The Journal of Laryngology & Otology

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How I do it: novel use of a modified nasopharyngeal airway in laryngotracheal stenosis as a temporary stent

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Short Communication

Sien Hui Tan takes responsibility for the integrity of the content of the paper

Cite this article: Ghauth S, Tan SH. How I do it: novel use of a modified nasopharyngeal airway in laryngotracheal stenosis as a temporary stent. *J Laryngol Otol* 2024;**138**: 696–698. https://doi.org/10.1017/S0022215123001858

Received: 1 August 2023
Revised: 23 August 2023
Accepted: 29 August 2023
First published online: 6 November 2023

Keywords:
Tracheal stenosis; stents; tracheostomy; phonation

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Abstract

Background. This paper reports the innovative use of a modified nasopharyngeal airway device as a temporary stent in patients with laryngotracheal stenosis. It also discusses the technique of endoscopic stent placement, and our experience in terms of the indications and suitability.

Method. The nasopharyngeal airway device was modified to use as an airway stent by trimming it to the desired length. Next, the stent was inserted endoscopically and anchored using a novel approach.

Results. The surgery was performed successfully without complications. The patients had full use of their voice while the stent was in situ. No significant granulation tissue was observed.

Conclusion. This paper demonstrates the feasibility of using a nasopharyngeal airway device as a temporary stent to prevent restenosis in cases where the patients have a strong demand for phonation. The modified nasopharyngeal airway device is potentially very promising, but cases must be selected carefully to avoid compromising efficacy and safety.

Introduction

Laryngotracheal stenosis is complex, and the choice of surgery must be tailored to the individual patient. Some situations warrant a more conservative approach such as endoscopic treatment with stenting of the airway.

We report the novel use of a modified nasopharyngeal airway device as a temporary stent for restoration of the airway and phonation in patients with laryngotracheal stenosis. We also discuss the technique of endoscopic stent placement, and our experience in terms of the indications and suitability.

Materials and methods

Case one

A 57-year-old man presented with progressive loss of voice leading to complete aphonia. He had a permanent tracheostomy for tracheal stenosis and tracheomalacia, secondary to trauma 20 years previously. Flexible nasopharyngoscopy showed normal vocal fold movement. Examination under anaesthesia demonstrated a Cotton–Myer grade IV stenotic segment (no detectable lumen), 4 cm from the vocal folds and measuring 2 cm in length. Despite endoscopic balloon dilatation with radial incisions and localised injection of steroids, there was recurrence of stenosis. A decision was made to insert a Montgomery T-tube size 11. However, the T-tube was not readily available, and expenses had to be borne by the patient. As the patient was dependent on his voice for income, we used a nasopharyngeal airway device as an interim stent with the tracheostomy tube in situ. We were only able to fit a size 5.5 T-tube, but it was adequate for vocalisation.

Case two

A 25-year-old man was referred to our tertiary centre for aphonia and subglottic stenosis of Cotton–Myer grade IV. Five months prior, he was involved in a motor vehicle accident where he suffered laryngeal trauma of Schaefer classification group IV (laryngeal structure destabilisation). He had undergone neck exploration, repair of the laryngeal disruption and a tracheostomy. Flexible nasopharyngoscopy showed normal vocal fold movement. Examination under anaesthesia demonstrated a Cotton–Myer grade IV stenotic segment, 1.5 cm from the vocal folds and measuring 1.2 cm in length. As the patient refused open surgery, he underwent endoscopic balloon dilatation with radial incisions and localised injection of steroids. Given his strong need for phonation because of his occupation, we placed a nasopharyngeal airway device size 6 as a temporary stent with the tracheostomy tube in situ.

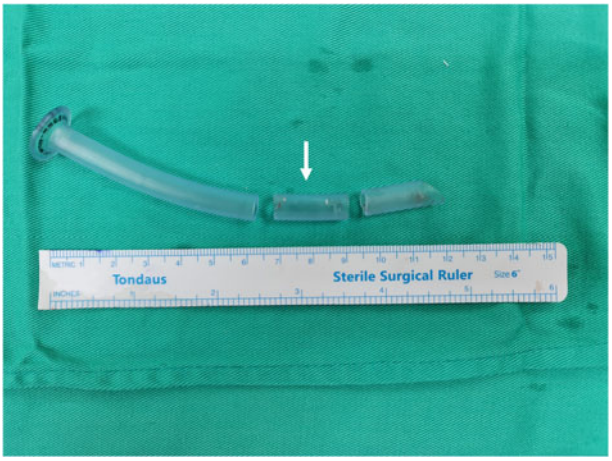

Figure 1. The nasopharyngeal airway tube trimmed to the desired length and used as a stent (arrow).

Surgical approach

The procedure was performed under general anaesthesia; suspension laryngoscopy was carried out using a Lindholm laryngoscope with the patient positioned to allow extension of the head at the atlanto-occipital joint and flexion of the neck on the chest. The distance from the inferior aspect of the vocal folds to the stenosis, and the length of stenosis, were measured. A nasopharyngeal airway tube was trimmed to the desired length so that it was longer than the stenotic segment, while ensuring the superior end did not abut the vocal folds (Figure 1).

In order to prevent migration, we anchored the stent with size 2/0 Prolene sutures. The stent was inserted via the laryngoscope using micro-laryngeal forceps, and placement was confirmed with direct visualisation (Figure 2). The needle was passed from the tracheostoma into the lumen of the nasopharyngeal airway device and out of the anterior neck skin, in an inferior to superior manner (Figure 3). An external knot was tied between both ends. A button and Silastic™ sheet were placed between the external knot and skin to prevent a pressure ulcer and skin irritation.

Post-operatively, our patients only required 1 day of hospitalisation. Both patients were well when discharged, with their tracheostomy tubes and stent in situ. They were given oral antibiotics, proton pump inhibitors and a two-week tapering dose of oral steroids, followed by inhalational steroids.

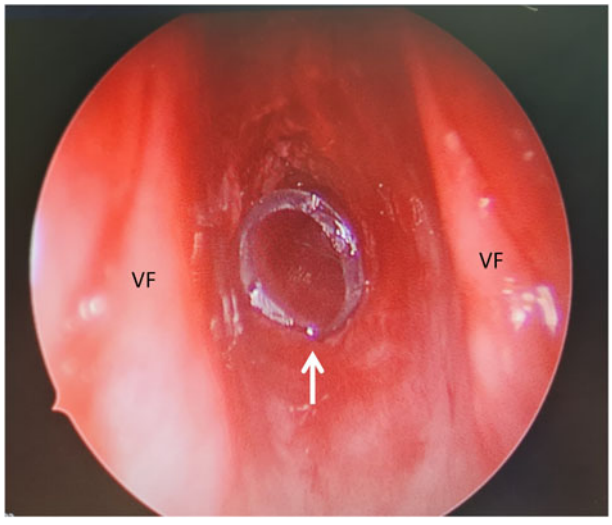

Figure 2. Proximal end of the nasopharyngeal airway stent (arrow) seen below the vocal folds (VF) endoscopically.

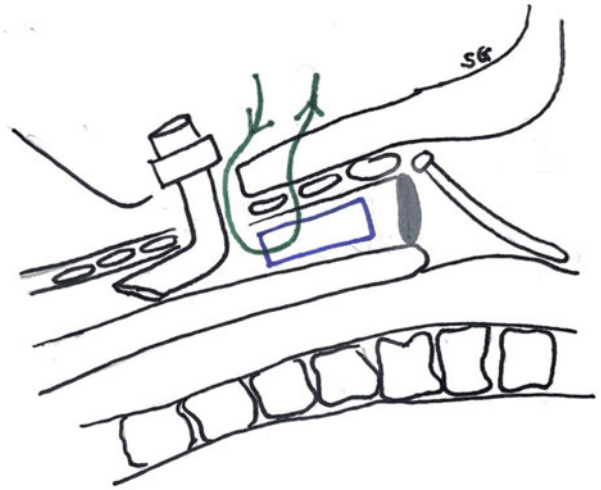

Figure 3. The free needle was passed from the tracheostoma into the lumen of the nasopharyngeal airway device and out of the anterior neck skin, in an inferior to superior manner.

Results

There were no complications during follow up and the patients had full use of their voice while the stent was in situ. Neither patient reported any aspiration symptoms. Six weeks later, the patients underwent direct laryngoscopy and the stent was removed. No significant granulation tissue was observed.

The first patient underwent repeat endoscopic balloon dilatation to enable insertion of the appropriate larger size 11 Montgomery T-tube. This was performed successfully, and he was discharged the following day. Follow up six months later revealed good phonatory function and airway patency. In view of his tracheomalacia and poor co-morbidities, open surgery was not suitable; instead, long-term placement of a Montgomery T-tube was planned.

The second patient refused a Montgomery T-tube for financial reasons and chose to have his tracheostomy in situ. Subsequent follow up four months later demonstrated satisfactory vocalisation and airway support. The previous stenotic segment remained patent and we are evaluating the patient's suitability for decannulation.

Discussion

Management of laryngotracheal stenosis is extremely challenging. The desired outcome is to re-establish epithelial continuity and reduce the formation of granulation tissue with ensuing fibrosis. This is accomplished by enabling the wound to heal around a relatively inert object which withstands the contraction process.[1] Stenting is used when the trachea is malacic or cannot sustain stable patency, or when surgical treatment is not feasible.[2]

To our best knowledge, this is the first paper to illustrate the role of a modified nasopharyngeal airway device as a temporary laryngeal stent. The use of a stent was strongly indicated as it addressed our patients' primary concern for phonatory function. We chose one that suited their financial situation and was readily available. The modified nasopharyngeal airway device

https://doi.org/10.1017/S0022215123001858 Published online by Cambridge University Press

was the perfect option to fulfil the patients' requirement for immediate vocalisation.

Many factors need to be considered during stent selection. Features of the ideal stent include the ability to be inserted and removed easily, fit the specific shape of stenosis, and maintain post-operative airway patency with minimal migration. In addition, it needs to be constructed of inert material to minimise granulation tissue and it needs to be affordable.[3] We believe the nasopharyngeal airway device largely fulfils the above criteria.

The nasopharyngeal airway device is available in various sizes, allowing us to pick one that fits the stenotic segment. The length of the nasopharyngeal airway tube can be trimmed to the desired length. Bourinet *et al.*[4] reported that it is crucial to leave at least 1 cm between the upper margin of a stent and the vocal folds, to avoid discomfort and obstructive complications such as laryngeal oedema and granulation tissue formation below the vocal folds. We were meticulous in our measurements so as to ensure that our stent was a precise fit.

The material in contact with the laryngotracheal mucosa is a key aspect that determines tissue changes.[5,6] Several papers have described the use of an endotracheal tube as a temporary stent.[7–9] However, endotracheal tubes are commonly made of polyvinyl chloride. Polyvinyl chloride, while inert by itself, is combined with plasticisers, stabilisers, antioxidants, lubricants, pigments and other filler material, which may cause irritation to the laryngotracheal mucosa.[1] Mandal *et al.*[1] reported that irreversible changes such as fibrosis were seen after just four weeks. As such, we preferred the nasopharyngeal airway device, which is made of silicon and is similar to the Montgomery T-tube.

Commercially available stents are expensive. Moreover, these stents must be ordered, taking several weeks to arrive. We did not use a finger cot, as we required a hollow stent for vocalisation. For our case series, the modified nasopharyngeal airway device was ideal for avoiding restenosis while addressing our patients' needs for urgent phonatory function.

Our patients were monitored closely for aspiration symptoms, as we used open stents and placed them just inferior to the vocal folds. Open stents were preferred to closed stents because our patients had a high vocal demand and needed immediate phonatory function. We believe their normal vocal fold sensation and movement played an important role in preventing aspiration.

One complication of stent placement is granulation formation at the ends of the stent.[10] Granulation implies the site of future scar development with subsequent stenosis, and their occurrence denotes a propensity towards restenosis.[1] In order to prevent or minimise granulation, our patients were prescribed systemic antibiotics and inhalational steroids.

Another disadvantage of stenting is stent migration, which can be averted with proper endoscopic stent placement. Anchoring the stent endoscopically typically requires a specialised needle carrier to place the sutures. In reality, many centres do not have this designated needle carrier. It is also a challenge to pass sutures endoscopically from the laryngeal lumen out of the anterior neck skin because of the narrow surgical field of a laryngoscope. Mace *et al.* described a suture technique whereby the needle is passed through the skin and trachea into the lumen of the stent and angled to exit laterally.[11] The needle is then reversed through the same exit and entry points, passing through only subcutaneous tissue.[11] This approach was not suitable for our patients owing to the fibrosis caused by their previous laryngeal trauma, and it would be difficult for the needle to pass through the subcutaneous tissue. This method also poses a problem for patients with thick necks, as it may not be possible for the needle to reach the lumen of the stent. We devised a novel technique to address these difficulties.

Conclusion

This paper demonstrates the feasibility of using a nasopharyngeal airway device as a temporary stent to prevent restenosis in cases where the patients have a strong demand for phonation. A larger sample size and longer follow-up period should be utilised to assess the effectiveness of this novel technique. The modified nasopharyngeal airway device is potentially very promising, but the cases must be selected carefully to avoid compromising efficacy and safety.

Competing interests. None declared

References

1 Mandal NG, Muralidhar V, Kumar S, Kaul HL, Ghosh P. Laryngeal changes following long-term stenting with polyvinyl chloride tubes. *Natl Med J India* 1995;**8**:213–15
2 Glikson E, Abbass A, Carmel E, Primov-Fever A, Alon EE, Wolf M. Endoscopic management of benign laryngo-tracheal stenosis: balloon vs. rigid dilatation. *Isr Med Assoc J* 2021;**23**:297–301
3 Lee P, Kupeli E, Mehta AC. Airway stents. *Clin Chest Med* 2010;**31**:141–50
4 Bourinet V, Raguin T, Fortin M, Chetrit E, Guinde J, Laroumagne S *et al.* Experience with transcordal silicone stents in adult laryngotracheal stenosis: a bicentric retrospective study. *Respiration* 2018;**95**:441–8
5 Saxena A, Kaul HL, Saxena N, Agarwal HC, Chopra P. Tissue reactions to indigenous endotracheal tube in rabbits. *Indian J Med Res* 1984;**79**:67–8
6 Saxena A, Kaul HL, Saxena N, Chopra P. Endotracheal tube toxicity testing by subconjunctival and intramuscular implantation. *Indian J Med Res* 1987;**85**:461–6
7 Yu SY, Liu YH, Hsieh MJ, Ko PJ. Temporary stenting of acute airway stenosis with endotracheal tube--an effective method. *Int J Clin Pract* 2010;**64**:103–5
8 Gustafson LM, Hartley BE, Liu JH, Link DT, Chadwell J, Koebbe C *et al.* Single-stage laryngotracheal reconstruction in children: a review of 200 cases. *Otolaryngol Head Neck Surg* 2000;**123**:430–4
9 Jacobs JP, Elliott MJ, Haw MP, Bailey CM, Herberhold C. Pediatric tracheal homograft reconstruction: a novel approach to complex tracheal stenoses in children. *J Thorac Cardiovasc Surg* 1996;**112**:1549–58; discussion 1559–60
10 Prasanna Kumar S, Ravikumar A, Senthil K, Somu L, Nazrin MI. Role of Montgomery T-tube stent for laryngotracheal stenosis. *Auris Nasus Larynx* 2013;**41**:195–200
11 Mace A, Sandhu G, Howard D. Securing tracheal stents: a new and simple method. *J Laryngol Otol* 2005;**119**:207–8

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