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Role of Montgomery T-tube in laryngotracheal stenosis

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ABSTRACT

Background: The purpose of this retrospective study was to evaluate the outcome of laryngotracheal stenosis in patients undergoing Montgomery T-tube insertion in our institution. This study also throws light on the indications and complications of Montgomery T-tube insertion.
Methods: 39 patients who presented with laryngotracheal stenosis in the Department of Otorhinolaryngology at the JSS Medical College, Mysore, India during period of January 2012-December 2015.Out of which, 32 patients underwent stenting by Montgomery T-tube through an external approach. The follow-up period ranged from 6-24 months.The T-tube was removed after a minimum period of 6–12 months.
Results: The most common cause of laryngotracheal stenosis was prolonged intubation as seen in 89.7% patients, majority of patients (41%) in this study were in the 3rd decade. In this study all the patients underwent tracheostomy prior to treatment for stenosis. Out of 32 patients, decannulation was not possible in four (12.5%). The most common complication seen was surgical emphysema in 21 patients (50%) followed by crusting in 13 patients (40.6%), granulations at the upper of end in 1 patient (3.1%), and granulations around the stoma in 4 patients (12.5%).
Conclusions: Laryngotracheal stenosis (LTS) has always been and will remain a challenge to the otolaryngologist and a multidisciplinary approach is required to tackle it. Stenting remains a relatively conservative treatment, is successful in a proportion of cases. Although there are complications associated with the T tube it is always easily manageable and are not usually life threatening.

Keywords: Laryngotracheal stenosis, Montgomery T-tube, Prolonged intubation

INTRODUCTION

Laryngotracheal stenosis (LTS) has been and remains one of the most vexing problems in the field of head and neck surgery. Cicatricial laryngotracheal stenosis is defined as the progressive and permanent diminution of the laryngotracheal lumen with replacement of normal wall tissue by new tissue, usually fibrous. This definition excludes noncicatricial laryngotracheal stenosis, i.e., stenosis resulting from external compression, edema, tumor or laryngeal paralysis.[1] Trauma, the most common cause of laryngeal, subglottic and tracheal stenosis, may be accidental or iatrogenic following prolonged in-tubation or high tracheostomy. Other etiologies include congenital stenosis, caustic injury, sarcoidosis, Wegener's granulomatosis and relapsing polychondritis.[2] The reported incidence of LTS following laryngotracheal intubation and tracheostomy ranges from 6% to 21% and 0.6% to 21% respectively. In the study by Herrak and Ahid, the incidence was as high as 55.17% post-intubation and 44.82% post-tracheostomy.[3]

Various factors responsible for laryngotracheal stenosis are high tracheostomies, excessive cartilage removal, infection following tracheostomy, prolonged intubations, use of improper size of tracheostomy tube and persistent infections.

In endotracheal intubation, LTS is caused either by the mechanical trauma of placement of an endotracheal tube

or its contact pressure. Mucosal hyperemia and edema will result in mucosal necrosis secondary to compression of capillaries in the tracheal mucosa causing ischemia; which is observed within hours of intubation and can result in exposure of the perichondrium of the cricoid cartilage. The resulting perichondritis secondary to infection will lead to healing with scar formation. If it heals with fibrous tissue formation - this tissue contains fibrocytes that possess directional memory. Due to this memory, merely incising and separating scar tissue will only lead to tissue trying to replace itself in its previous and original scarred state.

Many methods of tracheal stenosis treatment are available. These include tracheal dilation, excision of stricture and end-to-end anastomosis or staged reconstruction with muscle cutaneous flap. Restenosis may sometimes occur, particularly when the stenosis was more than two centimeters in length because of the presence of excessive tension at the line of anastomosis. In addition, delayed surgical correction may increase the severity by repeated and reciprocal irritation.

Montgomery, in 1965, reported the use of the T-tube tracheal stent to repair tracheal injuries and post trachesotomy tracheomalacia in an infant four and a half months old.[3] In 1974, he reported the silicone T-tube in 94 cases of subglottic and tracheal stenosis.[4] Oliverio et al reported the use of a T-tube stent in tracheomalacia after circumferential resection of a stenosis.[5] The main advantages of the T-tube include the preservation of normal respiration and phonation, minimal cough and tissue reaction to the silicone material, and virtual elimination of the risk of migration owing to the anchored external limb. T-tubes are well tolerated by patients and have been reported to stay in place for as long as 20 years.[6] The main disadvantages of the T-tube consist of the need for a tracheotomy orifice and, to some patients, the unpleasant cosmetic appearance of a protruding neck tube.

METHODS

Thirty nine patients with Laryngotracheal stenosis were treated at the Department of Otorhinolaryngology, JSS Medical College and Hospital, Mysore, India from January 2012 to December 2015. A Montgomery T tube stent was inserted in 32 patients due to long stenotic segment involving the cricoid and trachea, while 7 patients were treated by endoscopic methods; i.e., diode laser application, dilatation, and microlaryngeal excision. The follow-up period ranged 6-24months. In this study, there were 29 (74.3%) males and 10 (25.6%) females. The age range was from 4–65 years. The particulars of age range and the number of patients fall in that range are mentioned in the below Table 1.

All 32 patients were tracheostomized either previously or at the time of presentation. The stenosis was grade III or grade IV in all cases (Myer-Cotton grading). The stenosis was subglottic in 31 patients, subglottic and tracheal in 6 patients and tracheal in 2 patients. Length of stenosis was between 3.5 to 7cms. Causes of stenosis were depicted in Figure 1.

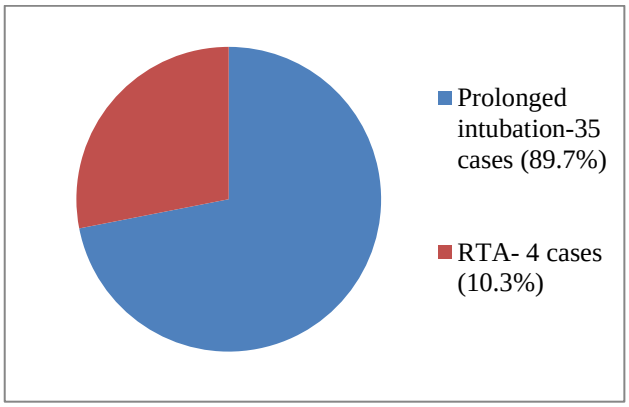

Figure 1: Causes of stenosis.

Patient evaluation

All the patients were worked up pre operatively with chest radiography, fiberbronchoscopy as shown in Figure 2 and computed tomogram (CT) scan of the neck and chest,virtual laryngotracheogram and routine blood investigations. All procedures were performed under general anaesthesia by suitable endotracheal tube through tracheostomy stoma. The length and size of the T-tube depends on the location and diameter of the trachea.

Figure 2: Fiberbronchoscopy image depicting the stenotic part pre-operatively.

Operative procedure

Under sterile conditions, parts were painted and draped, a horizontal or longitudinal incision was made over the midline of neck upward or downward depending on the site of lesion. After mobilizing the stenotic trachea, a longitudinal incision was made over the stenotic segment taking care not to injure the posterior tracheal wall and so anterior oesophageal wall, which will be identified by ryles tube placed previously. Opening in the trachea extended superiorly and inferiorly till normal lumen is

seen. The incision can be extended to cricoid cartilage if necessary. Laser assisted or cold steel instrument assisted removal of granulation tissue done without injuring cartilage. Topical Mitomycin C is applied. Ventilation was then stopped momentarily and the endotracheal tube was removed under adequate monitoring. At the same time, the T-tube as shown in Figure 3 was inserted into the trachea. Another endotracheal tube, appropriately preselected, was connected to horizontal limb for ventilation. After insertion of the T-tube, the fiber-bronchoscope was used to check that the Montgomery T-tube was in the appropriate position as in Figure 4. The tracheal incision wound was closed and secured the horizontal limb of the T-tube with 3-0 Vicryl, and then closed the neck wound with 3-0 Mersilk. Tracheo-oesophageal fistula was seen in 2 of our patients (5%). In these patients, the fistula was repaired first and then Montgomery stent was placed.

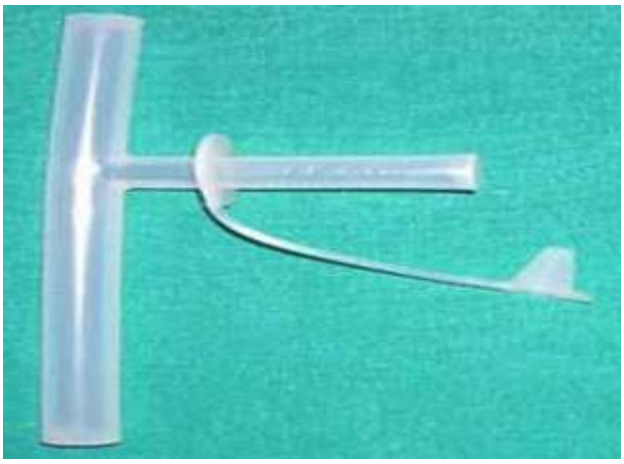

Figure 3: Mongtomery T-tube.

Figure 4: Fiberbronchoscopy image evaluating position of Montgomery T-tube with respect to Vocal cords intraoperatively.

The postoperative management included prophylactic antibiotics for one week, and saline nebulization and airway hygiene every 4 to 6 hours for 2 weeks. After discharge, the cleaning procedure with cotton tip applicators dipped in normal saline was performed 3 times a day, or more often if necessary, to dislodge tenacious mucus and crusts. In addition, the skin around the stoma was treated with antibiotic ointment at least 3 or 4 times a day. The horizontal limbs of the T-tube were plugged as soon as possible to maintain the normal humidification and phonation. The fiberbroncoscopy was performed under local anesthesia every month to check the T-tube condition and clean the tracheal airway. When the chest and neck showed no tracheal stenosis the T-tube was removed under local anesthesia.

RESULTS

32 patients (82%) underwent surgery with Montgomery T-stenting and the rest were treated with other treatment modalities like diode laser, dilatation and microlaryngeal excision. 16 patients (41%) were between the age 21-30 years while 13 (33.3%) were aged between 31–40 years as given in Table 1. In our study LTS was more common in males (74.3%) as per Table 1.

Table 1: Age and sex wise distribution of patients.

Age in years	No of patients	Male	Female
0-10	1	1	0
11-20	4	3	1
21-30	16	9	7
31-40	13	11	2
41-50	2	2	0
51-60	2	2	0
>61	1	1	0

Prolonged intubation was found to be the most common cause i.e. in 89.7% of patients correlating with a previous study by Mohammed et al.[7] There was no perioperative or immediate postoperative mortality. The most common complication was minimal surgical emphysema seen in 50% of the patients followed by crusting 40.6%, granulation around the stoma 12.5%, migration of tube above the cords seen in 6.25% and granulation at upper end of tube 3.1% correlating with studies by Gaissert et al, Kumar et al.[6,8] Out of 32 patients, decannulation was not possible in 4 patients (12.5%) at single stage compared with a success rate of 100%, and 95% respectively in previously reported studies.[9-11] The cause for unsuccessful decannulation was tracheomalacia in 1 patient, granulation formation between upper part stent and glottis in 1 patient and recurrence of stenosis in 2 patients. In the patient with tracheomalacia, reconstruction of the trachea with cartilage graft along with T tube stenting. In patient with granulation formation, the laryngeal stent was reinserted at a lower position with application of a laser to remove granulation. In patients with recurrence of stenosis, reinsertion of T tube was done. In our study, elective tracheostomy was not found to be a causative factor for subglottic stenosis.

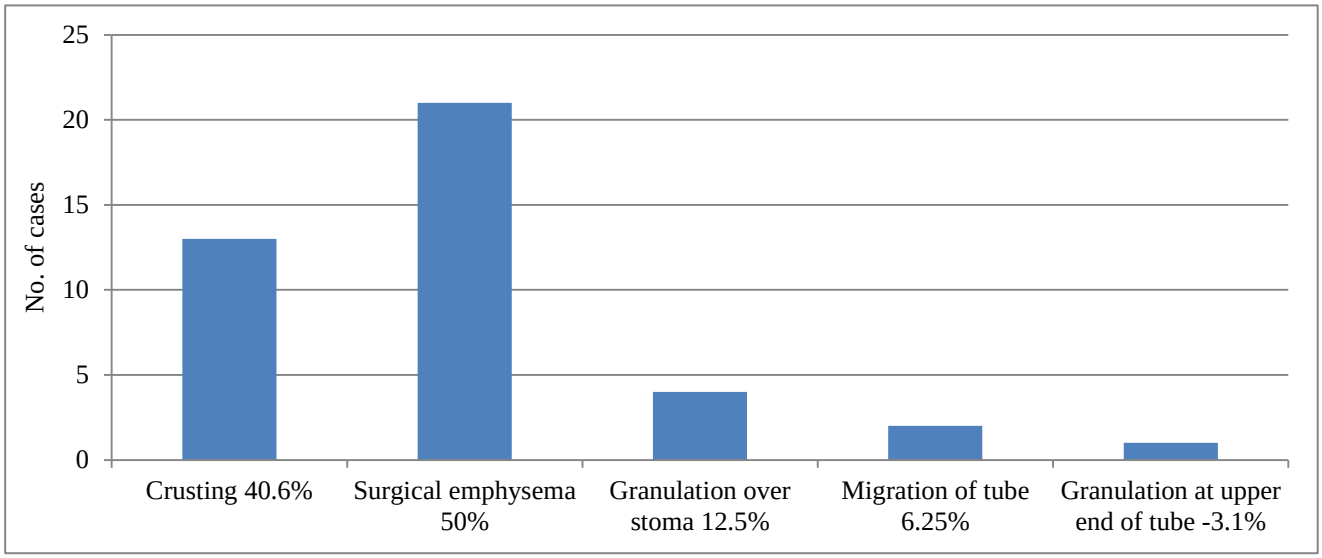

Figure 5: complications arising from Mongtomery T-tube stenting.

DISCUSSION

Management of LTS is a challenge. LTS is one of the most frequent complications associated with prolonged naso/orotracheal intubation and tracheostomy, such as in intensive care units. Post-intubation tracheal stenosis was identified in 1880, after study by MacEwen. The aim of any treatment modality is, in order of priority: (1) airway patency, (2) glottic competence for airway protection against aspiration and (3) acceptable voice quality.[12]

The oldest and simplest treatment method, viz permanent tracheostomy has numerous limitations like inability to vocalize without occluding the stoma, inherent disfigurement associated with wearing the tracheostomy tube, the social stigma associated with the tube and the inability to engage in certain recreational activities. Decannulation and closure of preliminary tracheostomy thus becomes yet another hurdle for modern therapy addressing airway stenosis.[13]

The causes of post intubation stenosis have been well established.[14,15] Prevention is possible to a high degree by use of large volume, low pressure cuffs and careful management of stomal tubes.[16] However, the lesions continue to appear, most likely because of over inflation of non-elastic plastic cuffs and leverage on tracheostomy tubes. It has also been established that subglottic stenosis can be prevented in patients requiring a long term mechanical ventilator support by performing and early elective tracheosotomy.

Various treatment modalities for laryngotracheal stenosis include laser, repeated endoscopic dilatations, cryosurgery, prolonged stenting, laryngotracheal reconstruction, and segmental resection with end-to end anastomosis. The ideal treatment modality should be customisied for each patient after a thorough discussion and counselling regarding the pros and cons of each procedure that would for suited for the patient. For better anastomotic results definitive laryngotracheal surgery should only be attempted after edema and inflammation have subsided. The use of silastic stents has both advantages and disadvantages. The 'tracheal stent' provides an excellent airway.[17,18] The upper stem of the tracheal T stent provides appropriate support to the subglottis and permits immediate postoperative phonation.

Stents have been proposed to protect laryngeal patency from the contracture of scar tissue, to promote the development of a new epithelial cover, and to prevent mechanical disruption caused by the movements of swallowing and breathing during healing.[19,20] Stenting remains a relatively conservative treatment, is successful in a proportion of cases, and does not preclude the possibility of future reconstructive surgery if it fails. The tracheal T-stent initiates little or no tissue reaction unless it touches the under surface of the vocal cord. This serves as both a stent and a tracheostomy tube. The intraluminal portion is of sufficient density and thickness to support a reconstituted stenotic larynx and trachea. Most of the time, the soft T-stent remains plugged, thus allowing respiration and phonation while maintaining the airway.[21] There are quite a few complications associated with Montgomery T tube insertion which were encountered in our study the commonest being surgical emphysema. In most of our cases surgical emphysema subsided on its own and only few required removing a few sutures near the stoma. The other complications were crusting, granulation tissue formation which correlated with a study by Kumar et al.[8] Crusting can be addressed by daily instillation of 1 cc to 2 cc of normal saline into the T-tube's lumen and cleaning of the extraluminal limb with a Q-tip soaked in 1/2 hydrogen peroxide is recommended in the first 1 or 2 postoperative weeks. Similarly, frequent suctioning of the T-tube is advised during the early postoperative period. We were not able to decannulate all

patients, even after different surgical treatment modalities were applied in our patients. Subglottic stenosis did not occur following elective tracheostomy in our institution which could be due to performing low tracheostomies and this did not correlate with the study by Herrak and Ahid.[3]

CONCLUSION

Laryngotracheal stenosis has always been and will remain a challenge to the otolaryngologist and a multidisciplinary approach is required to tackle it. The ideal treatment cannot be formed for this condition as it requires an individualised treatment plan for each patient which is usually a multistep approach. Stenting remains a relatively conservative treatment, is successful in a proportion of cases. Although there are complications associated with the T tube it is always easily manageable and are not usually life threatening. Hence, it can be considered as a first line in the management of laryngotracheal stenosis.

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