

Delayed Laryngotracheal Reconstruction With Titanium Plate: Report of 10 Cases

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Summary: Background. Subglottic stenosis is congenital or acquired narrowing of subglottic area. The management of subglottic stenosis is still a serious surgical challenge. Although different surgical techniques are accomplished to manage the condition, no standard treatment has been presented yet.

Study Design. Titanium mesh was used in the reconstruction of the anterior laryngotracheal wall in 10 tracheostomized patients with laryngotracheal stenosis because of prolonged intubation. The anterior laryngotracheal wall was split, followed by excision of scar tissue. After several weeks, in a second-stage performance, the titanium plate was fixed at the split edges.

Results. Finally, all the patients were decanulated. However, one patient developed respiratory distress because of granulation tissue and underwent a second trial of decanulation. In one patient, the titanium plate extruded.

Key Words: Subglottic stenosis–Decanulation–Prolonged intubation–Augmentation.

INTRODUCTION

Subglottic stenosis is a narrowing of the subglottic airway. Prolonged intubation is considered one of the important causes of the condition. Management of subglottic stenosis is influenced by the characteristics of the stenosis and associated medical problems. Careful preoperative evaluations and a good surgical technique are two of the most crucial steps toward decanulation.^{1,2}

In this study, we presented a report of 10 cases successfully decanulated with delayed anterior augmentation of laryngotracheal area with titanium plate. Most of these patients had undergone several endoscopic and open surgical procedures, such as reconstruction using cartilage rib graft (in two patients), which were unsuccessful.

SURGICAL METHOD

A two-staged repair was performed in 10 patients with laryngotracheal stenosis owing to prolonged intubation. The patients were all males with age ranging 18–30 years. Patients with concomitant supraglottic or glottic stenosis were excluded from the study. During the first stage, under general anesthesia, the anterior laryngotracheal wall was split from the site of tracheostomy superiorly up to the anterior commissure; all granulation and scar tissue was resected. The posterior wall of the trachea and postcricoid remnant were intact.

Further in this procedure, the lateral walls of the exteriorized larynx and trachea were sutured anteriorly with 4-0 nylon to the skin edges of the initial incision, creating a laryngotracheal trough. The trough was packed with medicated gauze superiorly, and in the mean time, tracheostomy tube was inserted inferiorly as well. The following day, the gauze was removed to allow the mucosa of the endolarynx to be in contact with open air. The patients were examined weekly with endoscope for any

newly developed granulation tissue to be removed. After several weeks (6–8 weeks), the second stage was accomplished with the stabilization of the laryngotracheal mucosa and without any growth in granulation tissue. In this procedure, the anterior wall was augmented with micro-titanium plate. A tented titanium plate was sutured to the edges of the trough (subcutaneous plane) with 3-0 nylon (Figure 1). Subsequently, the entire area was covered by advancement cervical skin flap (Figure 2). The patients were decanulated on the seventh postoperative day.

RESULTS

All patients were decanulated 1 week later. Although nine patients had no complaint, one patient developed respiratory distress after 2 months of decanulation. Therefore, emergency tracheostomy was performed. The granulation tissue was removed and second trial of decanulation was done. At the moment the patient has a patent airway. One week later, the titanium plate was exposed in another patient. He underwent repair with advancement cervical skin flap several weeks later.

In the follow-up study, based on an endoscopic examination, good epithelization was noticeable on the inner surface of the mesh in all patients. One year after follow-up, all had returned to their normal life continuing to have a patent airway.

In general, the voice results after surgery were satisfactory, although we did not analyze them. This satisfactory result was attributed to the fact that our study included only patients with subglottic stenosis and patients with glottic stenosis were excluded. Figure 3 shows axial computed tomography scans of subglottic area augmented with titanium plate after surgery.

DISCUSSION

The management of laryngotracheal stenosis has been a challenge confronting head and neck surgeons for over a century. Many surgical procedures, including laryngotracheal expansion with or without grafting, have been suggested for repairing laryngotracheal stenosis.^{2,3} They can be divided into two groups: first, laryngotracheal reconstruction procedures in which the cricoid cartilage is split and the framework is expanded with various combinations of cartilage grafts and stents; and second, cricotracheal resection, where a segmental

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FIGURE 1. Tented titanium plate in the laryngotracheal trough.

excision of the stenotic segment is carried out and an end-to-end anastomosis is performed.³

Many prosthetic materials can be used for laryngotracheal replacement, including glass, stainless steel, silicone, and Teflon. The ideal material should be strong enough to provide support and flexible enough to allow mobility of surrounding structures.⁴ In this study, we present a solution to counteract with granulation tissue, which usually creates an unsatisfactory result after laryngotracheal stenosis repair. In the author's opinion, if the tracheobronchial mucosa is in contact with open air, there is no chance of the granulation tissue growing any more, or in case of growth, it is visible with the naked eye to be removed easily. Based on this hypothesis, we split the anterior tracheal wall to allow the mucosa to be in contact with open air for several weeks. After the mucosa had been stable, we proceeded to reconstruct the anterior wall with tented titanium plate.

Lejeune and Owens introduced the concept of prolonged open laryngeal repair in 1935, when they described two patients with laryngeal stenosis that was repaired by split-thickness skin grafting of the anterior glottis, stenting, and maintaining access to the larynx through the thyrotomy until healing with a lumen



FIGURE 2. Titanium plate covered by cervical advancement flap.

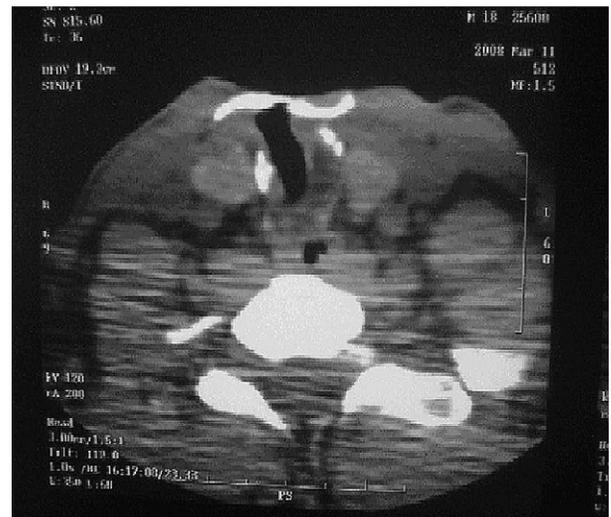
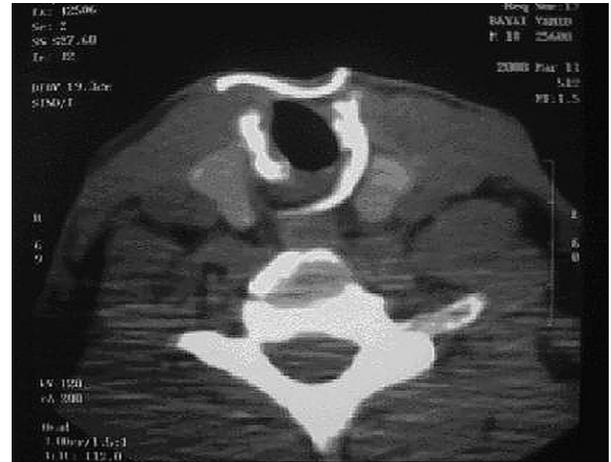


FIGURE 3. Axial subglottic computed tomography scans showing titanium membrane as anterior wall of the airway.

was ascertained.⁴ Gaafar et al described one-stage anterior laryngotracheal augmentation using titanium mesh in 2007.⁵

In fact, the idea of this study was taken from both previous studies. Excellent results were achieved through anterior augmentation in a previously split airway. To avoid the extrusion of titanium, the whole anterior wall was covered with skin flap without any tension, a difficult task owing to the scar tissue present in neck area caused by previous unsuccessful surgeries.

The titanium plate was exposed after 1 week in one patient. The main reason was excessive tension of skin flap. On weekly endoscopic examinations, epithelization was seen on the inner surface of the titanium plate.

The disadvantage of aforementioned technique is the necessity of intact remnant of posterior laryngotracheal wall as this remnant may consist of a relatively narrow cartilage strip. As more laryngotracheal injuries involve primarily the anterior and lateral walls, there is usually a portion of intact posterior wall.

In this technique, the entire area should be covered by cervical skin flap. Owing to the fact that most of our patients had undergone several open procedures, the scar tissue in the neck skin caused difficulties with advancement flaps. This problem caused extrusion of titanium plate in one patient.

CONCLUSION

Laryngotracheal split and delayed anterior augmentation with titanium plate can be a successful technique in the prevention of granulation tissue formation and decanulation of subglottic stenotic patients.

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