Managing subglottic stenosis with Montgomery tube – Our experience

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ABSTRACT

Background: The purpose of this retrospective study is to evaluate the outcome of Montgomery T-tube insertion in our institution (AIIMS, Raipur). This study also throws light on its indications and complications. Methods: This is a retrospective study of 10 patients who presented with laryngotracheal stenosis and managed by Laryngofissure with Montgomery Tube insertion in the Department of Otorhinolaryngology, Head and Neck Surgery at All India Institute of Medical Sciences (AIIMS) Raipur, India, during the period of January 2018- JUNE 2020. Results: The most common cause of laryngotracheal stenosis was prolonged intubation as seen in 80% patients. Majority of patients (40%) in this study were in the 3rd decade. In this study all the patients underwent tracheostomy prior to treatment for stenosis. The most common complication seen was surgical emphysema in post-operative period seen in 6 patients (60%) followed by crusting in 4 patients (40%), secondary granulation tissue formation in 4 patients (40%). Montgomery tube reinsertion had to be done in 2 patients (20%). Conclusions: Laryngotracheal stenosis (LTS) has always been and will remain a challenge to the otolaryngologist and a multidisciplinary approach is required to tackle it. A multitude of surgeries have been described for the management of Laryngotracheal stenosis ranging from Endoscopic dilatation and cricotracheal resection with anterior and posterior grafting and anastomosis but many of them require specialized training and expertise, prolonged ICU care and have morbidity and mortality. Laryngofissure and Montgomery Tube stenting provides a safe and easy treatment option which can be done at most centres provided appropriate case selection has been done.

Keywords: Laryngotracheal stenosis, Montgomery tube, Prolonged intubation

Introduction

Tracheal stenosis is a troublesome complication of prolonged endotracheal intubation and tracheostomy, with a reported incidence of 10–19 and 8–65%, respectively. It poses difficult challenges in decannulation. The Cotton-Myer classification divided subglottic stenosis into four grades based on the extent of luminal obstruction: Grade I (0–50%), Grade II (50–70%), Grade III (>70% with detectable lumen), Grade IV (complete obstruction). In 1965, William Montgomery pioneered the use of T-tube for the prevention of tracheal stenosis after tracheal surgery. The original T-tube was made of acrylic material and was later changed to silicone material due to the hard texture. It has a long intratracheal limb and a short extratracheal limb. The short limb projects through the tracheostomy stoma. The internal limb supports and shapes the trachea, and the external limb helps in external fixation, preventing T-tube slippage and displacement. The extratracheal tube can be closed with a plug attached to the tube to allow phonation. The Montgomery tubes have many benefits over tracheostomy tubes—they maintain the patency of tracheal stoma without the need to occupy the tracheal lumen, are easier to maintain and have a more concealable design.
case of any ventilator emergency, they can be exchanged for
traceostomy tubes. The Montgomery T-tube should be left for
at least 1 complete year in the airway as it results in negligible
chances of post-traumatic stenosis of the airway later.[8] It is
effective and safe to use Montgomery T-tube placement in
treating Cotton-Myer IV subglottic airway atresia after bi-level
airway recanalization and T-tube placement can be widely used
in clinical treatment.[9]

In this article, we discuss our experience with the Montgomery
tube and the varied outcomes.

Material and Methods

We retrospectively reviewed the data of 10 patients operated
between January 2018 and June 2020. Demographic data and
image shown in Table 1, Chart 1 and Figure 1. Institutional
permissions were obtained for carrying out the study [Table I].

Operative procedure

A direct laryngoscopic evaluation was done to identify the
type of stenosis and measure the exact size of stenosis.
A horizontal cervical incision was made, the strap muscles
were retracted, the thyroid gland isthmus was divided and
retracted. Laryngofissure was performed and the stenotic
segment was identified, fibrous tissue was excised with bipolar
cautery and coblation. The Montgomery tube (M tube) stent
was placed. The larynx was sutured with prolene suture and
reinforced with strap muscles. The upper end of the M Tube
was kept 5 mm below the level of the cords and its position
was checked by direct laryngoscopy. X ray performed to check
the position [Figure 2]. the gloves drain were put in the neck
to allow for air egress [Figure 3]. The wound was left open.
The patient could vocalize well by closing the M Tube on the
very next day. Care was to be taken for proper suctioning so
that both the upper and lower intratracheal limbs were clean
and crusts did not form. After around 3 days, the external
limb of the tube was kept closed throughout the day, and if
the patient was comfortable after 5 days, it was kept close
throughout.

| Age/Sex | Underlying condition | Tracheostomy duration | Symptoms and signs | Degree of stenosis | Level of stenosis | Stenotic segment length |
|---------|----------------------|-----------------------|--------------------|-------------------|------------------|------------------------|
| 24 yr/M | Electric injury      | 6 months              | Inability to speak | Complete           | Subglottic, 3 cm below true vocal cords | 2.5 cm                |
| 53 yr/M | CVA with pneumonia   | 2 months              | Failed decannulation-dysphagia, hoarseness, Stridor | 70%               | Subglottic, 2 cm below true vocal cords | 1.5 cm               |
| 27 yr/M | RTA-Rope stuck around neck | 1 month            | Neck swelling with emphysema, loss of voice | 70%               | Subglottic, 2 cm below true vocal cords | 1 cm                 |
| 64 yr/M | Organophosphate poisoning | 2 months          |                   | Complete           | Subglottic, 2.8 cm below true vocal cords | 1 cm                 |
| 10 yr/M | Snake bite           | 1 month               |                   | 50-70%             | Subglottic, 2.5 cm below true vocal cords | 1.5 cm               |
| 20 yr/M | Electric injury      | 8 months              | Failed decannulation | 70%               | Subglottic, just below the level of true vocal cords | 2.6 cm               |
| 47 yr/F | Organophosphate poisoning | 6 months          | Failed decannulation | 50-70%             | Subglottic, 5 cm below the level of true vocal cords | 1 cm                 |
| 29 yr/M | Aspiration pneumonitis-Organophosphate poisoning | 2 months          | Respiratory distress | >2/3              | Subglottic stenosis, 4.5 cm below true vocal cords | 1 cm                 |
| 40 yr/M | Tubercular meningitis | 11 months             | Failed decannulation | Complete           | Subglottic stenosis, 1 cm below true vocal cords | 1.4 cm               |
| 20 yr/M | Partial hanging      | 3 weeks               | Respiratory distress | Complete           | Subglottic Stenosis, 2.3 cm below true vocal cords | 2.1 cm               |
Follow-up
The patient was followed up every month for 3 months and then every 2 months for 6 months and then every 3 months for 9 months by video laryngoscopy and fiberoptic laryngoscopy. If the patient had any problems or complaints, then the patient was taken up for direct laryngoscopy Figure 4 and 5. The M tube removal was generally done under endoscopic guidance around 18–24 months.

Description of Montgomery tube
The M tube is an uncuffed silicon tube and has a unique T-shaped design with a long intratracheal limb and a short extratracheal limb coming out from the stoma [Figure 6]. The external limb has a stopper plug to allow for phonation and anchors the M tube thereby preventing displacement and allowing for a relatively smaller diameter intratracheal tube lumen. The smaller diameter intratracheal tube enables little pressure on the tracheal walls thereby preventing granulation formation even on long-term use. When the extratracheal limb is occluded, it allows for the passage of inspired air through the airway thus preserving phonation and humidification. It can be placed endoscopically or by open procedure.

Complications arising from Montgomery T-tube stenting
The most common complication was minimal surgical emphysema seen in 50% of the patients followed by crusting which was 40%, the granulation around the stoma was 20%, subglottic granulations were identified in 10% [Chart 2]. Two of the patients developed hoarseness of voice 2 weeks after surgery. The patients were taken for direct laryngoscopy and evaluation. The granulations had formed over the upper end of the tube and were removed. In two patients, the M tube was removed because of an accidental pull-out by the grandson, and in another case, the patient presented with respiratory distress and had to be removed in emergency and the tracheostomy tube was placed.

Discussion
The management of laryngotracheal stenosis (LTS) is a challenge. LTS is one of the most recurring complications associated with prolonged naso/orotracheal intubation and tracheostomy. Post-intubation tracheal stenosis was identified in 1880, after a study by MacEwen. The treatment is equally challenging. Various forms of treatment described for laryngotracheal stenosis include laser, repeated endoscopic dilatations, cryosurgery, prolonged stenting, laryngotracheal reconstruction, cricotracheal resection

Figure 1: X-ray of patient with subglottic stenosis with tracheostomy tube in situ

Figure 2: X-ray of patient after M tube insertion

Figure 3: Postoperative picture after Montgomery tube insertion

Figure 4: Post operative picture of well healed scar with m tube
with anterior and posterior grafting, and segmental resection with end-to-end anastomosis but many of them require specialized training and expertise, prolonged ICU care, and have morbidity and mortality. The effective treatment has to be individualized based on the patient clinical profile of type, extent, and size of stenosis, as each intervention has its pros and cons.\[12,13]\ The outcome of any treatment option preferentially requires in order of priority: (A) airway patency, (B) glottic competence for airway protection against aspiration, and (C) improvement in voice quality. Permanent tracheostomy has several disadvantages including poor humidification of inspired air and the lack of phonation due to bypassing the upper airway and larynx, respectively. The Montgomery tube with its external limb blocks preserves both. The other advantages include decreased chances of displacement (as the external limb anchors the intratracheal part across the stoma), decreased granulation tissue formation (as minimum pressure is exerted by the tube on the tracheal wall as its diameter is much less relative to the trachea), decreased risk of stent occlusion (as secretions can easily be suctioned out through the external limb).\[16]\ The laryngofissure and M Tube stenting provides a safe and easy treatment option which can be done at most centers provided appropriate case selection has been done.

However, more meticulous tube care and suctioning are required as M tubes are less frequently used than tracheostomy tubes. At times, it gets brittle and may dislodge. As it is not as commonly used, anesthetists and doctors are less familiar with the device, and in cases of emergency presentation at times, it becomes difficult for them to manage.

### Conclusions

M tube stenting is a reasonable option for selected cases of subglottic stenosis, easy to learn, and associated with less morbidity and mortality. Surgery can be done at a peripheral center and it serves the need of both airway patency and vocalization. However, it requires a thorough follow-up.

The Montgomery tube is a safe and easy treatment option for subglottic stenosis in properly selected patients so all primary care physicians should be aware of it along with handling the situation of accidental decannulation and blockage.

### Summary

M Tube is a very safe and simple option for selected patients with subglottic stenosis.

It requires proper care and follow-up.

The primary care practitioners and the anesthetist should be trained on how to handle accidental decannulation, blockage, how to give anesthesia through the M tube, and how to remove the tube.

### Declaration of consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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