



## **Airway Resection for Laryngotracheal Stenosis**

### **Historical Background or Introduction**

- Although the first primary tracheal anastomosis of cervical trachea was performed in 1886 by Kuster, innovation stalled in the beginning of the 20<sup>th</sup> century until renewed interest was spearheaded in the 1970's by Hermes Grillo.
- Gerwat and Bryce (1974) described the first cricotracheal resection (CTR) with preservation of the recurrent laryngeal nerves and later Pearson and Gullane reported their success in a series encompassing 22 years in 1996.
  - Pearson, F. G.; Gullane, P. (1996-10-01). "Subglottic resection with primary tracheal anastomosis: including synchronous laryngotracheal reconstructions". *Seminars in Thoracic and Cardiovascular Surgery*. 8 (4): 381–391

### **Pathophysiology or Scientific Premise**

- Laryngotracheal stenosis should be assessed in quality to determine its suitability for augmentation or resection of the stenotic area. To this end, stenosis should be characterized by: severity (percentage of obstruction of lumen), vertical length, distance from the glottis, and quality (membranous vs. framework disruption).
- Subglottic and tracheal stenosis are usually caused by iatrogenic airway manipulation (i.e. intubation and/or tracheotomy). The Cotton-Meyer staging system is the most common staging method of the subglottis, but can be used to describe tracheal obstruction as well. Otherwise, McCaffrey offers an alternate classification system that encompasses laryngotracheal stenosis.
- Tenets of open airway resection are that the anastomosis be tension free and utilization of surgical techniques to minimize disruption of laryngotracheal blood supply.
  - Grillo HC. Primary reconstruction of airway after resection of subglottic laryngeal and upper tracheal stenosis. *Ann Thorac Surg* 1982;33:3-18.
  - Grillo HC, Mathisen DJ, Wain JC. Laryngotracheal resection and reconstruction for subglottic stenosis. *Ann Thorac Surg* 1992;53: 54-63.

### **Indications and Contraindications**



- Cricotracheal resection (CTR) is indicated when there is a circumferential subglottic scar and in cases of grade II, III, or IV subglottic stenosis. Extended maneuvers are necessary when there is glottic involvement of stenosis.
- Tracheal resection and primary anastomosis can be considered in lengths up to 50% of the total tracheal length or 6cm in adults with the use of releasing maneuvers. Laccourreye et al. recommended that releasing maneuvers be considered with stenosis lengths greater than 3.5cm.
- Diabetes, stenosis greater than 4cm, age, laryngotracheal resections, and presence of a tracheotomy tube preoperatively increase the rate of anastomotic failure but are not absolute contraindications.
- Extralaryngeal or distal airway obstruction (such as tracheomalacia) that is not addressed during the resection is a relative contraindication.
  - Laccourreye O, Brasnu D, Cauchois R, et al. Tracheal resection with end-to-end anastomosis for isolated postintubation cervical trachea stenosis: long-term results. *Ann Otol Rhinol Laryngol* 1996;105:944-948.

### **Treatment Method**

- Tracheal resection is best performed by isolating the stenotic segment with sharp dissection directly on the tracheal cartilage to avoid injury to the recurrent laryngeal nerves. The tracheotomy site (if present) is included in the resection and horizontal incision are made at the superior and inferior margins of the involved trachea. The posterior tracheal segment is separated from the underlying esophagus using a combination of blunt and sharp dissection. The tracheal segment is then completely removed. The neck is placed into flexion and the remaining tracheal margins are reanastomosed and the patient reintubated from above. Anastomotic closure is tested with a leak test and the wound is closed.
- Cricotracheal resection usually describes resection of just the anterior cricoid arch and preservation of the lateral and posterior aspects along with the recurrent laryngeal nerves. The mucosa overlying the posterior cricoid plate may be resected and replaced by a lip of posterior tracheal mucosa from the distal tracheal segment. Cricotracheal resection may include partial or extended techniques depending on the stenosis type and extent.



- Grillo HC. Primary reconstruction of airway after resection of subglottic laryngeal and upper tracheal stenosis. *Ann Thorac Surg* 1982;33:3-18.
- Grillo HC, Mathisen DJ, Wain JC. Laryngotracheal resection and reconstruction for subglottic stenosis. *Ann Thorac Surg* 1992;53: 54-63.
- Monnier P. Partial Cricotracheal Resection and Extended Cricotracheal Resection for Pediatric Laryngotracheal Stenosis. *Thorac Surg Clin*. 2018 May;28(2):177-187.
- Sandu K, Monnier P. Cricotracheal resection. *Otolaryngol Clin North Am*. 2008 Oct;41(5):981-98, x.

### **Management of Complications**

- Complications occur in approximately 20% of patients and approximately 50% of these complications are anastomotic in nature.
- Complications include anastomotic failure/dehiscence, vocal fold paralysis/paresis, hemorrhage, tracheoinnominate or tracheoesophageal fistula, and wound infection. Additionally, subcutaneous emphysema, pneumomediastinum, and pneumothorax can be caused by anastomotic failure.
- Anastomotic failure/dehiscence is a surgical emergency and control of the airway is necessary either by intubation or placement of a tracheotomy tube.
- Wound infection is a rare occurrence and treatment includes draining and culturing the wound in order to prevent anastomotic infection and erosion. Furthermore, the integrity of the anastomosis should be questioned as wound infection may be the presenting symptom and so bronchoscopy should be considered if there are accompanying worrisome symptoms.
  - Grillo HC, Donahue DM, Mathiesen DJ, et al. Postintubation tracheal stenosis. Treatment and results. *J Thorac Cardiovasc Surg* 1995;109:486-492.
  - Wright CD, Grillo HC, Wain JC, et al. Anastomotic complications after tracheal resection: prognostic factors and management. *J Thorac Cardiovasc Surg* 2004;128:731-739.
  - Auchincloss HG, Wright CD. Complications after tracheal resection and reconstruction: prevention and treatment. *J Thorac Dis*. 2016 Mar;8(Suppl 2):S160-7.