**Management of Subglottic Stenosis**

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**Introduction**

Despite medical advances and newer surgical techniques, subglottic stenosis (SGS) remains a challenging problem to treat. Patients often experience relief of dyspnea following a dilation procedure only to succumb to a fairly high rate (up to 70%) of restenosis in the coming months to years.

Early on in this case series, patients with SGS were treated by balloon dilation only or rigid dilation only. Over time, the preferred techniques evolved into 1) CO2 laser incision of stenosis followed by balloon dilation, and 2) microdebrider-assisted excision of stenosis with rigid dilation. The purpose of this paper was to compare results between the various techniques employed.

**Methods and Materials**

Project approval was obtained from the Oregon Health & Science University (OHSU) Institutional Review Board (IRB). Current Procedural Terminology (CPT) codes 31528 (direct laryngoscopy with dilation of laryngeal stenosis, initial) and 31529 (direct laryngoscopy with dilation of laryngeal stenosis, subsequent) were used to query a university database to identify relevant procedures from January 1, 2006 to July 1, 2014.

Patient charts were reviewed on an electronic medical record. Patients were included for analysis if they were at least 18 years of age, and had subglottic stenosis. Patients were excluded if there was concomitant glottic or supraglottic stenosis.

**Surgical Technique**

One surgeon (JSS) primarily uses the CO2 laser to make radial incisions in the stenosis followed by balloon dilation. A second surgeon (PWF) primarily uses a laryngeal microdebrider followed by a rigid laryngeal dilator. Adjunct steroid injections are given in both techniques, and Mitomycin C is rarely used. Other surgeons at our institution have used dilation alone with either a balloon system or rigid laryngeal dilator.

**Results**

133 patients undergoing 256 procedures were identified. Nine operating surgeons were identified although 3 surgeons performed 94% (240) of the procedures.

Twenty six patients were considered to have traumatically-induced SGS secondary to a primary laryngeal injury (2 patients), prolonged intubation (20 patients), or high tracheostomy tube placement (4 patients). Of those with an autoimmune etiology of SGS, 13 patients were found to have Granulomatosis with Polyangiitis and 1 patient had relapsing polychondritis. 93 patients were ultimately declared to have idiopathic SGS.

Characteristics of patients stratified according to the etiology of SGS are described in Table 1. The most common techniques employed to endoscopically manage SGS consisted of laser excision with balloon dilation (group A, n=112), microdebrider excision of stenosis with rigid dilation (group B, n=37), balloon dilation only (group C, n=59), and rigid dilation only (group D, n=26), as noted in Table 2. For those patients which required 2 or more dilations (n=181), the mean time between dilations was 14.8 months for Group A, 9.4 months for Group B, 16.9 months for Group C, and 11.7 months for Group D, although the differences were not statistically significant. However, when the more homogenous Groups A and B were compared with each other, there was a significant advantage in time in between dilation for Group A (p=0.02, student t-test). When the more homogenous Groups C and D were compared to each other, there was a non-significant advantage in time in between dilation for Group C (p=0.09, student t-test).

For those patients requiring at least 2 dilations, factors affecting time between dilation were studied (Table 3). Measurements of the length and aperture of the stenosis were recorded from each procedure. Measurements of stenosis length and measurement were evaluated over time (Figure 1).

**Discussion**

Management of subglottic stenosis continues to involve. Most patients are managed endoscopically, but with different techniques. Our data shows that females continue to be more affected by idiopathic subglottic stenosis than males. Those that have SGS secondary to an autoimmune disease are much more likely to need multiple dilations compared to the idiopathic and traumatic subgroups.

This report highlights that radial cuts with a laser followed by balloon dilation of the SGS provides a significantly longer time to next dilation (14.8 months) compared to microdebrider excision and rigid dilation (9.4 months). We believe this may be secondary to a decrease in mucosal preservation with the latter technique. However, some of this difference may well be attributed to a better dilation with the balloon dilator compared to the rigid dilator. This balloon dilation difference seems to be underscored in the comparison of Groups C & D as well. Although it is interesting to make comparisons between Group A and C and note that balloon dilation alone seemed to provide longer benefit (16.9 months) than CO2 laser with balloon dilation (14.8 months), we were hesitant to make such a conclusion given the heterogeneity between the groups' etiological subtypes.

Although there was a trend toward longer time between dilations for the idiopathic subtype compared to the traumatic and autoimmune subtypes, the numbers in this series were not powerful enough to demonstrate statistical significance. Intraleisional steroid injections significantly impacted the time until next dilation. Diabetes Mellitus significantly decreased the duration of a dilation. Mitomycin C, tobacco use, and heartburn did not seem to impact the length of a dilation. For those with SGS secondary to an autoimmune disease such as GPA, we believe that the use of adjunct immunosuppressive drugs dramatically improves the duration of a dilation, although the numbers in this series were not enough to reach statistical significance.

It appears that there is little change over time in the dimensions of a patient's stenosis. We initially wondered if the length of a stenosis may decrease over time as patients' awareness of their disease over time became more acute. However, it appears that there is a given resistance to airflow (created by the aperture and length of the stenosis) that produces a symptomatic- enough airway that prompts the patient to seek intervention.

**Conclusions**

Those with autoimmune-related SGS require significantly more dilations than their idiopathic and trauma-related SGS counterparts. Balloon dilation is more effective than rigid dilation. Use of the microdebrider to excise the stenosis and create demucosalized surfaces leads to shorter durations between dilations. Steroids are an effective adjunct at prolonging the time until next dilation.