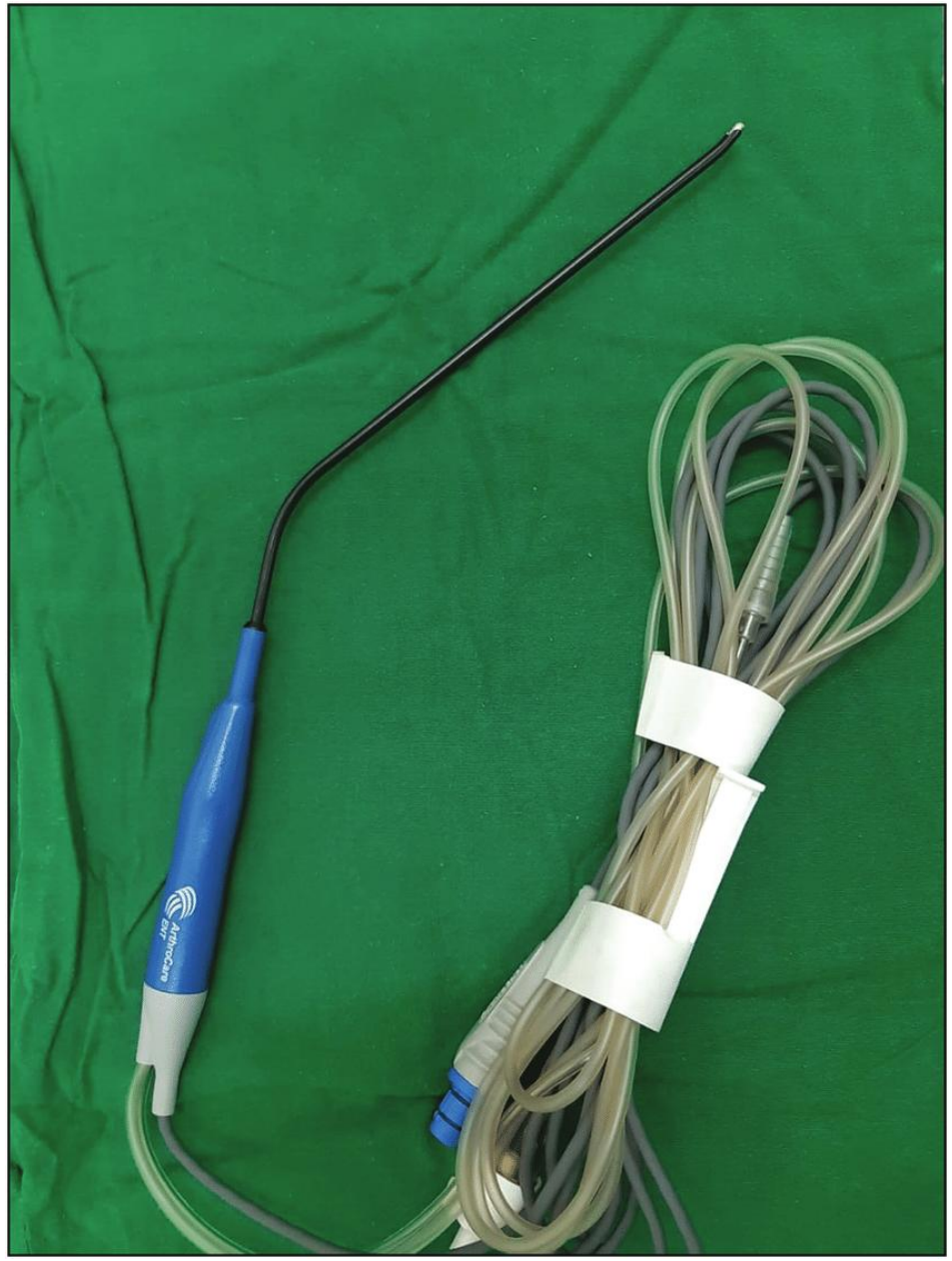

Coblation Technology (compared to CO2 laser)

- **Greater hemostasis (Ablation and Coagulation Mode)**
- **Rapid removal of bulk tissue**
- **Less airway fire risk (no free beam)**

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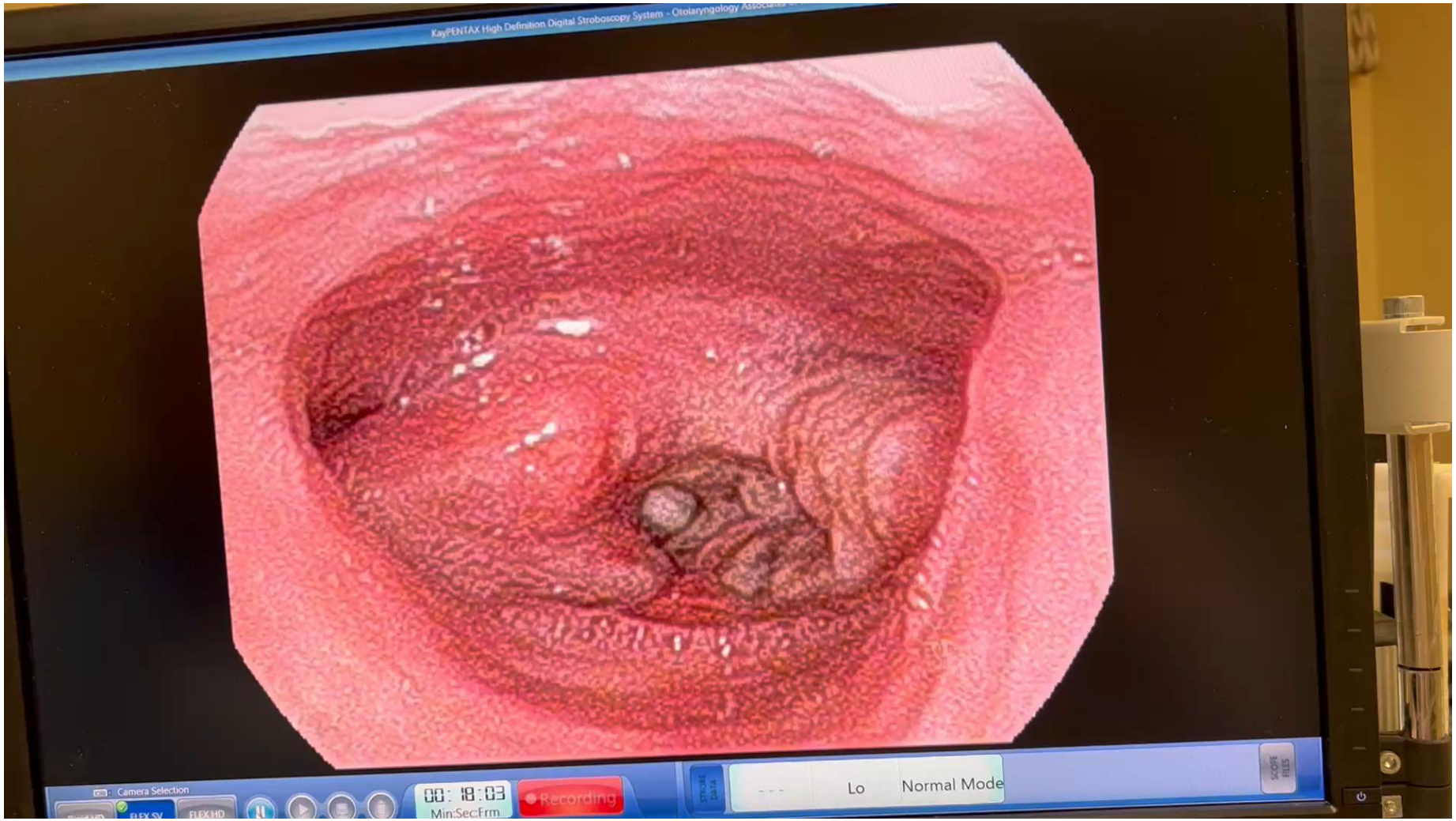

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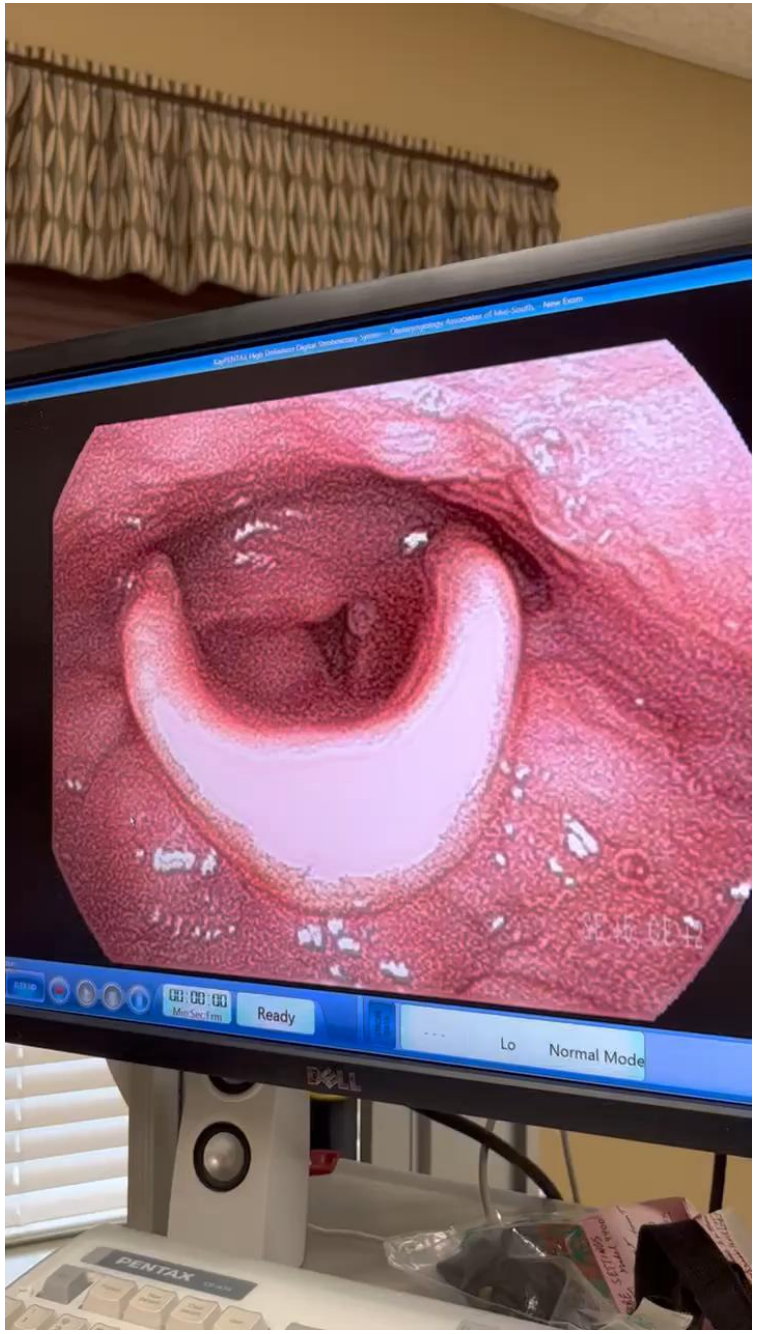

- Temporary aspiration of liquids (2-3 days)
- Decannulated at 2 weeks
- Breathy voice but very pleased
- Able to sleep soundly while lying supine for the first time in years.

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Laryngotracheal Stenosis
Increasing Incidence

- Better survival of ICU/Trauma patients
- Aging population
- Obesity (difficult anatomy)
- Poor tracheotomy technique and care

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Obesity = Difficult Airway Management

70% of patients (42/62) with stenosis treated at UTHSC over 18 month period were obese

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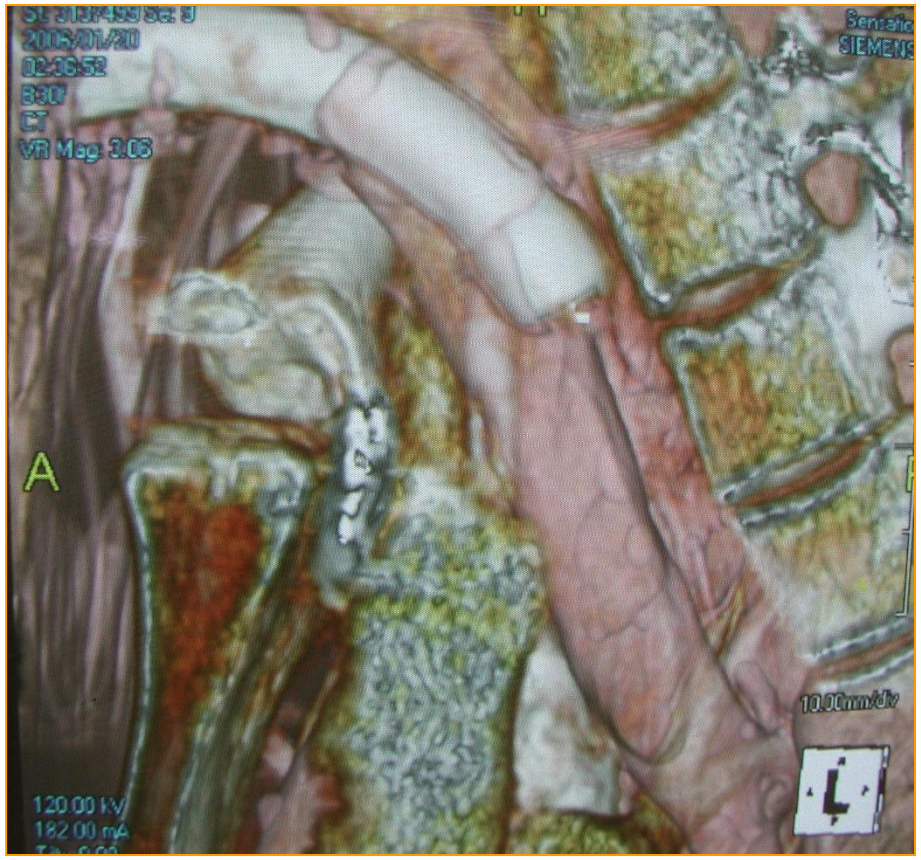
Etiology

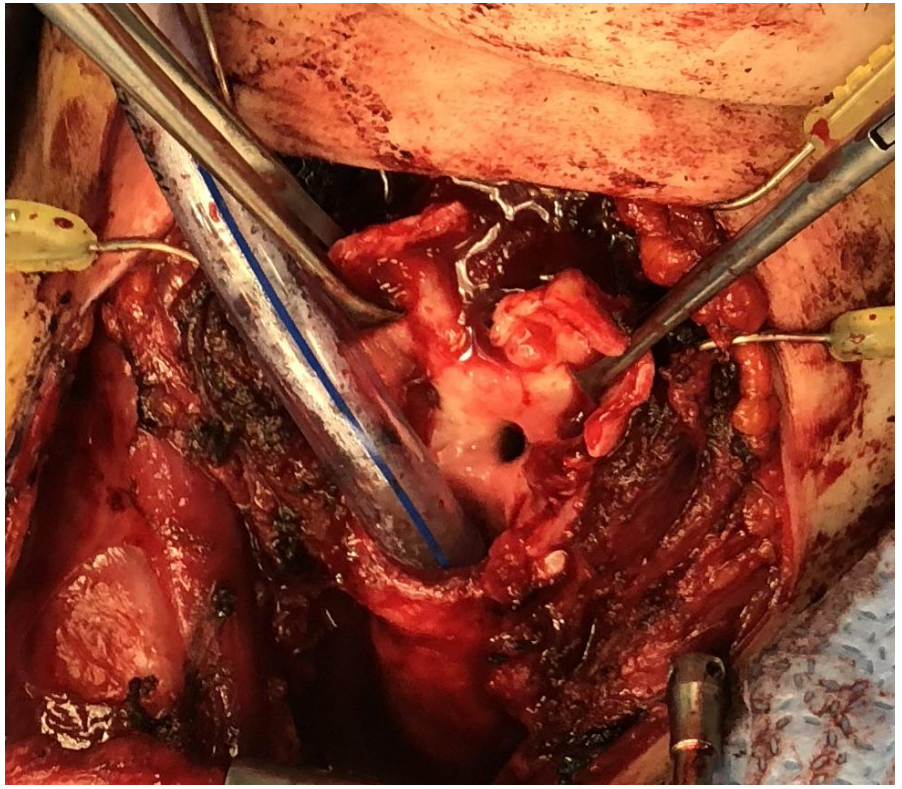
- Prolonged intubation (> 7 days)
- Large ET tubes (≥ 7.5 size)
- Tracheotomy (Percutaneous Tracheotomy)
- Idiopathic (SGS)- Laryngopharyngeal reflux (LPR)
  aberrant T cell response (IL-17/IL-23)
  possibly triggered by mycobacterium
- Tumor (thyroid; laryngeal; minor salivary)
- Trauma (Blunt; penetrating; external beam irradiation)
- Caustic inhalation
- Infiltrative (Sarcoid; Amyloid)
- Autoimmune (relapsing polychondritis; pemphigus;
  granulomatosis with polyangiitis)
- Infectious (tuberculosis)

Percutaneous Tracheotomy

- Currently #1 cause of tracheal stenosis in my practice
- Difficult to prove that this increases late complications (same code 31600 making database studies impossible)
- Usually due to fracture of cricoid or invaginated tracheal rings.
- Blue Rhino Set (Cook)- #8 cuffed tube
- Inexperienced surgeons- medical critical care
- Poor patient selection- obese, nonpalpable landmarks, low cricoid
- Poor surgical technique- lack of dissection to create an established track; side wall; excessive force

Traumatic Tracheal Stenosis





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Percutaneous Tracheotomy

Changes in Tracheostomy- and Intubation-Related Tracheal Stenosis: Implications for Surgery

Samuel S. Kim, MD, Zain Khalpey, MD, Charles Hsu, MD, and Alex G. Little, MD

Division of Cardiothoracic Surgery, and Department of Radiation Oncology, University of Arizona, Tucson, Arizona

Conclusions. Recent advances in percutaneous tracheostomy have increased the numbers of patients presenting with proximal tracheal stenosis, thus necessitating more complex subglottic resection and reconstruction. The anastomotic and overall complication rate remains low despite these more complex operations.

(Ann Thorac Surg 2017;104:964–70)

16 cases of PDT vs.
6 cases of open

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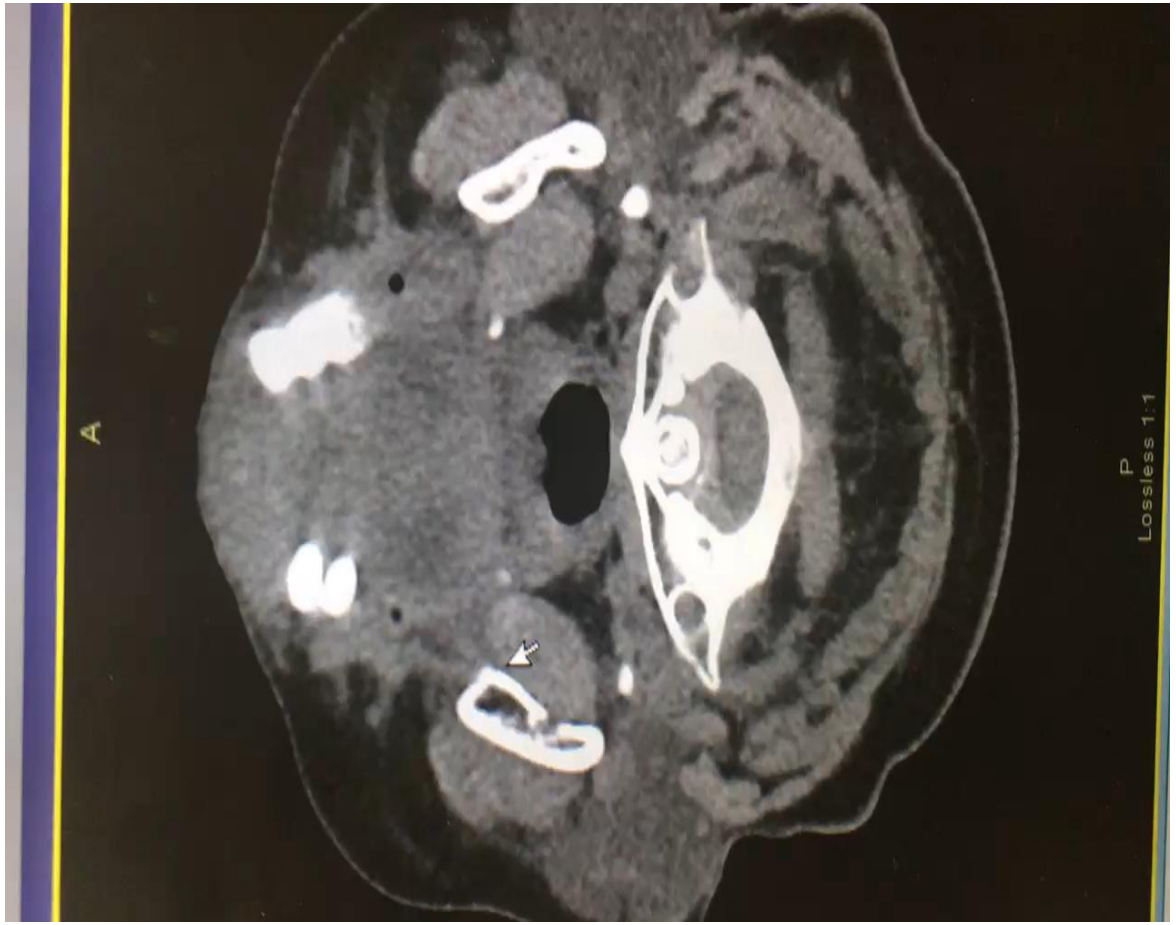
PercutaneousTracheotomy



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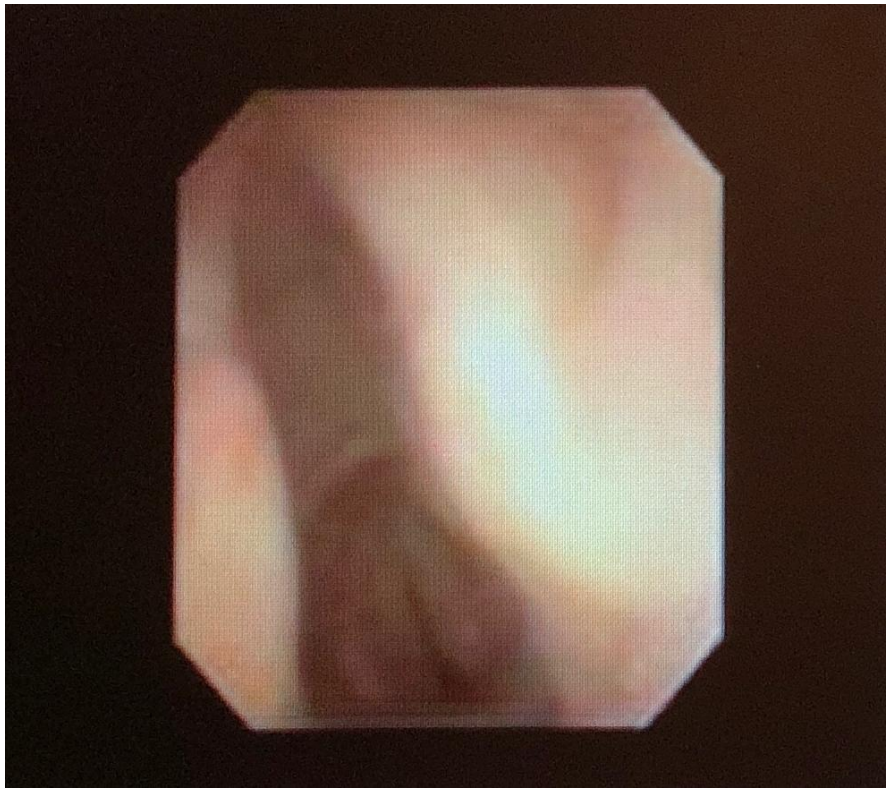
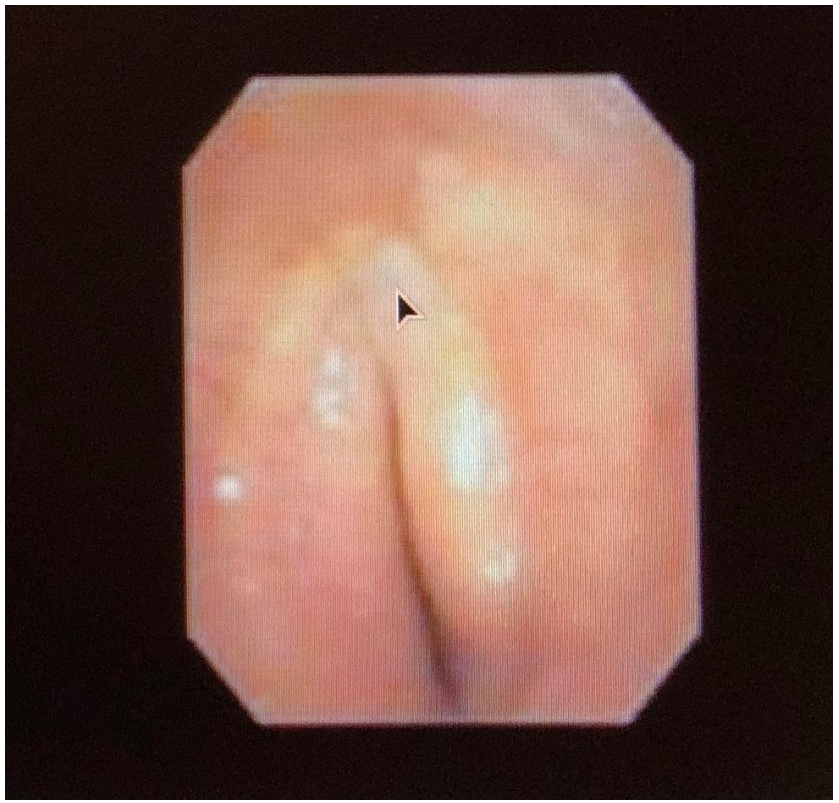
PercutaneousTracheotomy





A-frame Deformity

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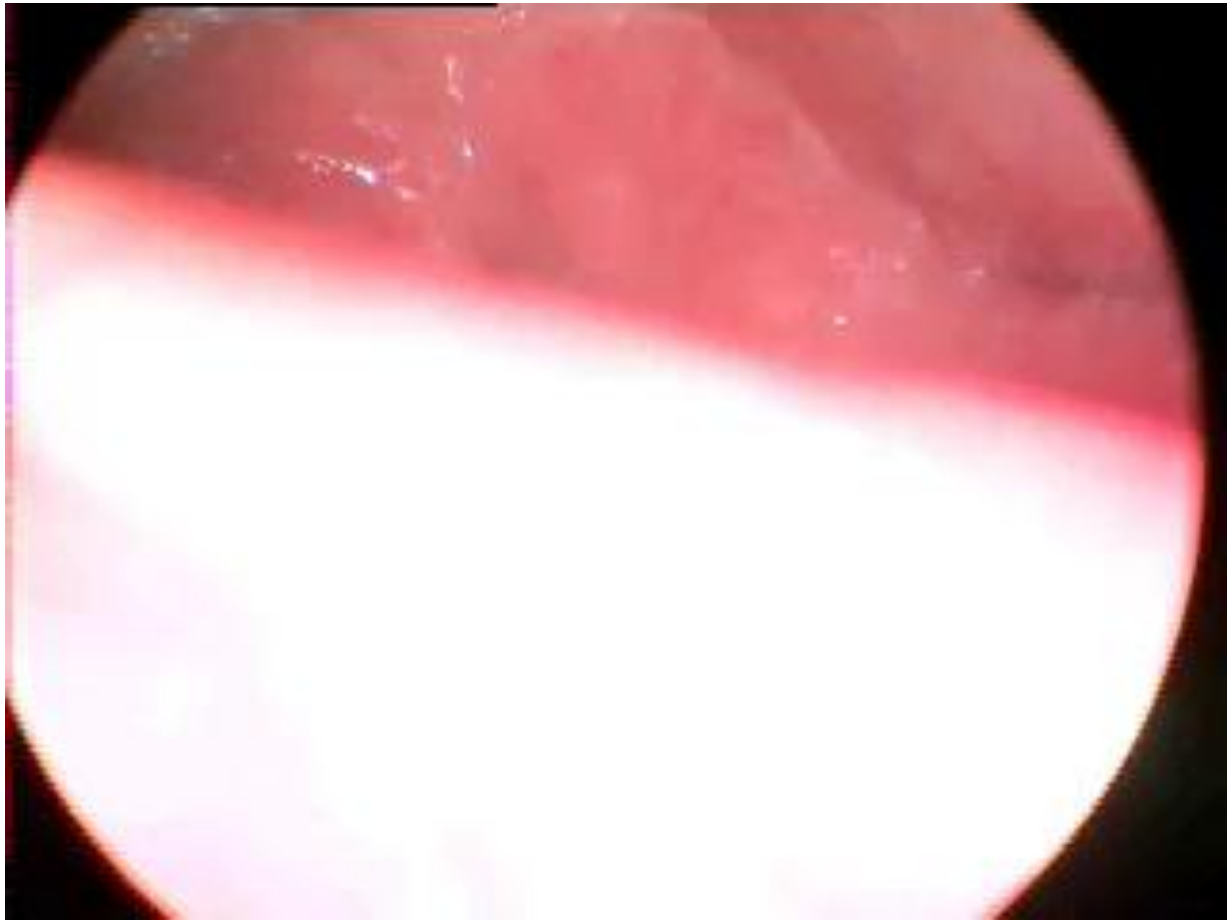
Laryngotracheal Stenosis
Patient Presentation

- **Tracheotomized Patient- inability to decannulate, or urgent need to re-insert tracheotomy tube following decannulation.**
- **Non-tracheotomized patient- SOB on exertion; respiratory stridor; often prolonged attempts to treat “asthma”**

Patient Evaluation

- Fiberoptic laryngoscopy ± stroboscopy ± office tracheoscopy (vocal fold mobility; visualize stenosis)
- Imaging- fine-cut CT scan (1.25 mm) without contrast
- Pulmonary function tests (may help to determine timing of intervention)
- Operative Laryngoscopy and Bronchoscopy

Videostroboscopy



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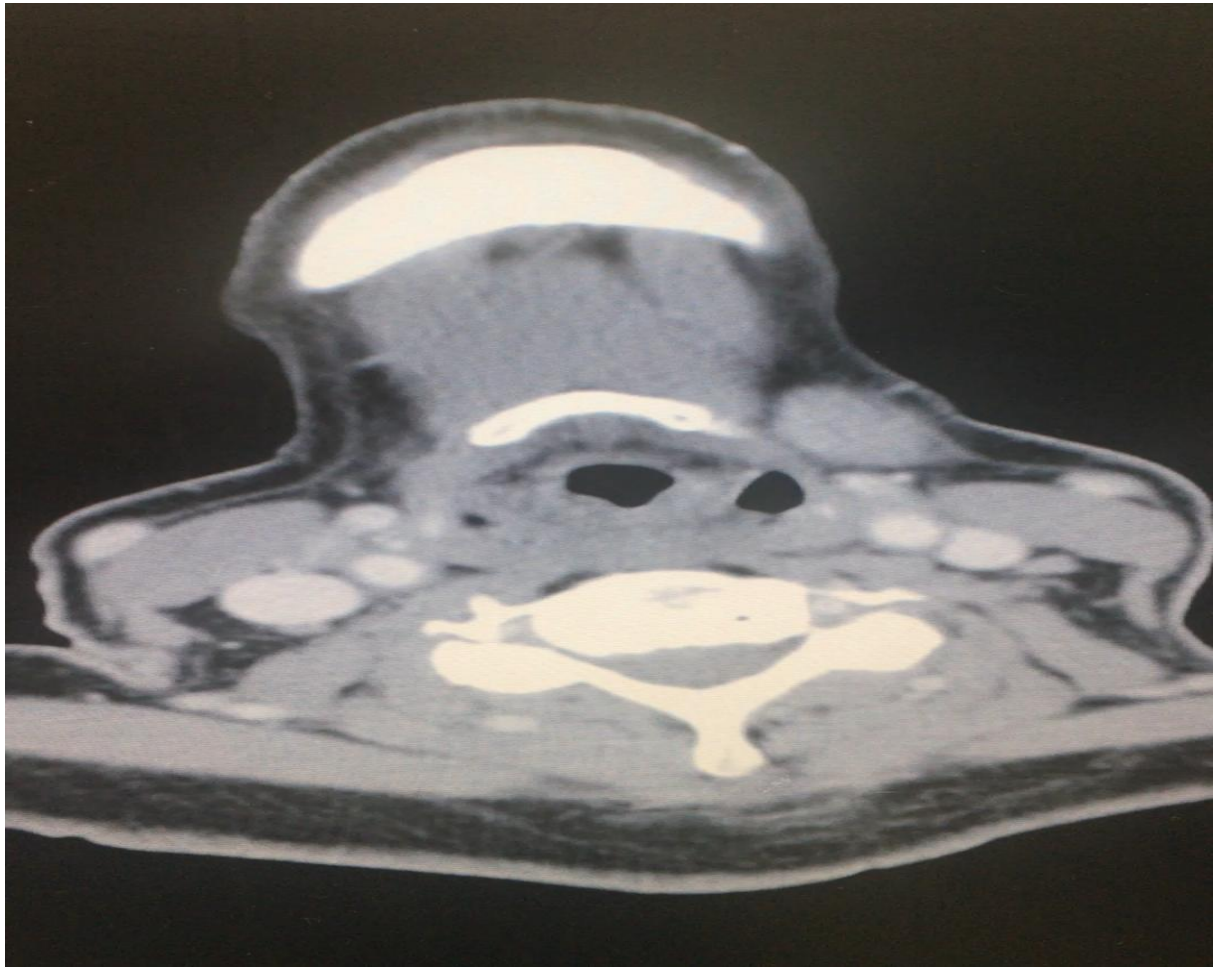
Importance of CT Scan



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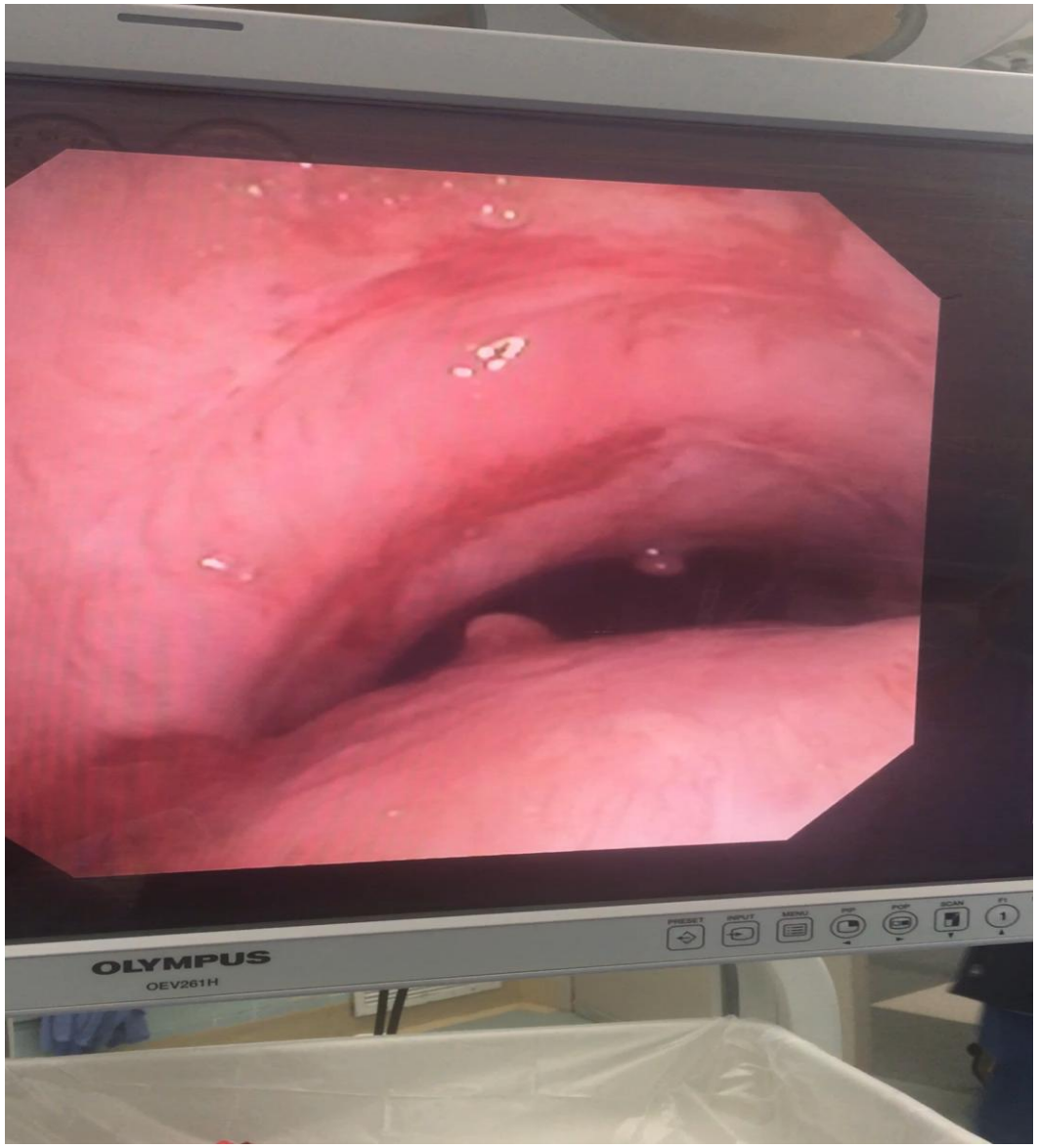

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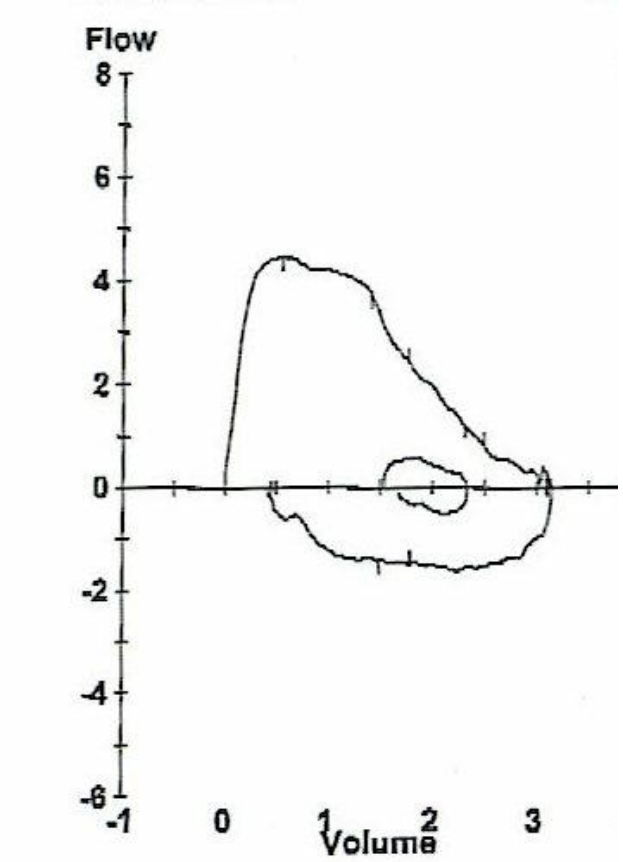
Flow-Volume Loop

- **Critical Airway- <1.5 L/s max inspiratory airflow**



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Operative Laryngoscopy & Bronchoscopy

- **Proper Equipment**
  - Open trach tray
  - Variety of laryngoscopes (Dedo; Anterior Commissure; Lindholm)
  - Intubating Bougie
  - Airway Dilating Balloons (Various sizes-14 & 16 mm)
  - Rigid Bronchoscope
- **Mobility of Vocal Folds (direct palpation)**
- **Location of stenosis (larynx, SG, trachea)**
- **Grade of Posterior Glottic Stenosis (Bogdasarian-Olsen)**
  - Grade 1 Vocal process adhesion with a posterior tract
  - Grade 2 Interarytenoid adhesion without tract
  - Grade 3 Interarytenoid adhesion with one fixed arytenoid
  - Grade 4 Interarytenoid adhesion with bilateral fixed arytenoids

Operative Laryngoscopy & Bronchoscopy

- Grade of tracheal stenosis (Cotton-Meyer)- luminal obstruction
  - Grade 1 < 50%
  - Grade 2 51-70%
  - Grade 3 70-99%
  - Grade 4 100%
- Character of stenosis- Soft, fibrotic, cartilaginous
- Character of trachea beyond stenosis (tracheomalacia; inflammatory polyps)
- Length of stenosis- Marking pen on rigid telescope
  - < 2cm
  - 2-4 cm
  - > 4cm

Operative Laryngoscopy & Bronchoscopy

Classification	From	To	Endoscopic appearance
Grade I	 No Obstruction	 50% Obstruction	
Grade II	 51%	 70%	
Grade III	 71%	 99%	
Grade IV	No detectable lumen		

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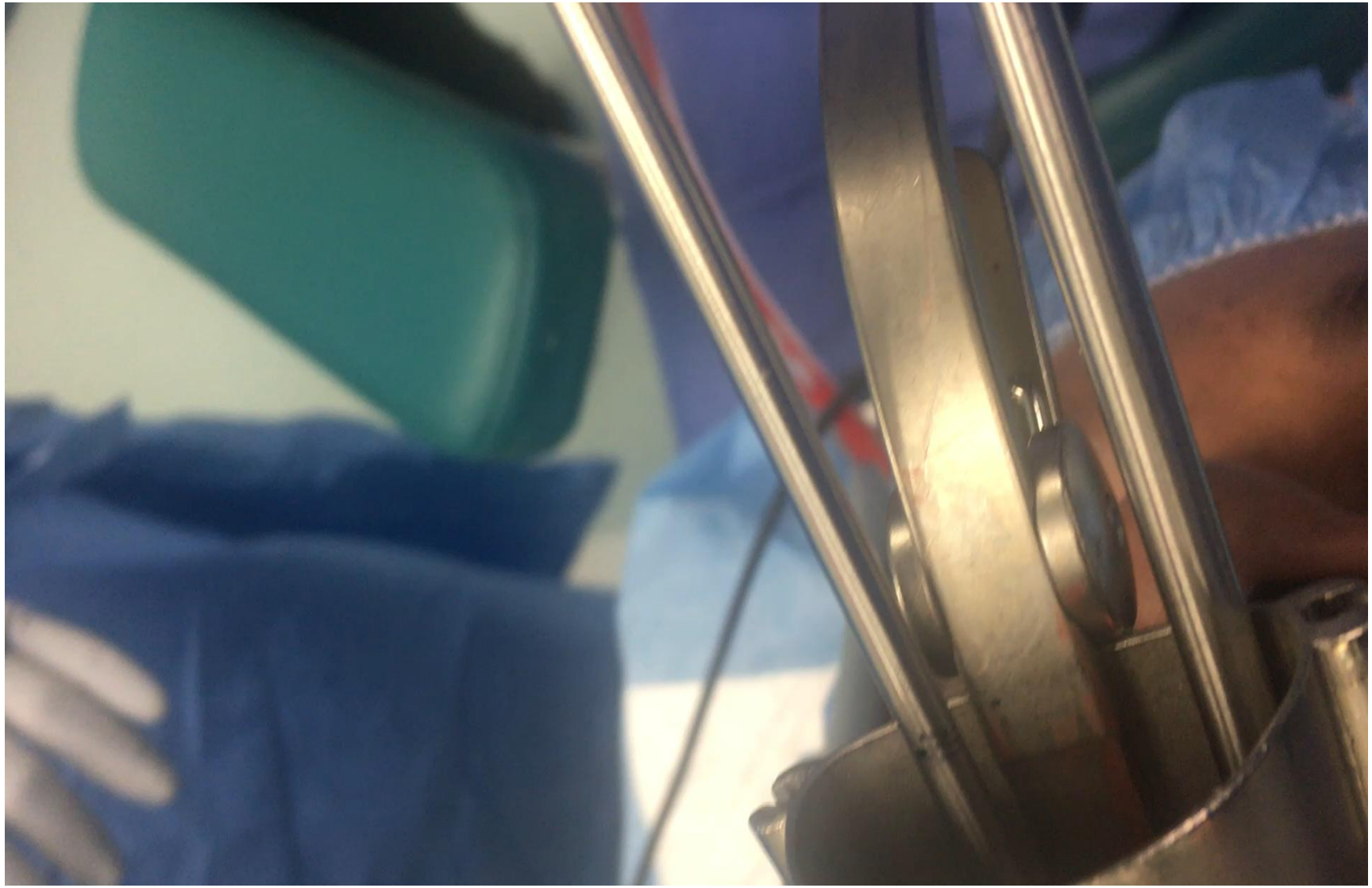
Microlaryngoscopy and Bronchoscopy



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Microlaryngoscopy and Bronchoscopy

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Posterior Glottic Stenosis

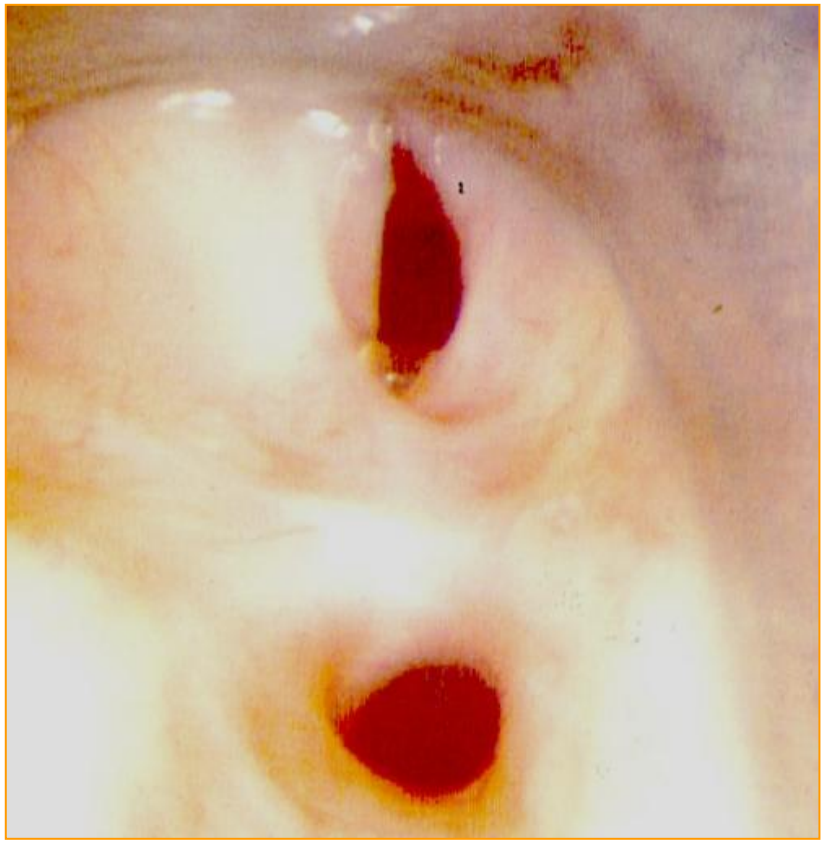
- Etiology (most common)- pressure necrosis of vocal mucosa from ET tube; if injury extends into submucosa, healing occurs by fibrosis and scar contracture.
- Factors- intubation time; tube size; tube mobility; LPR
- Intubation Time- < 7 days (2% risk)
  7-10 days (5-10%)
  > 10 days (12%)
- Other causes (Radiation; caustic ingestion; autoimmune)

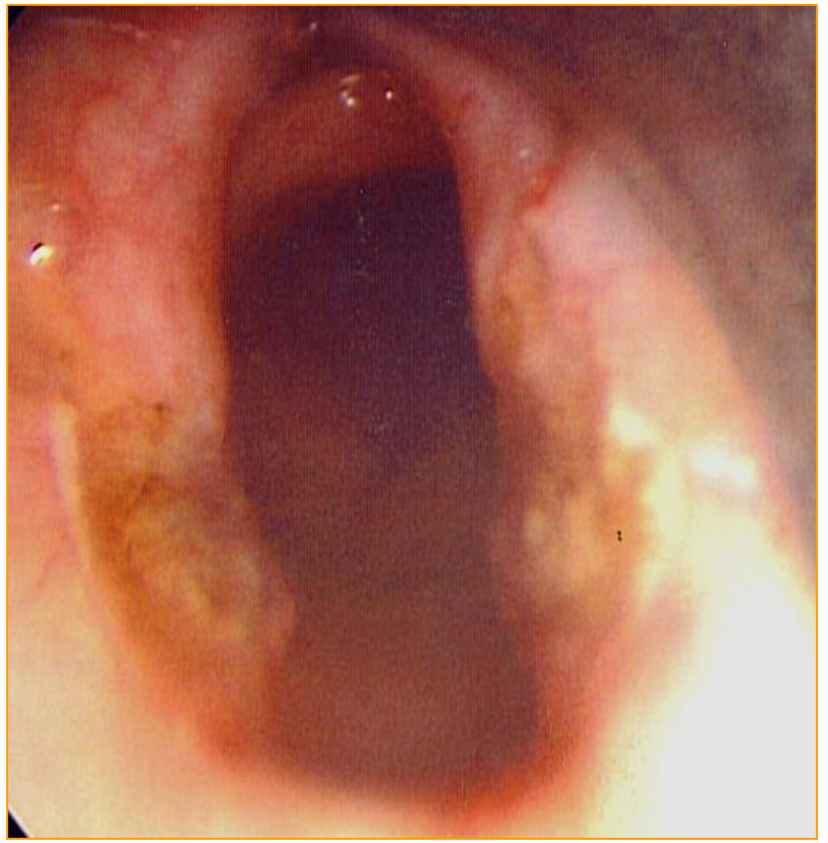
Posterior Glottic Stenosis Management

- Tracheotomy (good voice; best airway; social and work ramifications)
- Arytenoids mobile:
  Posterior cordectomy (adequate voice; marginal airway)
- One immobile arytenoid:
  Posterior cordectomy with arytenoidectomy (immobile arytenoid)
  (breathy voice; aspiration risk (MBS); adequate airway)
- Two immobile arytenoids:
  Posterior cricoid split and graft (laryngofissure)
  (prolonged healing; aspiration risk)

Posterior Glottic Stenosis

- **Grade 1 - Endoscopic Management generally successful**





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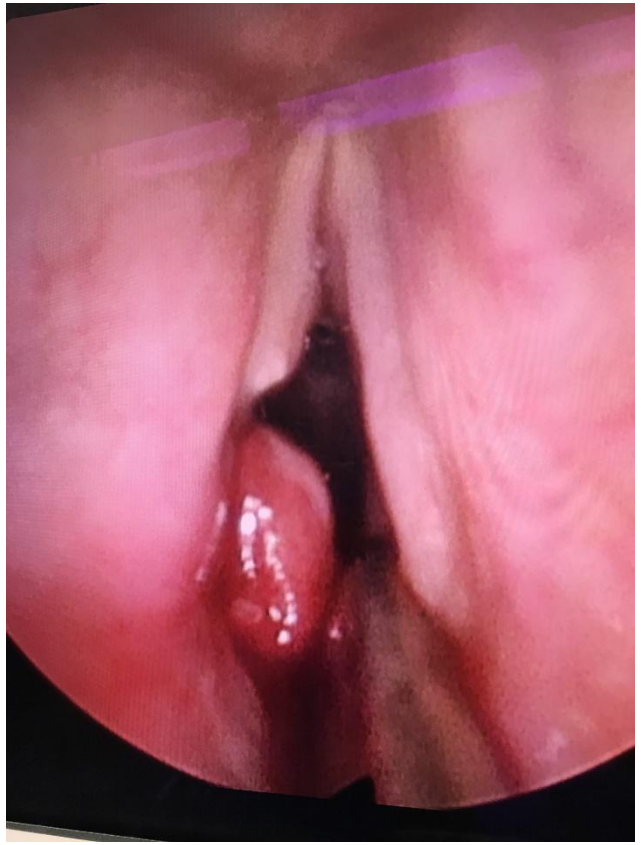
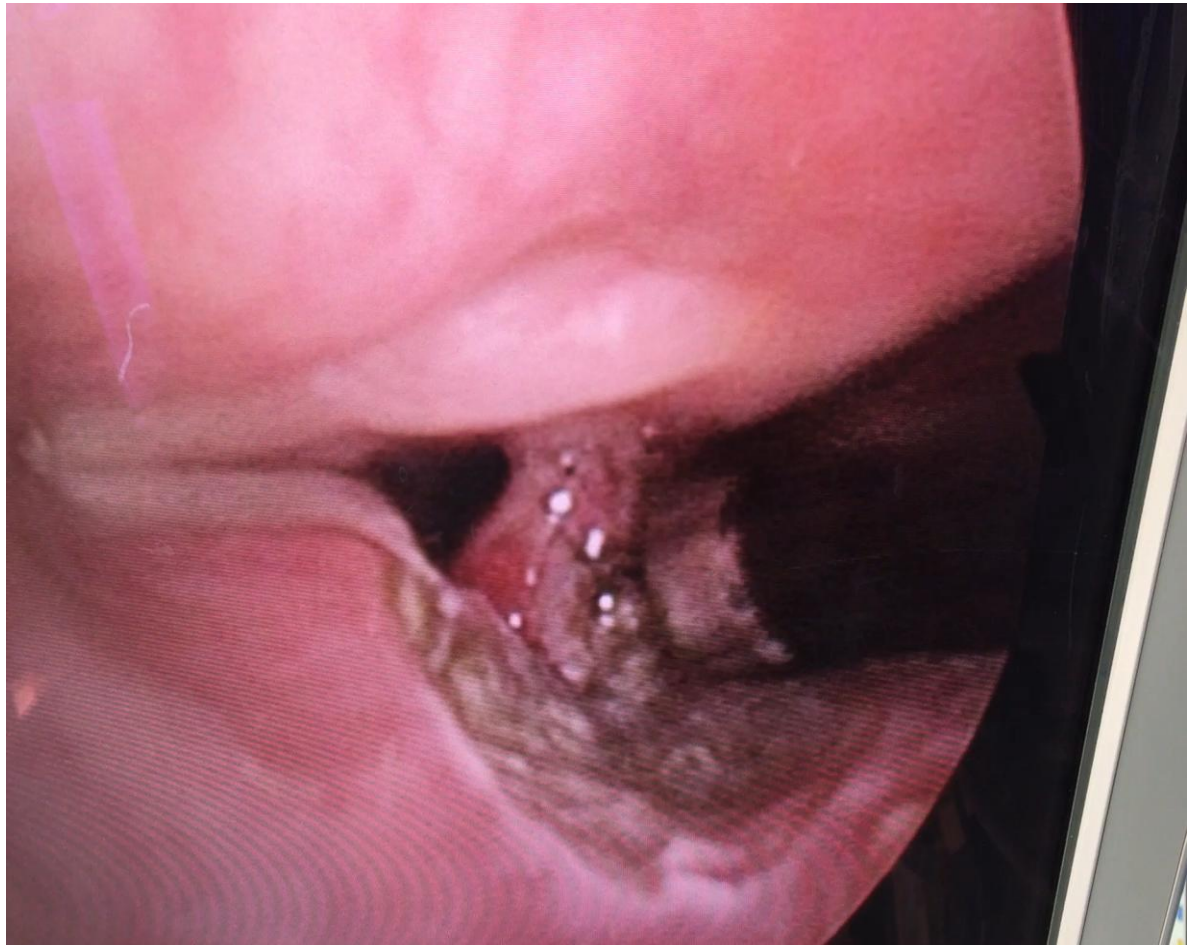
- **Type II- Revision Posterior Cordectomy**





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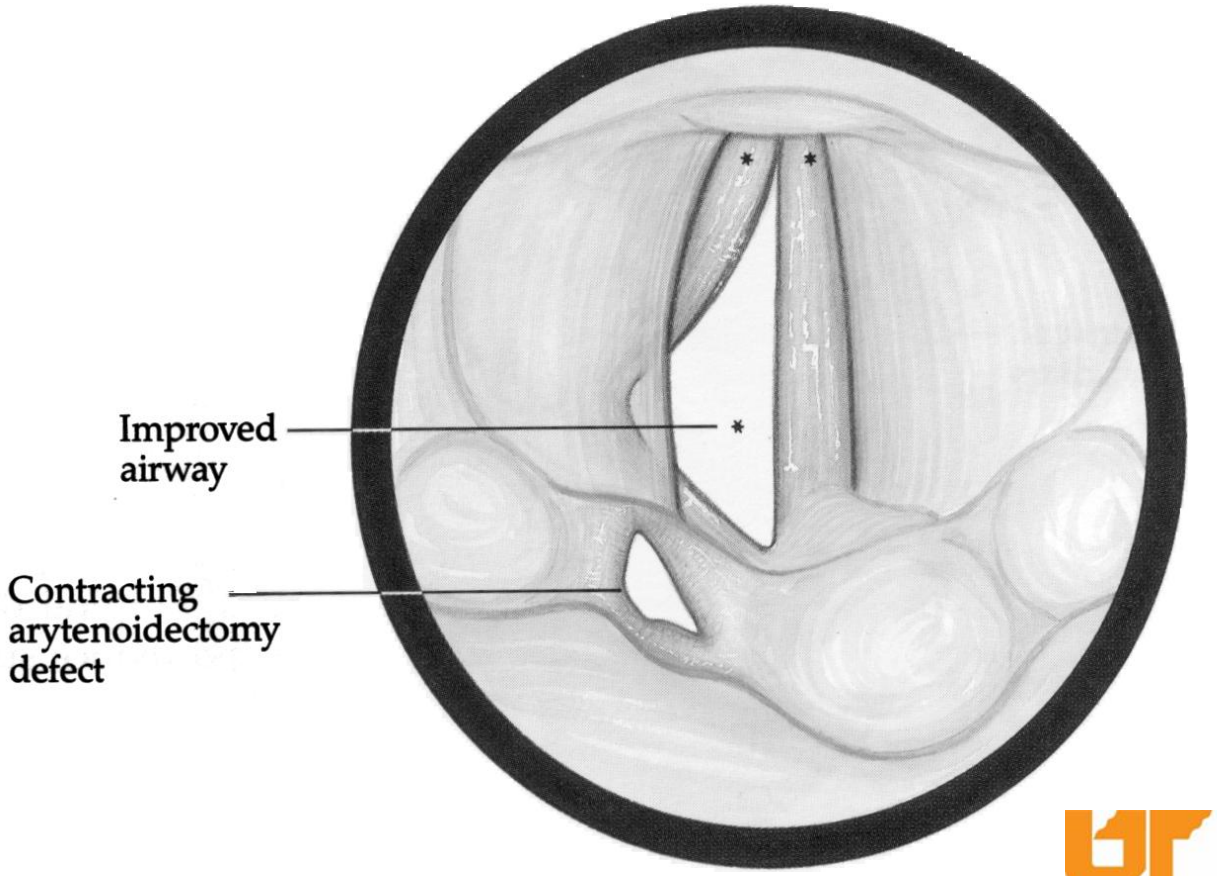
Bilateral Vocal Fold Motion Impairment

Endoscopic Arytenoidectomy



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Tracheal Stenosis Management

- Grade 1 (<50% obstruction)- Endoscopic Management
- Subglottic (Grade 2,3,4) (from 1 cm below cords to bottom of cricoid) Cricotracheal resection
- Tracheal (Grade 2,3,4)-
  < 4cm (4-5 rings)- cervical only
  > 4cm- (>6 rings)- cervico-thoracic
- Tracheotomy or Ttube (poor medical risk; obese (BMI >35); multiple comorbidities)

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Tracheal Stenosis
Endoscopic Management

- Grade 1 (<50% obstruction) or to temporarily avoid trach in more severe stenosis.
- Equipment-
  Tracheostomy set (stand-by)
  Lindholm laryngoscope
  Rigid bronchoscopes (urgent dilation)
  Suction tips
  Laser (fiber; line of site difficult)
  Airway balloon (16 or 18 mm)
  Steroids (Kenalog 10; butterfly needle; active inflammation)
  Mitomycin (±; unproven benefit in RCTs)
- Various size tubes for intubation (cuffed/uncuffed 5.0; 5.5; 6.0)
- Radial incisions (2 or 3) followed by dilation x 2

Tracheal Stenosis

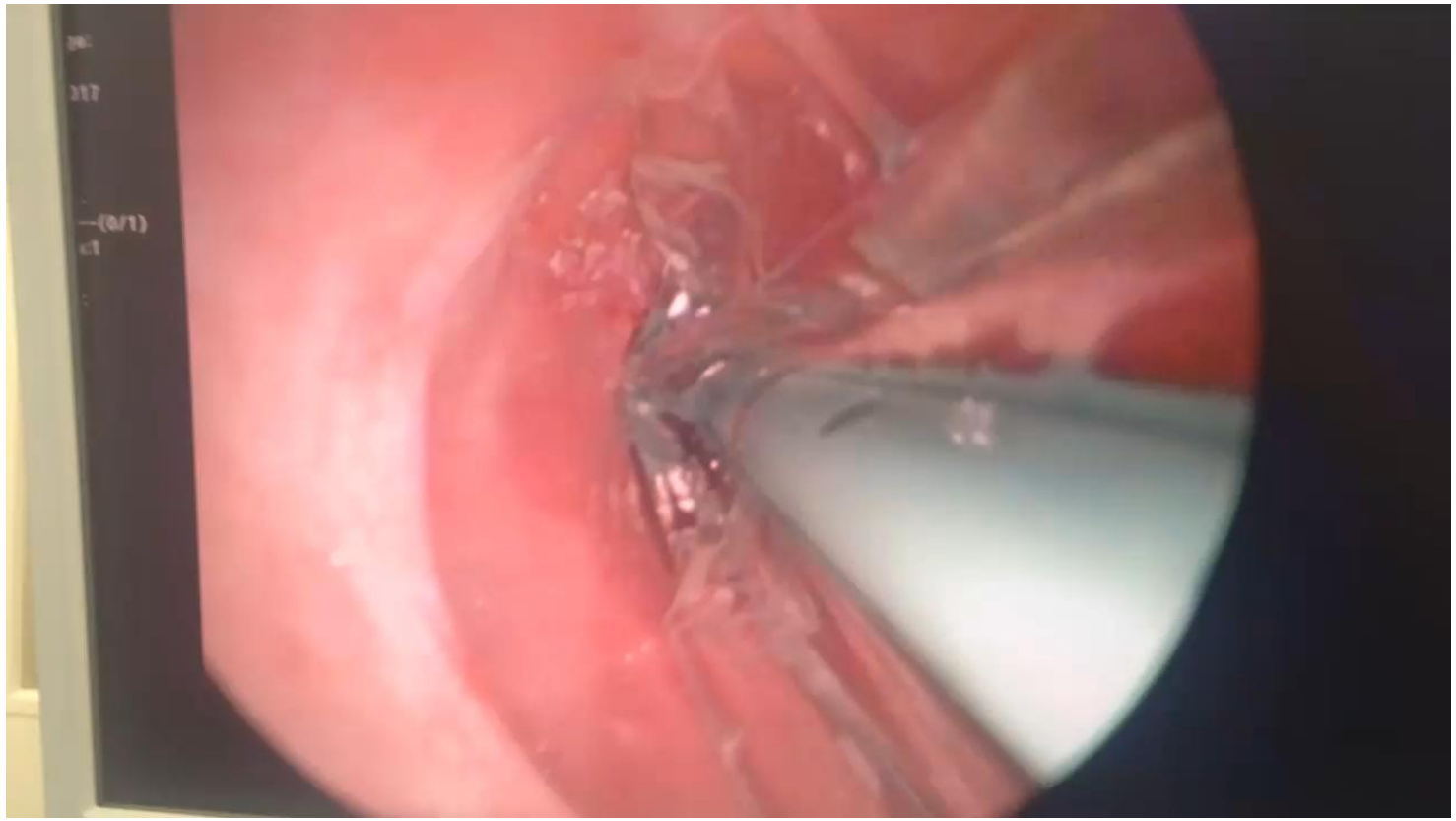
- **Grade 1 (<50% obstruction)- Endoscopic Management**

Tracheal Stenosis

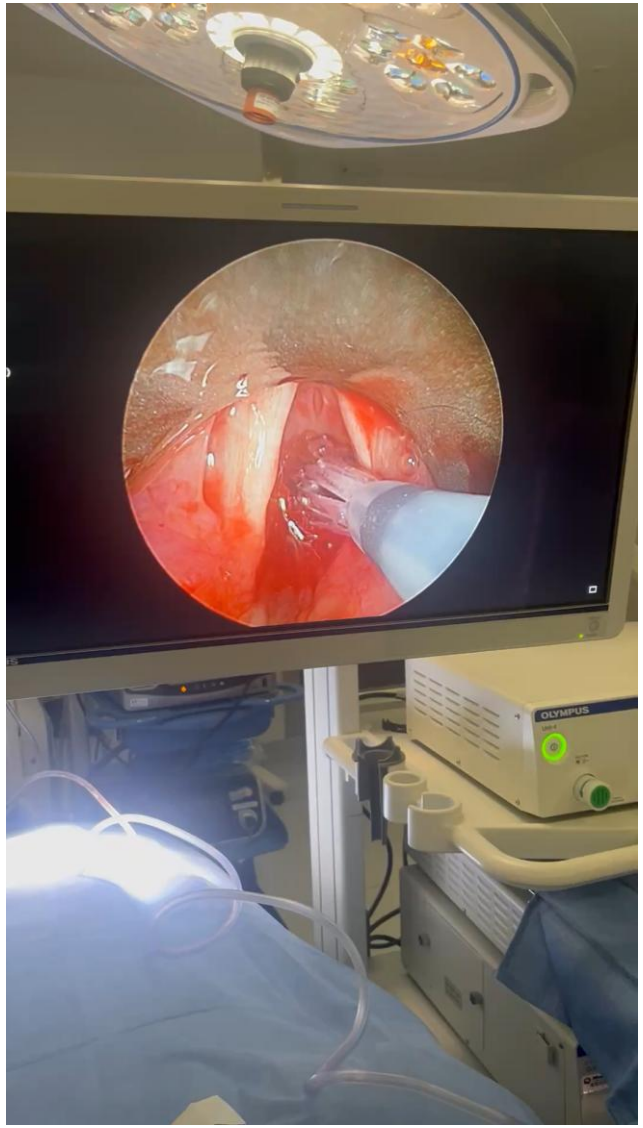
- **Grade 1 (<50% obstruction)- 2 or 3 linear laser incisions**

Tracheal Stenosis

- **Grade 1 (<50% obstruction)- Balloon Dilation**



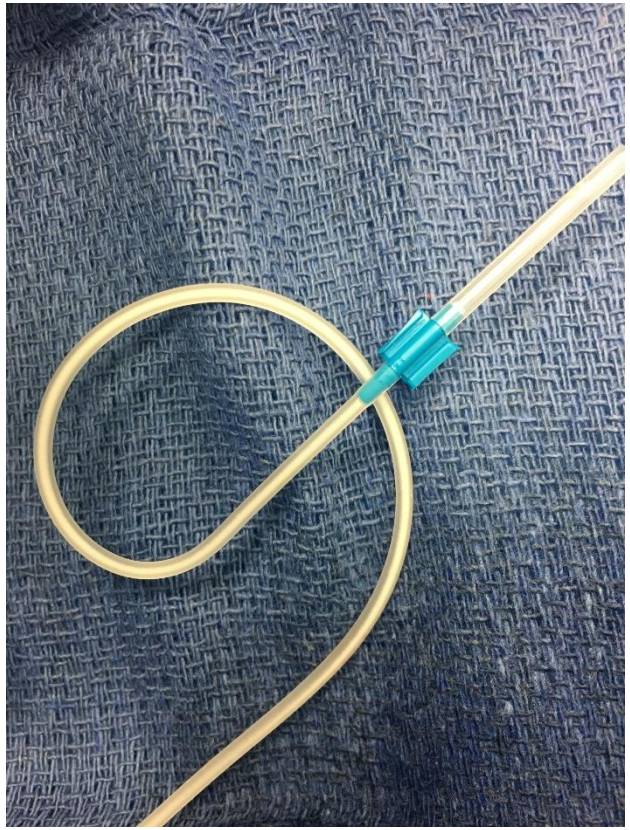
Trachealator Balloon

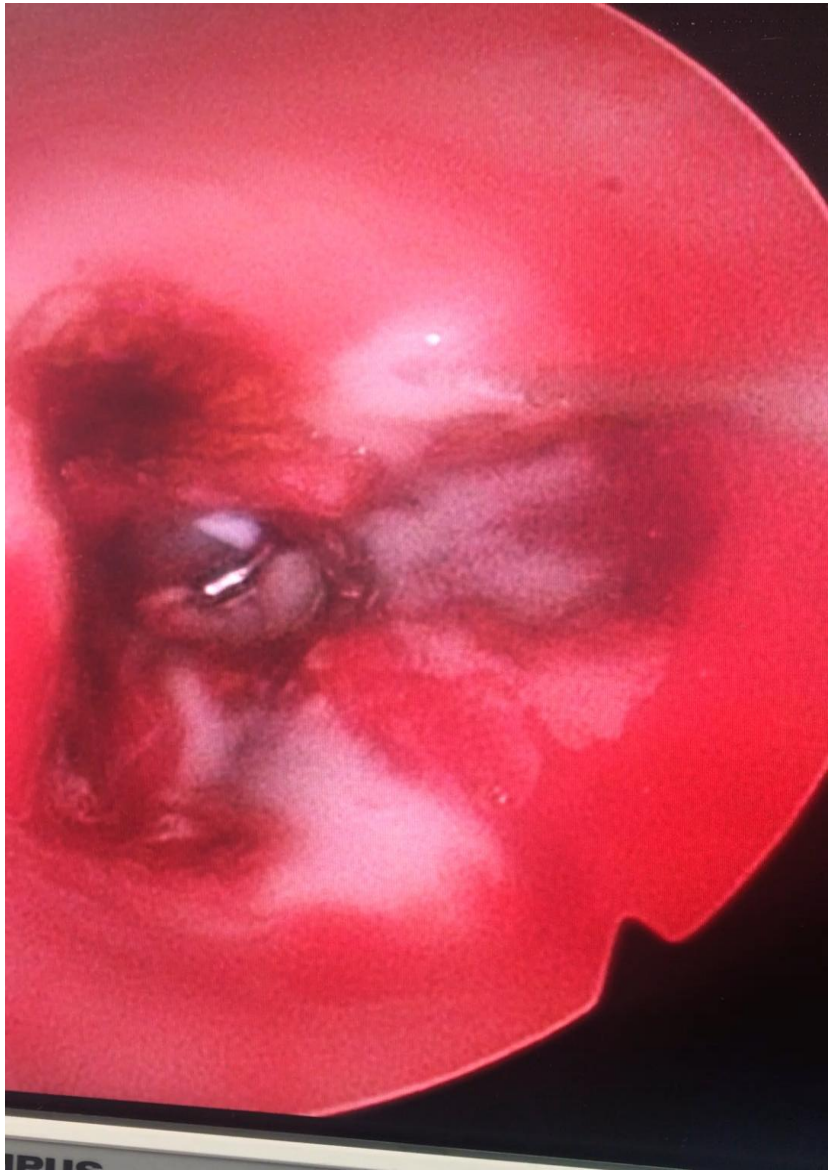


- Allows ventilation during dilation
- 2x more expensive than standard balloons
- Good option for patients with poor pulmonary reserve

Tracheal Stenosis

- **Endoscopic Steroid Injection**





Tracheal Stenosis

Tracheal resection- Technique

< 2cm (1-2 rings)- Cartilagenous resection only (muscularis intact)

2-4 cm (3-4 rings) Circumferential resection and anastomosis (cervical)

> 4cm- (5-6 rings) Circumferential resection and anastomosis (cervico-thoracic)

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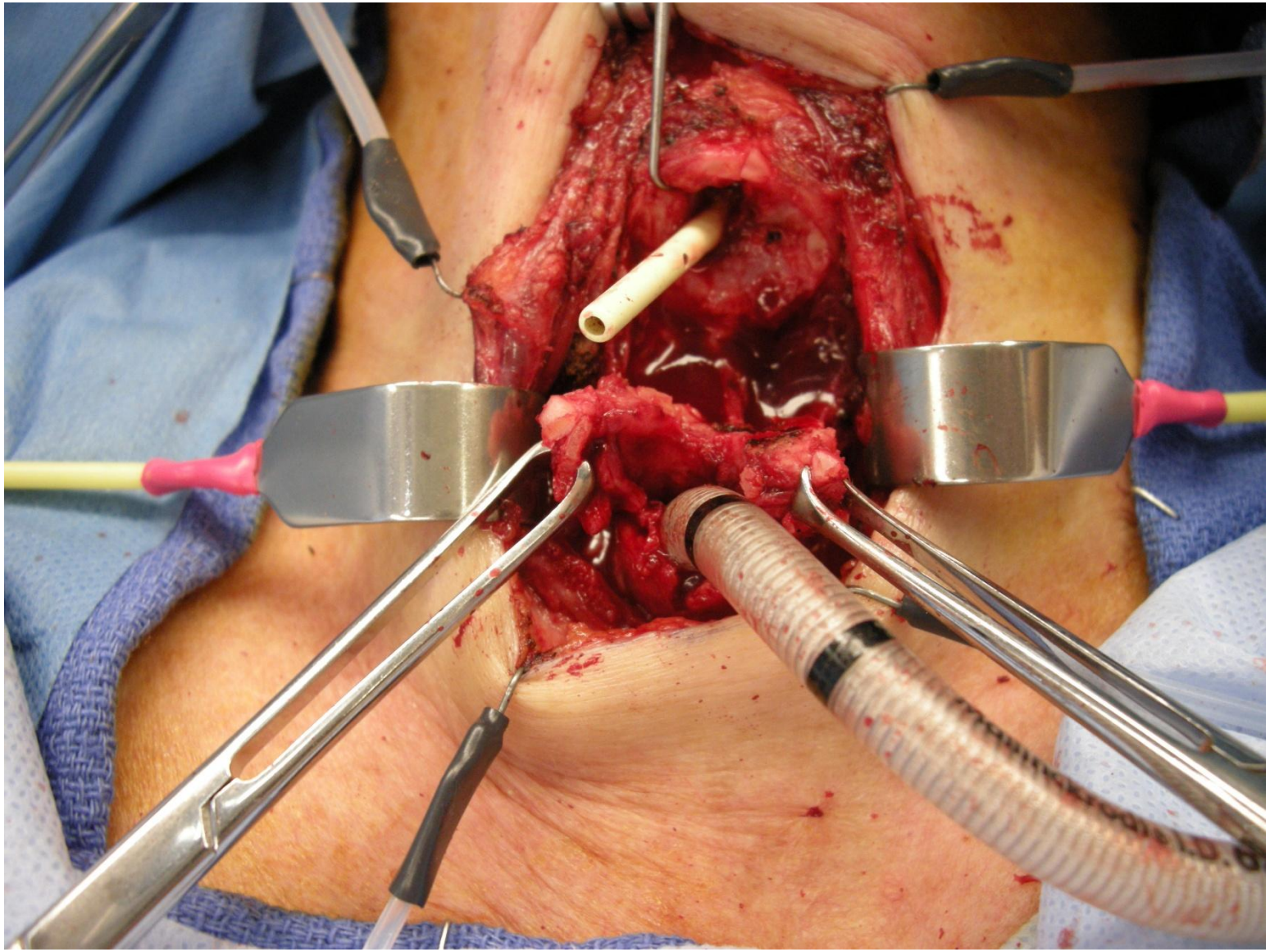

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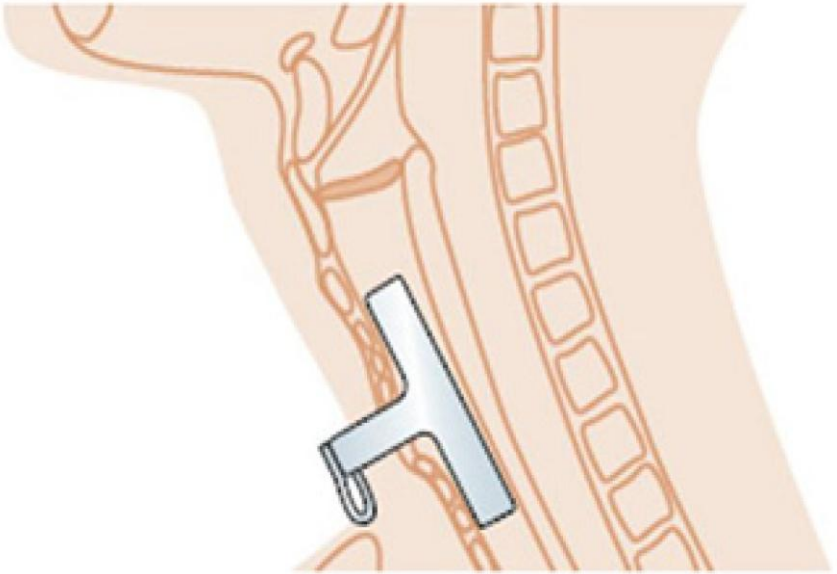
Tracheal Stenosis

T-tube- Tips & Pearls

- SG/Upper tracheal stenosis; not candidate for open repair (co-morbidities; distal tracheomalacia)
- Montgomery or Hood
- 11 mm smallest acceptable size
- Cut upper limb with 11 blade to make sure not touching vocal cords.
- Cap in recovery; observe in hospital 48-72 hours
- Proper training in suction technique and removal
- Back up trach
- Hydration, guaifenesin (acetylcysteine, 1 cc BID)
- If foul smell- dilute acetic acid (1 cup white vinegar/ 1qrt distilled H20; Ciprodex drops)
- Monthly visits for first 3 months, then every other month
- Leave in for 18 months (minimum)



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Questions or Concerns:

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