

# Laryngotracheal Resection and Reconstruction

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## KEYWORDS

• Laryngotracheal • Resection • Reconstruction • Subglottic Stenosis

## KEY POINTS

- A thorough understanding of the extent of the stenosis and laryngotracheal anatomy is crucial before undertaking surgical repair.
- The posterior cricoid plate must be preserved to avoid recurrent laryngeal nerve injury.
- Careful attention to matching the geometry of the ends to be anastomosed is important to avoid gaps or weak points.
- The use of release maneuvers may be necessary if there is too much tension.
- High tracheal resection and reconstruction can be challenging and should not be underestimated by centers with little experience.

## INTRODUCTION

The adult trachea is 10 to 12 cm long and consists of 16 to 20 horseshoe-shaped cartilages. High tracheal resections are uncommon and pose specific surgical challenges, and this is the focus of this article. Nonsurgical maneuvers are often used in preparation for surgery, but surgical treatment is often the final curative modality.

## PRESENTATION AND DIAGNOSIS

The most common indication for high tracheal resection is symptomatic stenosis related to prolonged intubation or malignancy.<sup>1,2</sup> In 1 study,<sup>3</sup> 46 of 60 (77%) cases were for postintubation stenosis. Previous tracheostomy, fistulas, blunt trauma, and idiopathic causes account for the rest. The symptoms may include cough, stridor, dyspnea, or hemoptysis (malignancy). Fistulas may present as swallow-cough sign.

Clinical presentation is usually acute or chronic dyspnea. Acute presentation can be dramatic and may lead to a need for cardiopulmonary resuscitation. Chronic dyspnea may initially

manifest with exertion only and then become persistent at rest. Sometimes, an acute flare is triggered by an upper respiratory tract infection. The trachea is usually narrowed up to 75% when acute symptoms are present in adults.<sup>4</sup>

Diagnostic modalities include rigid and flexible bronchoscopy and computed tomography. Direct laryngoscopy by an otolaryngologist is imperative in cases in which lesions extend into the glottis. Presence of enough subglottic space is required for a successful resection (**Fig. 1**).<sup>1,5</sup> Dilation, stenting, and T-tubes are used in selected cases in preparation for surgery.

## ANESTHESIA FOR TRACHEAL RESECTION

Surgery for high tracheal resection requires specific anesthesia considerations. Muscle relaxants are usually avoided.<sup>4</sup> Frequent intraoperative communication between the surgeon and anesthesiologist is critical to the successful recovery of the patient. A small inflatable shoulder roll is usually used. Flexible and rigid bronchoscopy and dilation are used in the operating room just before the surgery in some cases to place an

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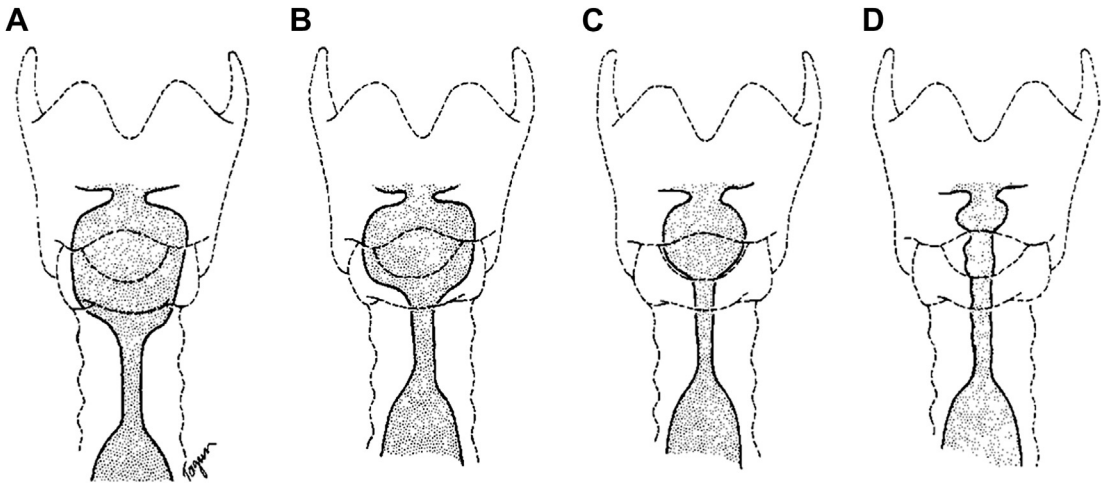
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**Fig. 1.** Classification of upper airway stenosis. (A) High tracheal stenosis, easily treated by segmental resection and tracheotracheal anastomosis; (B) stenosis that reaches to the lower border of the cricoid cartilage; (C) stenosis of the lower subglottic larynx and upper trachea (the extent of the lesion involves the anterior portion of the cricoid cartilage); (D) stenosis that reaches to the glottis. There is no subglottic space to which an effective anastomosis can be made. (From Mathisen DJ. Subglottic stenosis. *Operat Tech Thorac Cardiovasc Surg* 1998;3(3):143; with permission.)

endotracheal tube, which is typically of a small caliber. A slow, deep induction while maintaining spontaneous breathing is often helpful.<sup>1</sup> Intraoperative jet ventilation can be used in selective cases.<sup>6</sup> A more detailed discussion is available in the article elsewhere in this issue by Wiedemann and Männle on Anesthesia and gas exchange in tracheal surgery.

## SURGICAL TECHNIQUE

Tracheal resection and end-to-end anastomosis is the best surgical technique for the treatment of circumferential cervical tracheal stenosis. It is imperative that a tension-free anastomosis is created, otherwise, disruption of sutures occurs, leading to restenosis and other potentially life-threatening complications. If the gap between the 2 tracheal stumps cannot be closed without tension, tracheal release techniques must be used for a tension-free approximation.<sup>7</sup>

### Incision and Exposure

A horizontal neck (collar) incision is used for initial exploration and is usually sufficient for high tracheal resections. A subplatysmal flap is raised, reaching the anterior border of the sternocleidomastoid muscles laterally. The sternohyoid and sternothyroid muscles are divided in the midline, and the thyroid gland isthmus is divided and ligated.<sup>7</sup> The anterior trachea is exposed in the midline from thyroid cartilage to suprasternal notch. In the case of a short trachea, the hilum

should be exposed, typically through a median sternotomy.

### Tracheal Resection

The length of stenosis is determined and the trachea is dissected circumferentially around it. Ideally, the area of circumferential dissection should not extend more than 1 cm above and below the area of resection to ensure adequate blood supply to the anastomosis. Thyroid arteries supply the cervical trachea, whereas bronchial arteries supply the mediastinal trachea. A vertical incision in the anterior trachea is made to evaluate the extent of narrowing.<sup>1,8</sup> If a stoma is present, the tracheal wall is divided vertically above and below the stoma.<sup>7</sup>

The trachea is sharply divided above and below the stenosis in normal tissue and limited to the area of stenosis to avoid ischemia of the stumps. Injury to the esophagus and recurrent laryngeal nerves (RLNs) could occur at this stage, if appropriate care is not taken. The endotracheal tube is pulled into the proximal trachea above the upper incision before the incision is made. For a high stenosis, it can be useful to tie a suture to the end of the endotracheal tube to facilitate subsequent retrieval. After complete resection of the affected segment, a second tube is introduced into the distal stump for ventilation.<sup>7</sup> An end-to-end tracheal anastomosis is constructed as described in the article elsewhere in this issue by Stoelben and colleagues on Benign stenosis of the trachea.

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