Management of Severe Subglottic Stenosis Secondary to Trauma: Case to Case Comparison of Resection Anastomosis Versus Cartilage Augmentation

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SUMMARY

We studied two similar cases of severe subglottic stenosis secondary to trauma with different treatment modalities. One had laryngotracheal reconstruction with cartilage augmentation and the other had laryngotracheal resection anastomosis. We wish to compare the two popular choices of surgery for laryngotracheal stenosis from two cases with similar nature and severity thus highlighting the complexity of managing severe subglottic stenosis in adult.

KEY WORDS:
subglottic stenosis, cartilage augmentation, resection anastomosis

INTRODUCTION

Laryngotracheal stenosis remains one of the most challenging problems facing the otolaryngologists. Surgical options available for severe stenosis can be broadly classified into two categories: cartilage augmentation and resection anastomosis. Cartilage augmentation involves increasing the airway diameter by placing a homogenous cartilage graft into the edges of a surgically created split in the anterior or posterior laryngeal/tracheal cartilages. Resection anastomosis is 'simply' resection of the stenotic segment and suture anastomosis the proximal and the distal end together. Despite the two available choices of surgery, there is still no clear cut indication for one above the other and the choice is very much up to the surgeon's preferences.

MATERIALS AND METHODS

The study retrospectively evaluated two adult patients who received treatment in Hospital Universiti Sains Malaysia, Kubang Kerian in 2006 (patient B) and Hospital Tengku Ampuan Afzan (HTAA), Kuantan in 2007 (patient A) for severe subglottic stenosis. Both patients are male in their twenties and presented with signs and symptoms of laryngeal injury immediately after history of motor vehicle accident (MVA). Both patients had emergency tracheostomy done to secure the airway. In both cases, the diagnosis of severe subglottic stenosis was confirmed with rigid bronchoscopy at two months post injury. Patient A had resection anastomosis, and patient B had laryngotracheal augmentation with cartilage graft.

The data documented include patient's morphology, pre-operative bronchoscopic findings, details of surgery, length of intensive care unit (ICU) stay, length of hospital stay, number of surgical procedures done, post-operative complications, decannulation time post-operatively, numbers of readmissions, follow-up lengths and patient's outcome.

RESULTS

Data from the two patients are summarized in table I.

DISCUSSION

Despite the available surgical techniques for subglottic stenosis, the final decision is very much operator dependent, i.e. depends on the exposure and preferences of the surgeons themselves. However, many will agree that the length of the stenotic segment and the distance of it from the vocal cords play important roles in deciding which type of surgery is appropriate. It is generally accepted that a lesion greater than 5 centimetres is not suitable for resection anastomosis due to the difficulty in suturing the two ends together without creating a sustainable tension to the airway. Similarly a lesion very close or involving the vocal cords is not suitable for resection anastomosis due to lack of tissue to stitch the proximal cut end without jeopardizing the cord's function or mobility. In our two cases, both surgical options can be used as the lesions are still within acceptable limit to allow for either technique to be done.

Patient A was treated with resection anastomosis despite the close distant of the stenotic segment to the vocal cord (5mm). Here, the decision to use this technique was made intraoperatively because the extensive damage of the anterior cricoid and the first two tracheal rings rendered it impossible to reconstruct. The vocal cord function on one side was already affected by the injury but no further loss of function was noted post-operatively. In this case, we cut off the damaged anterior half of the cricoid cartilage and maintained the posterior half, and sutured them to the distal edge of the thyroid cartilage above. The emphasis here is to preserve the posterior end of the cricoid ring because there sits the two arytenoids that maintain the vocal fold mobility. At least we have to preserve one functioning arytenoids to keep the protective function of

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the vocal cord. In patient B, the decision to use cartilage augmentation was made since the length of the stenotic segment was relatively long (3.5cm). There were some distance of the stenotic segment to the vocal cords (10mm) and both vocal cord functions are intact pre and post-operatively in this case.

In the two cases, emergency tracheostomy had to be done pre-operatively to secure the airway as both presented with acute respiratory obstruction. In both patients, we placed the tracheotomy incision through the damaged cartilage in order to preserve as much as possible the length of the healthy airway tissue. In case the damaged cartilages need to be resected at the same time, it is wise to do tracheostomy as high as possible but be sure to try and keep the posterior part of the cricoid and the thyroid cartilage intact to prevent damage to the vocal cord function. Otherwise the patient may end-up with permanent tracheostomy.

In comparing the two cases, both had surgery performed few months after the injury had occurred. This is important to allow some times for the healing process to take place and further assessment on the airway before any decision is made to whether any surgical reconstruction is required or not. Both patients had post-operative recovery in the intensive care unit (ICU) with patient A stayed much longer than patient B. This was due to the immediate post-operative complication of blocked endotracheal tube (ETT) in patient A warranting emergency tracheostomy to be performed immediately. This was an avoidable complication with frequent endotracheal tube suction. In patient B, the ICU recovery was uneventful and he was discharged from the ICU after 2 days.

Patient B failed many attempted decannulation and underwent far more surgical procedures before successful decannulation. Our lack of success to decannulate patient

Table I: Morphology and clinical data of the two cases

	Patient A (2007)	***Patient B (2006)***
Age at operation	24 years	22 years
Gender	Male	Male
Type of stenosis	Acquired (MVA)	Acquired (MVA)
Pre-operative laryngo-bronchoscopy assessment (at 2 months post MVA):		
Degree of stenosis	Grade III Cotton-Myer[1] (>90% stenosis)	Grade III Cotton-Myer[1] (>90% stenosis)
Length of stenotic segment	2 cm	3.5 cm
Distant of stenosis from the vocal cord	5 mm	10 mm
Vocal cord movement	Right sided palsy, left side sluggish	Both vocal cord mobile
Surgical treatment received	Resection anastomosis	Cartilage augmentation
Duration from the date of accident to the date of surgery	6 months	4 months
Intraoperative findings and surgical procedure done	Comminuted fracture of anterior cricoid cartilage into 3 small pieces. 1st & 2nd tracheal ring totally crushed & collapsed inward in an hour-glass appearance. Anterior half of the cricoid cartilage removed (partial cricothyroid resection), first 2 tracheal rings resected. End to end anastomosis done and lumen stented with ETT.	Fracture line at the anterior cricoid cartilage down to the first tracheal ring. Thickened tracheal mucosa occluded with granulation tissue. Anterior cricotracheal split and removal of granulation tissue done. Cartilage graft harvested from 7th costal cartilage and sutured to the opening. Stenting with Montgomery T-tube.
Immediate post-operative complications	Day 1 post-op: ETT stent blocked with clot, failed reintubation and emergency tracheostomy performed in OT.	Nil
Length of ICU stay post-op	4 days	2 days
Overall length of hospital stay (from date of operation until discharge from ward following surgery)	8 days	7 days
Other procedures performed in the follow-up period (name and number of times performed)	Direct laryngoscopy and removal of tracheostomy (x1)	Direct laryngoscopy and laser removal of granulation tissue (x4) Direct laryngoscopy and removal of tracheostomy (x1)
Decannulation time (from date of surgery)	4 months	2.5 years
Follow-up period	2 years	3.5 years
Patient's outcome/satisfaction	*Voice:* coarse, but able to communicate normally without voice fatigue *Cough reflex:* good *Feeding:* Very rarely aspirated on heavy bolus.	*Voice:* Almost normal *Cough reflex:* good *Feeding:* well tolerated orally

MVA, motor vehicle accident; ICU, intensive care unit.

B earlier may be down to few reasons. First, we did performed several laser endoscopic removal of the granulation tissue in every two to three months for patient B as there were excessive granulation tissue formation occurring post-operatively. Looking back, we thought that we had attempted too many procedures on the injured cartilage too soon and that to some way or another has interfered with the recovery process and further impaired the potential normal tissue healing and altered the structure of the cartilage. In patient B, we did laser excision of granulation tissue as soon as after one month; unlike patient A where we left him undisturbed until 4 months post-operatively. This allows time for tissue healing in patient A that we were able to decannulate straight away at 4 months. Also, patient B may have had an underlying abnormal cartilage and soft tissue structure that further impaired the healing process and frequent interference to the cartilage may have altered the structure leading to healing by fibrosis and further granulation tissue formation. Thus, what we have learned here is that we need to give time for normal tissue healing to take place first before embarking on any surgical interference on the delicate tissue of the airway. We also found, as agreed by many authors that the use of mitomycin C helps in reducing the granulation tissue formation and enable us to decannulate in this patient[2,3].

Our adult cartilage augmentation case (patient B) took 2.5 years to decannulate post-operatively, much longer decannulation time compared to our augmentation series in pediatric patients previously published (9 months)[4]. Being in an active growth phase, children is expected to have a better healing chances and faster recovery compares to the adult population, and the incidence of granulation tissue formation is lesser compared to adult[3]. However, the decannulation time is determined by many other factors apart from surgery. Factors like poor post-operative care, patients and relative's anxiety, poor knowledge, physical disability, poor family support, poor financial support and logistic problems can impair post-operative follow-up and subsequently delay the decannulation time[3].

In general, successful decannulation rate was reported to be higher and quicker in cricotracheal resection anastomosis than cartilage augmentation[2,3]. This is also proven in our two cases comparison here. However, resection anastomosis has more limitations compared to augmentation procedure. It can only be used when the stenotic lesion does not involve the vocal cord. Resection anastomosis also reduces the length of the airway, making further reconstruction difficult or impossible in the future[2,3]. While in cartilage augmentation, the length of the airway is not affected and further reconstruction is still a possibility[4,5]. Post-operative recovery usually is quicker in resection anastomosis in comparison with cartilage augmentation where both the donor and recipient sites recovery has to be taken into account[2-5]. Complications can occur equally in both techniques and it is often avoidable with good post-operative care.

In conclusion, surgical management of severe subglottic stenosis requires careful preoperative assessments and many a times the decision to choose which surgical technique is only made intraoperatively. Both resection anastomosis and cartilage augmentation have the advantages and the disadvantages over one another, and no technique is proven superior in all circumstances. It is wise to give time for natural healing process to take place and to limit the number of procedures on the damaged soft tissue structure of the airway. Complications can occur with both techniques which most of the times are preventable with a very good post-operative care.

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