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How I Do It

Laryngology

A Targeted Problem and Its Solution

Improved Method of Insertion of a Montgomery T-Tube

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INTRODUCTION

The Montgomery silicone tracheal T-tube (Safe-T-Tube) has gained a role in laryngeal and tracheal reconstruction and revision by providing patients a long-term, indwelling stent that allows voice production and swallowing.

Montgomery designed the tracheal T-tube in 1968.[1] The T-tube is made of silicone and therefore relatively inert and resistant to tissue reaction.[2] It can be used for long-term stenting of the larynx and trachea for up to 7 years, or, if it is periodically replaced, for up to 15 years.[2] The T-tube is contraindicated in a patient with aspiration or positive pressure ventilation requirement. The T-tube can be inserted to stent a tracheal or subglottic stenosis only or occasionally extend across the cords to stent a laryngeal stenosis. The tube consists of a hollow silicone tube with an intraluminal portion and perpendicular to this an extra-luminal portion that may be obtained with external grooves to hold a washer ring (Fig. 1).

Montgomery described a method of insertion of the T-tube by which the inferior intraluminal portion is folded in on itself and then directed inferiorly with a hemostat.[2] The extraluminal portion and superior limb of the intraluminal portion are then manipulated externally until the superior limb is across the stenosis, effectively stenting the airway. The extraluminal portion is then pulled anteriorly and secured with a ring washer.

An alternative method of inserting the T-tube is described in the package insert. It involves sliding the superior aspect of the T-tube into the tracheostomy stoma over a flexible dilator, which is removed through a direct laryngoscope. The inferior limb is then placed by external manipulation with a hemostat and the extraluminal limb is secured with the enclosed ring washer.[2] Similar methods of insertion describe insertion of the superior limb over an umbilical tape[3] or nasogastric tube[4] that extends through the stoma, across the stenosis, and out through the laryngoscope.

With these methods, the precise dimensions of the T-tube are difficult to plan. It is also difficult to manipulate the superior aspect of the intraluminal portion into correct placement, especially across a stenotic segment of trachea. Correct positioning after placement is also difficult to assess. Therefore, we describe a method of customizing the T-tube to the specific stenosis dimensions and placing the T-tube across the stenosis with control and accuracy.

METHODS

The procedure is described with a previously existing tracheostomy stoma and clinically and/or radiographically defined stenosis above the tracheostomy. The patient is brought to the operating room and anesthetized through his or her tracheostomy tube. Then this tube is replace with a small-caliber armor endotracheal tube placed inferiorly through the tracheostomy stoma. This tube is secured but not sutured into place.

The patient is positioned and a standard direct operative laryngoscopy with suspension is performed with an anterior commissure laryngoscope and a 0° endoscope. The vocal cords, subglottic stenosis, and tracheostomy stoma can be examined through the laryngoscope. If necessary, laser excision or sequential dilation of the stenosis can be performed through the laryngoscope with standard laryngeal dilators, but care must be taken to ensure that the endotracheal tube airway is not dislodged. External examination of the tracheostomy stoma can be done by deflating the endotracheal tube balloon and removing it under apneic conditions. Any stomal granula-

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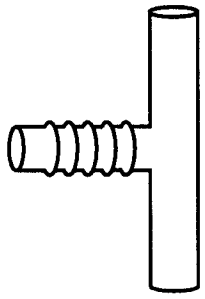

Fig. 1. Montgomery T-tube showing intraluminal and extraluminal aspects.

tion tissue or stenosis can be examined, biopsied, and/or cultured.

The level of stenosis is then measured using a velvet-tipped suction and the 0° endoscope under apneic conditions. First the suction is place through the laryngoscope to the level of the midportion of the tracheostomy stoma as visualized externally by the surgical assistant. An ink mark is made on the suction at the point where it exits the laryngoscope cranially. The ventilating endotracheal tube is then replaced. Under endoscopic visualization, the suction is placed at the caudal aspect of the stenosis and another mark is made on the catheter. This method is used to mark the cranial aspect of the stenosis and the level of the true vocal cords on the catheter (Fig. 2).

The catheter is removed and the marks are used as a template to define the optimum length of the superior limb of the intraluminal T-tube (Fig. 2). Proper placement across a subglottic stenosis requires stenting the stenotic segment, but not crossing the vocal cords. The T-tube is custom trimmed and the edges smoothed as described by Montgomery.[2] The T-tube is then rinsed in saline and placed on the scrub table.

The endotracheal tube is again removed from the stoma, and a 0 silk suture is passed from the stoma into the tracheal lumen. Endoscopic forceps are used to grasp the suture and withdraw it through the laryngoscope (Fig. 3), so that one end is through the tracheostomy stoma and the other is through the laryngoscope. The ventilating endotracheal tube is reinserted and the suture is loosely fastened to the drapes with a clamp to prevent accidental dislodging. A second 0 suture on a tapered needle is

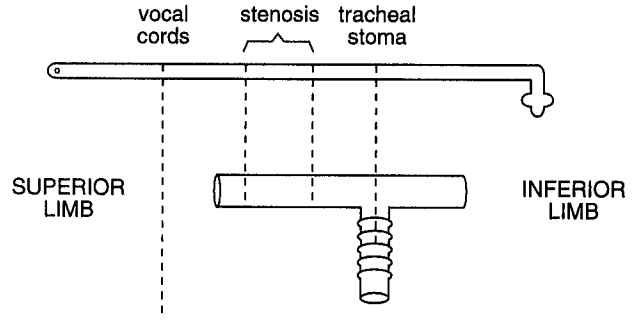

Fig. 2. Technique to customize the T-tube by marking the suction corresponding to the level of the tracheostomy, stenosis, and true vocal cords.

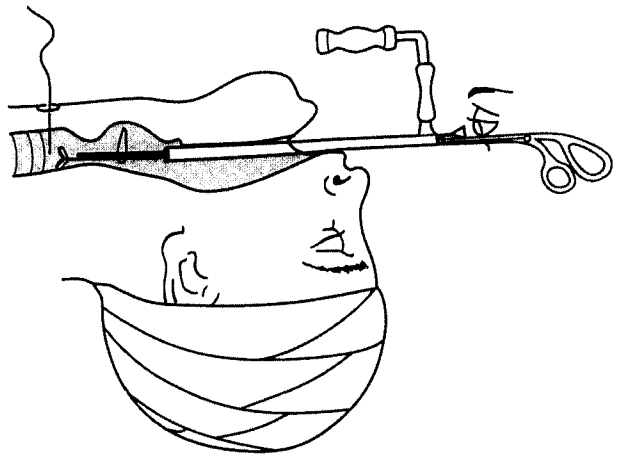

Fig. 3. Grasping the silk suture through the laryngoscope to position it across the stenosis.

passed through both front and back walls of the superior limb of the T-tube. The ends of this suture are tied together in a loop and this knot is tied to the stomal end of the first silk suture (Fig. 4).

After the patient is well oxygenated, the inferior limb of the intraluminal T-tube is then crimped together and grasped with a hemostat clamp. The endotracheal tube is removed under apneic conditions. The inferior limb of the T-tube is inserted caudally into the tracheal lumen through the tracheostomy stoma. Once the superior aspect of the T-tube is passed intratracheally, gentle traction is placed on the cranial end of the silk suture until the superior limb is pulled across the stenosis and properly positioned. Precision placement can easily be assessed by using the 0° endoscope both through the laryngoscope and the T-tube to ensure that the stenotic segment has been adequately stented. Then the large loop of suture that is still through the superior aspect of the T-tube is cut and gently pulled out, leaving the T-tube in place (Fig. 5). The patient is ventilated through the T-tube until anesthesia

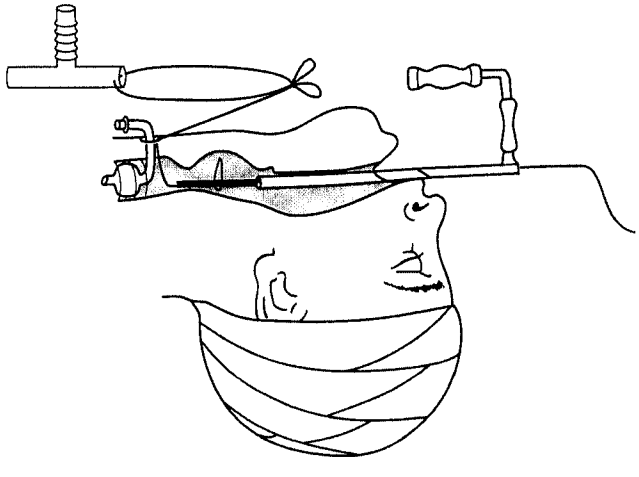

Fig. 4. Placing the looped suture through the superior limb of the T-tube, then connecting it to the first suture and extending out the laryngoscope, with armor endotracheal tube in position.

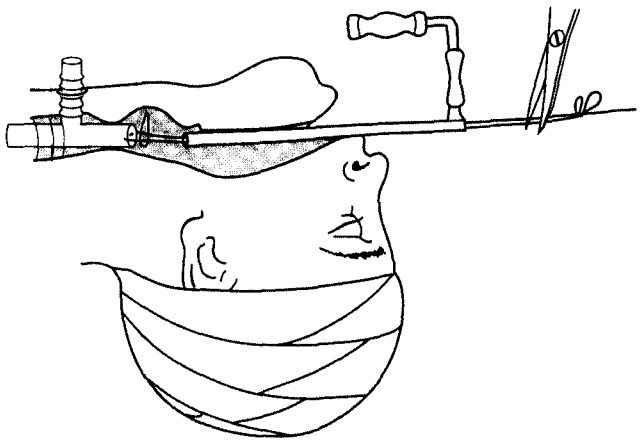

Fig. 5. Proper placement of the T-tube through the stoma, across the stenosis. The looped suture is then cut and removed.

has been adequately reversed. Occasionally it is necessary to hold the mouth and nose closed to adequately ventilate during this period.

ADVANTAGES

There are several advantages to this technique of T-tube insertion across a subglottic stenosis over previously documented techniques. This method gives increased control of the airway via the laryngoscope especially during apneic episodes. Direct visualization of the stenosis and trachea makes positioning of the T-tube possible in very short time. If difficulties arise, the ventilating armor endotracheal tube can be reinserted with the string still in situ from the laryngoscope to the stoma. If necessary, the string provides a "safety net" for T-tube retrieval from the trachea. Grasping the string with a small forceps is much easier than trying to manipulate dilators or a nasogastric tube through a stenosis.

The T-tube can easily be custom designed with specific measurements to stent the trachea yet not cross the true vocal cords unless required. Previously, the measurement relied on estimations and trials. Narrow stenoses can be stented more easily by pulling the superior limb superiorly rather than trying to push the flexible tube superiorly into the subglottis. The inferior limb is easy to control and directly place in the proximal trachea. Finally, the exact position of the T-tube can be verified with the 0° endoscope at the completion of the procedure.

CONCLUSION

This method for inserting Montgomery T-tubes has been successfully used at UCLA for patients with severe tracheal stenosis that would have been impossible to stent using the previously described methods. We believe that our method allows for the precise customizing of the T-tube to fit the specific stenosis and increased control while placing the T-tube across that stenosis. Montgomery T-tubes have been used successfully in long-term situations when reconstruction or difficult stenoses precluded voice production and successful decannulation.

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