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Coblation of suprastomal granulomas in tracheostomy-dependent children

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ABSTRACT

Objective: Suprastomal granulomas pose a persistent challenge for tracheostomy-dependent children. They can limit phonation, cause difficulty with tracheostomy tube changes and prevent decannulation. We describe the use of the coblator for radiofrequency plasma ablation of suprastomal granulomas in five consecutive children from September 2012 to January 2016.
Method: Retrospective case series at a tertiary medical center.
Results: The suprastomal granuloma could be removed with the coblator in all 5 cases. Three were removed entirely endoscopically and 2 required additional external approach through the tracheal stoma for complete removal. There were no intraoperative or postoperative complications. One patient was subsequently decannulated and 2 patients have improved tolerance of their speaking valves. Two patients remain ventilator dependent, but their bleeding and difficulty with tracheostomy tube changes resolved. Three of the patients have had subsequent re-evaluation with bronchoscopy, demonstrating resolution or markedly decreased size of the granuloma. This technique is time efficient, simple and minimizes risks associated with other techniques. The relatively low temperature and use of continuous saline irrigation with the coblator device minimizes the risk of airway fires. Additionally, the risk of hypoxia from keeping a low fractional inspiratory oxygen level (FIO_2) to prevent fire is avoided. The concurrent suction in the device decreases blood and tissue displacement into the distal airway.
Conclusion: Coblation can be used safely and effectively with an endoscopic or external approach to remove suprastomal granulomas in tracheostomy-dependent children. More studies that are larger and have longer follow-up are needed to evaluate the use of this technique.

1. Introduction

Suprastomal granulomas present a common challenge in the management of tracheostomy dependent children. Rosenfeld et al. reviewed 265 rigid bronchoscopies in 50 children with tracheostomy-dependent subglottic stenosis and found that granulomas had developed in 80% of the patients [1]. The granuloma formation was not found to be related to any known patient factor including age or duration of tracheostomy. They found no significant reduction in recurrence after excision and therefore did not recommend removal in otherwise stable patients. Mahadevan et al. found that granuloma formation occurred in most pediatric patients with tracheostomy and more than 12% required intervention [2]. In a review of 282 cases over 37 years Ozmen et al. found that the majority of tracheotomies in children were performed for upper airway obstruction and decannulation was achieved in 35% of cases [3]. Suprastomal granuloma formation is likely due to stasis of secretions, chronic infection, friction or foreign body reaction at the tracheostomy site. Obstructive suprastomal granulomas can prevent planned decannulation and cause significant respiratory distress in the event of an accidental decannulation. For patients with a long-term tracheostomy requirement, a granuloma can also limit or preclude speaking valve use and make tracheostomy tube changes difficult.

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Coblation (abbreviation for controlled ablation) is one of the several available techniques to remove suprastomal granulomas. It utilizes bipolar radiofrequency plasma ablation to remove excess tissue. Since its introduction at the beginning of the 21st century it has been used frequently for adenotonsillectomy [4] and inferior turbinate reduction [5]. Its use has also been described for microcystic lymphatic malformations [6], aerodigestive tumors [7], airway stenosis [8] and laryngeal papillomatosis [9]. In 2009 Kitsko et al. initially described a technique of using coblation to remove suprastomal granulomas externally through the tracheal stoma under bronchoscopic guidance [10]. We present five cases of suprastomal granuloma that were effectively managed with a similar, but primarily endoscopic coblation technique.

2. Materials and methods

Duke University Institutional Review Board approval was obtained prior to review of these patients (Pro00068727).

2.1. Surgical technique

General anesthesia is induced. The tracheostomy tube is replaced by a standard cuffed endotracheal tube inserted into the tracheal stoma for greater ease in ventilation and repositioning of the tube. Next, direct laryngoscopy is performed with a Parsons laryngoscope and the patient is placed in suspension. Bronchoscopy is performed with a zero-degree telescope. Then, the Smith and Nephew® Procise MLW or LW Coblation wand is passed endoscopically through the larynx and into the suprastomal area to ablate the granuloma under direct telescopic visualization. This completely endoscopic approach differs from the external technique that has been previously described by Kitsko et al. [10]. An ablation setting of 7 and coagulation setting of 4 is used with the Smith and Nephew® Coblator II Surgery System. The end of the wand can be slightly bent as needed to allow for the correct angle of contact between the distal end of the instrument and the granuloma.

If the granuloma cannot be completely ablated endoscopically, then the endotracheal tube is temporarily removed and the same wand used externally through the tracheal stoma to ablate the remainder of the granuloma under continued endoscopic visualization. The instrument can also be used as a manipulation probe, because of the continuous suction through the device even without activation of the ablation function. This feature facilitates complete and rapid removal of the granuloma. If hemostasis is not achieved through the ablation function, then the coagulation setting can be used. A tracheostomy tube is replaced at the end of the procedure.

3. Results

This technique was used effectively in all 5 cases that the senior author E.R. has attempted with this technique. Three of the 5 patients had recurrent granulomas after removal with another technique, but they were subsequently successfully removed with the coblator. Two patients remained ventilator dependent, but their bleeding and difficulty with tracheostomy tube changes resolved. Two patients had improved tolerance of their speaking valves. One patient was successfully decannulated. Three of the patients have had subsequent re-evaluation with bronchoscopy demonstrating resolution or substantially decreased size of the granuloma. There were no immediate or delayed complications from this procedure and the patients have done well in subsequent follow-up ranging from 6 months to 3 years.

3.1. Patient 1

A 6 month old with Costello syndrome underwent tracheostomy for chronic respiratory failure. She was subsequently unable to tolerate a speaking valve. At 18 months a granuloma was removed with the microdebrider and cup forceps. Two years later, a recurrent granuloma was removed with the CO_2 laser with only slight improvement in speaking valve tolerance. One year later a completely obstructing granuloma was identified (Fig. 1A) and removed with the coblator (Fig. 1B). At one year follow up, she was tolerating her speaking valve and surveillance bronchoscopy showed no granuloma (Fig. 1C).

3.2. Patient 2

A 3 month old with Pierre Robin sequence and a history of prolonged intubation underwent emergent tracheostomy after acute decompensation in the setting of subglottic stenosis. Two bronchoscopies performed during the next year showed subglottic stenosis, requiring balloon dilation, however no suprastomal granuloma was noted. After endoscopic dilation of the stenosis at 18 months of age she was tolerating a speaking valve. A surveillance bronchoscopy prior to initiating cap trials at 3 years of age revealed grade 3 subglottic stenosis and an obstructive suprastomal granuloma. These were treated with balloon dilation and cup forceps, respectively. She subsequently developed more difficulty with speaking valve use and bronchoscopy revealed recurrence of the subglottic stenosis and granuloma at 4 years of age (Fig. 2A). These were treated with balloon dilation and coblation, respectively. This granuloma required an endoscopic and external approach through the stoma to achieve a patent subglottic airway (Fig. 2B). Six months later there was a small amount of recurrent granuloma that was removed. Six months later she continued to phonate well and was proceeding towards decannulation.

3.3. Patient 3

A 7 month old with Pompe's disease, upper airway collapse, diaphragm paralysis and BiPap dependence underwent tracheostomy. At 4 years of age her caregivers had difficulty with tracheostomy tube changes due to high resistance and bleeding. Suprastomal granuloma that extended to the superior mucocutaneous junction of the stoma was removed with the coblator. The tracheostomy change problems resolved and her tube could be upsized to accommodate her continued need for ventilator support. Three years after the procedure a bronchoscopy showed only minimal suprastomal granulation.

3.4. Patient 4

A 4 year old with cerebral palsy and hypoxic-ischemic encephalopathy underwent tracheostomy for ventilator dependence. She presented to the emergency department 2 years later after her dislodged tracheostomy tube could not be replaced at home. A suprastomal granuloma was subsequently identified (Fig. 3A) and removed, which enabled a necessary tube upsize for continued nighttime ventilator support (Fig. 3B). The difficulty with the tube changes resolved over the subsequent 11 months.

3.5. Patient 5

This patient was previously treated at another institution with a history of two supraglottoplasties for laryngomalacia at 4 and 6 weeks of age and tracheostomy at 3 months. Three bronchoscopies were subsequently performed and showed suprastomal