# Prophylaxis and Treatment of Complications After Tracheal Resection

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**KEYWORDS**

• Tracheal diseases • Surgery • Complications • Prophylaxis • Treatment

**KEY POINTS**

- Tracheal resections are major surgical procedures that require a multidisciplinary approach involving thoracic surgery, anesthesiology, interventional airway endoscopy, otolaryngology, intensive care therapy, and speech pathology.
- Adequate patient selection and preparation may include interim procedures and correction of major comorbidities to achieve a successful outcome.
- Early and late postoperative complications may ensue and usually derive from local (ie, length of stenosis) and/or systemic (ie, diabetes) factors.
- Complications must be recognized and dealt with accordingly, based on its severity, and it may affect the long-term outcome.
- Cornerstones for prophylaxis of complications are meticulous patient selection, surgical planning and accurate technique, standardized postoperative care, and full patient awareness of the procedure.

## INTRODUCTION

Tracheal stenosis is a complex surgical problem. It is frequently mistaken and interpreted as being a simple structural disease defined anatomically by its extension, diameter, and distance from the closest anatomic landmark, such as the vocal folds or the tracheal carina. In fact, tracheal stenosis is a heterogeneous disease in its cause, natural history, and clinical outcome.[1] It derives from various clinical entities, such as iatrogenic airway injuries (ie, postintubation, post-tracheostomy), autoimmune diseases (ie, Wegener granulomatosis, relapsing polychondritis, sarcoidosis, amyloidosis), congenital, primary and secondary neoplastic diseases, and idiopathic.

Postintubation tracheal stenosis still represents the most common indication for tracheal resection worldwide. Airway resection with primary reconstruction remains the definitive treatment modality for benign and malignant tracheal diseases.

The nature of airway surgery is challenging. It requires surgical expertise and skill in interventional endoscopic airway procedures. The advancements in tracheal surgery achieved after decades of research and solid clinical experience have ultimately led to an increase in the number of resections worldwide. Likewise, there has been an increase in the number of postresection complications ranging from 5% to 44%.[2–5] Identification of

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predictors for complications after tracheal resection, such as comorbidities, technical issues, and other factors, deserves consideration when a patient undergoes selection for a resection. There is a convergence between many of the predictors for complications in different centers.[3,4] The largest series ever published is a single-institution retrospective review of 901 patients who underwent tracheal resection at the Massachusetts General Hospital in Boston.[6] Complications occurred in 164 patients (18.2%) and half of the complications were anastomotic. At our institution, the complication rate was higher (44%) with 16% restenosis and 23% of nonanastomotic-related complications. The presence of comorbidities, previous resection, the extent of the resection, and laryngotracheal resections were related to a higher complication rate.[4] Higher anastomosis and redo tracheal resection are more prone to complications. Macchiarini and colleagues[7] described early complications in 41% of the patients submitted to a partial cricoidectomy with primary thyrotracheal anastomosis. Marulli and colleagues[8] reported 45.9% complications after laryngotracheal resections. The same authors reported a higher complication rate among idiopathic laryngotracheal stenosis (66.6%). An earlier large series of 75 redo tracheal resections reported a complication rate of 39% with a predominance in the group of patients submitted to previous laryngeal release maneuvers (63%).[9] The early detection of complications followed by a structured course of action in a timely fashion is critical for a successful outcome. Nowadays, the widespread use of computed tomography (CT) scan and bronchoscopy plays an important role in detecting complications and assessing its severity. Postresection complications and mortality vary across the series in different centers (Table 1).

**Table 1**
**Postresection complications and mortality in different centers**

| Author, Date | Patients (N) | Complications (%) | Mortality (%) |
|---|---|---|---|
| Couraud,[10] 1994 | 217 | 4.6 | 3.2 |
| Donahue et al,[9] 1997 | 75 | 39 | 2.6 |
| Macchiarini et al,[7] 2001 | 45 | 41 | 2 |
| Rea,[11] 2002 | 65 | 12.3 | 1.5 |
| Wright et al,[6] 2004 | 901 | 18.2 | 1 |
| Amoros,[12] 2006 | 54 | 9.2 | 1.8 |
| D'Andrilli et al,[13] 2008 | 35 | 14.3 | 0 |
| Marulli et al,[8] 2008 | 37 | 8.1 | 0 |
| Cordos,[14] 2009 | 60 | 13.3 | 5 |
| Bibas et al,[4] 2014 | 94 | 44.6 | 0 |

## IMPACT OF COMORBIDITIES

Clinical comorbidities are important risk factors on multivariate analysis in our cohort of complications after tracheal resections. Metabolic diseases and cardiovascular are the most frequently found in this population.

### *Diabetes*

Diabetes is notorious for damaging the microcirculation and for its negative impact on wound healing. The nature of central airway resection and anastomosis includes a critical healing area in the presence of some degree of tension between the ends and a rather poor vascular supply. Such factors, when combined with a diseased microvascular bed secondary to diabetes, can triple the number of airway anastomotic complications, particularly anastomotic dehiscence after tracheal resection (odds ratio, 2.72; 95% confidence interval, 1.53–4.82; $P = .0004$).[3,6] In our cohort, the presence of diabetes was the most prominent comorbidity (45%).[4]

### *Obesity*

Obesity is a risk factor in itself for prolonged mechanical ventilation. A meta-analysis comparing obese (body mass index $\geq$30 kg/m$^2$) with nonobese patients demonstrated that obesity in critically ill patients was not associated with excessive mortality but with prolonged duration of mechanical ventilation.[15] There are no prospective studies on the impact of obesity on the outcome of tracheal resection in tracheal stenosis and it varies across the series. There are, however, interesting studies on tracheostomy patients. A study on critically ill morbidly obese patients (body mass index $\geq$40 kg/m$^2$) submitted to tracheostomy showed an incidence of 25% complications compared with 14% in the nonmorbidly obese patients. On multivariate analysis, the morbid obesity was independently associated with a four-fold increased