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# Powered debridement of suprastomal granulation tissue to facilitate pediatric tracheotomy decannulation

Cynthia Chen [a,*], John P. Bent [a], Sanjay R. Parikh [b]

[a] Dept. of Otorhinolaryngology-Head and Neck Surgery, Albert Einstein College of Medicine, Children's Hospital at Montefiore, Bronx, NY, United States
[b] Dept. of Otolaryngology, Seattle Children's Hospital, Seattle, WA, United States

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ABSTRACT

*Objective:* To compare suprastomal granulation tissue (SSGT) removal using the microdebrider with other common methods of excision.
*Methods:* Retrospective review ($n = 21$) of SSGT excision at a tertiary care pediatric hospital (2004–10). Outcome measures included intraoperative blood loss, operative time, decannulation rates, and complications.
*Results:* 10 children underwent excision of SSGT via powered SSGT debridement and 8 were decannulated (80% success rate). Of the other 11 patients who had manually non-powered techniques (kerrison rongeur, laryngeal microinstruments, or optical forceps), 7 were decannulated (63% success rate). Operative time was on average shorter than all other procedures, but not significantly ($p = 0.101$). There was no significant difference in blood loss when powered debridement was compared to other techniques ($p = 0.872$). There were no significant complications encountered in our patients who received SSGT powered debridement.
*Conclusions:* Endoscopic powered SSGT debridement is a simple and useful tool in the process of pediatric tracheotomy decannulation with superior decannulation rate, shorter operative time, and comparable blood loss to other techniques.



## 1. Introduction

The feasibility of decannulation following pediatric tracheotomy is influenced by a myriad of factors. The major requirement is the resolution of the underlying disorder that precipitated the need for a tracheotomy. However, secondary lesions can develop that hinder decannulation, such as the development of tracheal granulation tissue, the most common late complication of long-term tracheotomy [1–3]. Tracheal granulation tissue can occur anywhere in the trachea, but most commonly noted to emanate from the anterior wall of the suprastomal trachea. The incidence of suprastomal granulation tissue (SSGT) development has been reported to be as high as 80% within the pediatric population [1].

Tracheal granulomas develop from chronic frictional trauma from the tracheotomy tube. Theoretically, postoperative infections, the presence of acid from reflux, pooling of secretions, and aggressive suctioning can also contribute to granuloma formation and maturation. Excessive cuff pressure can also add to tracheal mucosa erosion and granulation formation [4]. Most SSGT are nonobstructing and asymptomatic, and do not require intervention. However, because they can cause bleeding, aphonia, and airway obstruction that can delay decannulation, and even death with accidental decannulation [3,5,6], multiple methods of excision of these lesions have been developed and described in the literature. Most SSGT can be removed endoscopically via several methods such as the hook and eversion technique, sphenoid punch, kerrison rongeur, optical forceps [1], $CO_2$, Nd:YAG, KTP laser [7,8] and coblation [9]. Some severely fibrosed SSGT require open procedures involving laryngotracheofissure [1]. However, there are inherent risks with each of these techniques, they can be very time-consuming, and none have been proven to be superior to one another. The use of hook and eversion, sphenoid punch or kerrison rongeur, and optical forceps has been associated with the risk of dislodgment of the SSGT and occlusion of the distal airways. The use of lasers in the trachea has the concern of potential airway fire, mandate additional, specially trained nursing assistants, and often prolongs operative time. Open procedures broaden surgical risks, including acquired malacia and stenosis.

Microdebrider SSGT excision has been studied in the adult literature [6] but has only been mentioned anecdotally in the pediatric literature [10]. The endoscopic microdebrider technique is versatile, and enables excision of large, obstructing SSGT, either immature and soft, or fibrotic and mature. Theoretically, the

* Corresponding author. Tel.: +1 408 887 1442.
*E-mail addresses:* Cchen@montefiore.org (C. Chen), Jbent@montefiore.org (J.P. Bent).

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combination of suction with precise shaving would allow for shorter operative time in comparison to other techniques. Because of the bleeding from SSGT is usually self-limiting and based on capillary blood supply, we also hypothesize that the use of the microdebrider would not cause increased blood loss. To examine these hypotheses, we performed a 6-year review of all children with SSGT who have undergone some form of SSGT excision at our institution.

## 2. Methods

All patients who had undergone SSGT excision by any method from 2004 to 2010 were retrospectively identified in the pediatric airway database of Children's Hospital at Montefiore, a tertiary care pediatric hospital. IRB approval was in place for the review of these charts. Entry criteria included patients under the age of 18 who had a tracheotomy and were documented to have tracheal granulation tissue on direct endoscopic visualization of the airway. Patients were excluded if the patient was not a candidate for decannulation due to remaining medical issues, if the granulation tissue was not excised, or if the granuloma was external. We identified 21 cases that fit our criteria, and the charts were retrospectively reviewed. Children who underwent granuloma excision to allow for decannulation were divided into two groups: those who underwent powered debridement, and those who underwent other techniques such as kerrison rongeur, microinstrument, or optical forcep-guided excision.

## 3. Surgical procedures

Operations were performed under general anesthesia using spontaneous ventilation through either the patient's preexisting tracheotomy tube, or through a ventilating bronchoscope. Parsons laryngoscopes were used to expose the patient's glottis, and a suspension apparatus was employed when indicated. Appropriately sized Hopkin's telescope rods, usually inside of a rigid ventilating bronchoscope, were connected to a high-definition video system (Karl Storz, Tuttlingen, Germany), and passed through the larynx to visualize the airway throughout the operation. We then used curved sinus blades that shave on their concave surface (XOMED Surgical Products, Jacksonville, FL, USA) passed transtomal, to engage and debride the granuloma. The procedure requires one surgeon to manipulate the microdebrider from the side of the table while an endoscopist positions the bronchoscope for optimal viewing. The microdebrider was not engaged until both the endoscopist and surgeon were visualizing the open blade on the video system to maximize safety. The endoscopist used a second suction to prevent any blood not contained by the microdebrider from migrating distally into the bronchi. The speed of the microdebrider system was set between 3000 and 5000 rotations per minute. Oxymetazoline-soaked pledgets were used for hemostasis if bleeding did not quickly resolve spontaneously. Patient received single dose preoperative intravenous dexamethasone (0.5–1.0 mg/kg), but no antibiotics.

If the patient was a candidate for decannulation, we would follow our institutional protocol of placing a fenestrated tracheotomy in the operating room, then capping after the patient is awake and recovered. The patient was then observed in the hospital overnight. If the patient had no respiratory issues, the patient would then be decannulated the morning after the procedure, observed for several hours, and then discharged. This protocol has been described by our senior author in a previous publication [11].

## 4. Results

Between 2004 and 2010, a total of 21 children (12 males, 9 females) with ages ranging from 4 months to 17 years old (mean age 45.6 months), with tracheotomy underwent endoscopic excision of tracheal granulation tissue by either powered debridement, kerrison rongeur, laryngeal microinstruments, or optical forceps. All children were undergoing airway evaluation for possible decannulation when the granulation tissue was discovered. Table 1 illustrates the demographics and pathology leading to necessity of tracheotomy in our 21 children (Figs. 1–3).

Ten children underwent powered debridement for excision of SSGT. 80% (8/10) of these children were able to be decannulated subsequently. 63% (7/11) of the children who underwent kerrison rongeur, laryngeal microinstrument, or optical forcep excision of their SGGT were eventually decannulated.

Several children who either underwent powered debridement of SSGT, or another technique, required other interventions for decannulation. Two children required laryngotracheoplasty to correct additional suprastomal collapse, while another child underwent serial balloon dilation for subglottic stenosis before decannulation was possible. However, removal of SSGT was a necessary procedure despite these additional procedures for decannulation.

In terms of differences between the two groups, operating time and blood loss were examined. On average, the powered debridement procedure required 34.0 min (SD 11.0), whereas the other procedures required on average 44.1 min (SD 15.8). There was no statistical significance between these two groups ($p = 0.101$), likely due to the small population sizes. In terms of blood loss, there was no statistically significant difference between the average blood loss recorded for the debrider group (avg 2.6 ml, SD 2.1) and other group (avg 2.5 ml, SD 2.0) $p = 0.872$.

There were no mortalities associated with any of our procedures. There were no complications from powered debridement of SSGT. One child who was decannulated after excision of SSGT by kerrison rongeur required tracheotomy several years later due to inability to tolerate his secretions and frequent episodes of aspiration pneumonia. Two children required closure of tracheocutaneous fistula,

**Table 1**
Patient characteristics.

| Patient | Age (years)/sex | Reason for trach |
|---|---|---|
| 1 | 6F | Encephalitis |
| 2 | 3M | Chromosomal abnormalities, laryngotracheal stenosis |
| 3 | 1.3M | Prematurity, situs inversus |
| 4 | 3.5M | Encephalitis |
| 5 | 3M | Bilateral VCP |
| 6 | 4.75M | Post. fossa tumor, bilateral VCP |
| 7 | 6M | Prematurity, chronic lung |
| 8 | 6F | Hemangioma PHACES |
| 9 | 17F | RRP |
| 10 | 5F | Prematurity |
| 11 | 3F | Prematurity |
| 12 | 1.6F | s/p cardiac surgery |
| 13 | 0.92M | Respiratory failure |
| 14 | 1.6M | Klinefelters, prolonged intubation, bilateral VCP |
| 15 | 1.5M | Prolonged intubation, Pierre robin |
| 16 | 2.75F | Prematurity, CLD |
| 17 | 0.33M | Prematurity, prolonged intubation |
| 18 | 3F | Tracheomalacia, Ttube |
| 19 | 4M | Downs', SGS, CLD |
| 20 | 2.5M | Down's, CLD |
| 21 | 2.5F | SGS, s/p LTP |

VCP, vocal cord paralysis; RRP, recurrent respiratory papillomatosis; CLD, chronic lung disease; SGS, subglottic stenosis; LTP, laryngotracheoplasty.