Abstract

**Objectives:** To review a single institution’s experience managing adult tracheal and subglottic stenosis with tracheal resection.

**Methods:** A retrospective review of 26 consecutive patients who underwent either laryngotracheal resection (LTR) or tracheal resection (TR) for airway stenosis between 1998 and 2006. Co-morbidities and causes of stenosis were recorded. The major outcome measure was decannulation with overall outcome measures of complications and the number of post-operative procedures.

**Results:** Patient co-morbidities included 9 patients with cardiac or cerebrovascular disease, 2 patients with previous throat or chest injury, 2 patients with previous head and neck surgery, 1 patient with a pulmonary embolism, 1 patient with a surgical site infection, 2 patients with respiratory failure, 1 patient with hypothyroidism, 1 patient with anaphylaxis, 1 patient with aortic dissection, and 1 patient with aortic aneurysm. The majority of stenosis (22/26) were related to long-term intubation with 3 patients having a history of laryngotraheal trauma and one patient with an incisional injury. 15/26 (57%) were successfully decannulated. However, 16 of these patients required a post-operative procedure, most commonly bronchoscopy with radial incision and dilatation. One patient received tracheostomy and was unable to decannulate. This was one case of anastomotic breakdown. Re-stenosis was the most common complication recorded. One patient died at home 3 days from a presumed upper airway event. All deaths were due to complications arising from laryngotraheal trauma.

**Conclusion:** Although the complication rate is lower than the larger published series, our patients had significantly higher rates of co-morbidities. Although LTR and TR are relatively safe procedures, long-term decannulation remains difficult. Patients’ overall medical condition must be considered when determining candidacy for open surgical treatment of airway stenosis.

Discussion

Despite technical advances, management of laryngotracheal stenosis remains a significant challenge. In the 1980s, low volume high-pressure cuffs attributed to many of the cases of subglottic stenosis resulting from prolonged intubation. While some nurses have been trained to use modern intensive care unit techniques, the increased survival of critically ill patients may have increased the overall number of patients with laryngotracheal stenosis (4).

The pathophysiology of airway stenosis is a stepwise path to destruction of tissue. First, tracheal injury causes occlusion of the mucosa and cartilage. This damage causes an inflammatory response, leading to granulation and fibrous tissue formation (5). Munkauro et al. took specimens of resected tracheal stenotic and found that there is a decrease in type I collagen compared to normal segments of trachea, and an increase in type II collagen (6). With such permanent changes in the basic histopathology of the trachea, it is no wonder that correction of damaged tissue is challenging in the operating setting.

Operative management is the mainstay in treatment and many institutions have published high rates of successful reconstructions. In 1995, Gritti et al. reported a success rate of 75% in 50 patients with a success rate of 93.7% for postintubation stenosis (3). Smaller studies conducted by Wolf et al. and Rea et al. recently had similar success rates, 95.6% and 95.7% respectively (7).

Our successful decannulation rate of 57% is substantially lower than these published series. This may be attributed to the fact that our patients had significantly more co-morbidities. Herrington et al. described co-morbidities of patients in detail, and the majority had gastroesophageal reflux disease (9). This is in contrast to the demographics at our institution where the majority of patients suffered from neoplastic and neurological co-morbidities.

In this report we describe our results for definitive surgical management of airway stenosis. Our lower decannulation rate (57%) is likely the result higher co-morbidities in our patients and the increased use of procedures prior to the definitive reconstruction. Our patients tended to be sicker, with more advanced stenosis (60% cotton grade IV) than most published series. In addition, they had failed multiple previous endoscopic procedures, implying that they were already predisposed to scarring. Grillo et al. has described factors that lead to a negative outcome in tracheal reconstruction following postinjury (9). Such factors include a significant length of stenosis in relation to tracheal length and previous attempts for correction.

Our methods of reconstruction are similar with other studies (10). Subglottic edema and chin stuns were used when they were felt to be necessary to prevent anastomotic breakdown. Our low incidence of airway stenosis at the site of the anastomosis is in part due to the presence of the tracheostomy. We believe that our high failure rate is largely related to poor patient selection, with most of our patients having significant co-morbidities and having failed multiple previous endoscopic procedures.

Methods and Materials

The medical records of twenty-six patients admitted between 1998 and 2006 to our institution with laryngotracheal stenosis who underwent resection or tracheal resection with primary end or end to end anastomosis were retrospectively reviewed. All operations were performed by the senior author (BC). Direct rigid laryngoscopy and bronchoscopy was performed on all patients prior to surgery for diagnosis and staging.

Postoperative variables included, endotracheal intubation, length of hospital stay, and need for additional procedures or tracheostomy. The major outcome measure was successful decannulation.

Results

The length of stenosis ranged from 1 cm – 6.3 cm (mean 2.14 cm +/- 1.19 cm). All anastamoses were performed using absorbable Ethicon brand Vicryl, size 2-0 or 3-0. Eleven patients (43%) underwent supraglottic release to relieve excess tension on the anastomosis tissue. In 10 patients, the tracheal resection was performed post-tracheostomy with or without tracheostomy (n=25). One patient was diagnosed with idiopathic progressive subglottic stenosis. Many of the patients had significant co-morbidities, including cerebrovascular accidents (n=3 patients), cardiac events, including myocardial infarction (n=6), and end stage renal failure (n=1). Thirteen patients were admitted for trauma. One patient suffered from infection of the trachea. Twenty-two patients (85%) had pre-definitive procedures. Twenty-one underwent endoscopic dilation and/or incision. Postoperative variables evaluated included the presence of chin stuts, supraglottid release, drains, and the use of T-tubes following the reconstruction. Postoperative variables studied included the duration of intubation, length of hospital stay, and need for additional procedures or tracheostomy.

Complications: A total of six patients developed subglottic stenosis in the post-operative period, but each case responded spontaneously. Two patients showed signs of vocal fold immobility immediately following the procedure, and one patient required intubation of the Cricoid into the left vocal cord two months after reinsertion. The other case occurred spontaneously without sequelae. Pneumonia was diagnosed in two patients in the postoperative period, but were treated and resolved before discharge. One patient died in the immediate postoperative period. She was intubated post-operatively with a small air leak, stridor, and respiratory distress. The patient was transported by ambulance to the nearest hospital (a community hospital) and died on arrival. The patient was transported by ambulance to the nearest hospital (a community hospital) and died on arrival. Two patients had partial anastomotic breakdown and one patient had a second LTR prior to decannulation.

Follow Up E-Follow of 26 (26%/13%) patients were successfully decannulated at the last follow-up. However, 16 patients required bronchoscopy with dilation and/or excision of scar tissue formation (8). Ten patients (38%) were evaluated at 6 months follow-up for decannulation and one patient (3%) died from upper airway obstruction within weeks after discharge. We believe that our high failure rate is largely related to poor patient selection, with most of our patients having significant co-morbidities and having failed multiple previous endoscopic procedures.

Conclusions

We conclude that tracheal resection is a relatively safe procedure for the treatment of tracheal stenosis, but achieving success rates similar to large published series may be challenging. Severity of disease and patient co-morbidities are key variables that must be evaluated for each case to determine the overall likelihood of success.

References