Monitoring Recurrent Subglottic Stenosis with a Peak Flow Meter

Eran E. Alon MD1, Eric S. Edell MD2, Jan L. Kasperbauer MD1
Departments of Otolaryngology-Head and Neck Surgery1 and Pulmonary and Critical Care Medicine2
Mayo Clinic, Rochester, MN

BACKGROUND
Recurrent subglottic stenosis (RSS) is a rare disease in which patients experience repeated episodes of subglottic narrowing, usually secondary to a surgical procedure or inflammatory process. In our institution, the vast majority of our patients are females diagnosed with idiopathic subglottic stenosis. RSS causes significant morbidity, with progressive exercise intolerance, shortness of breath, stridor, and rarely impending airway compromise. These patients will present repeatedly requiring multiple surgical procedures to allow an adequate patent airway.

Multiple treatment strategies have been previously described for treating RSS, medical treatments to control the inflammation, and control proposed mitigating factors (like acid reflux disease) and surgical treatments to excise or resuscitate the affected stenotic area. Unfortunately, the “magic bullet” for managing RSS has yet to be found.

The difficulty with RSS centers not only on treatment, but also on anticipating the progression of the disease. Most patients will present to us with significant symptoms and narrowing before seeking further care. Attempting to identify progressive airway narrowing prior to significant morbidity has been a challenge.

We have recently begun to use home peak flow meters (PFM) in an attempt to identify early narrowing prior to symptoms.

METHODS
Patients with a known history of recurrent subglottic stenosis were given a home PFM (Figure 1). They were asked to measure peak flows and to maintain a diary with the results. They were instructed to report any continuous decrease in their peak flows by at least 20%, or new respiratory symptoms. The study was conducted between January and December 2006 and involved patients previously diagnosed with recurrent subglottic stenosis requiring surgical intervention.

RESULTS
25 patients with recurrent subglottic stenosis were enrolled. All of the patients were females with a mean age of 54 range 31-84. 88% of the patients (22/25) were diagnosed with idiopathic subglottic stenosis. During the study period 12 patients were compliant with the use of the PFM and maintained an appropriate diary. 5 of these 12 patients required an airway procedure for progressive subglottic stenosis. 3/5 patients identified a decrease in their peak flows values and sought medical intervention prior to any significant clinical symptoms. The other 2 patients did record decreasing levels of peak flow but sought medical attention only when they experienced significant clinical symptoms.

CASE PRESENTATION
A 29 year old female first experienced chronic cough with wheezing during her first pregnancy. Two years later, during her second pregnancy, she presented to an outside institution with worsening of her symptoms. She was found to have a significant subglottic stenosis, was placed on anti-reflux medication, and underwent a cricoid split with stent placement. The stent was removed approximately one month after her initial procedure. She presented 3 years later to our institution with obvious stridor and cough. Her pulmonary function study showed a fixed obstruction, and an endoscopy exam revealed a significant subglottic stenosis, which was treated with endoscopic CO2 laser resection of her stenosis, local Kenalog injection and Mitomycin-C application. Subsequently, she had multiple endoscopic procedures. In August of 2005 after undergoing another endoscopic procedure to improve her airway she was given a peak flow meter. Her postoperative pulmonary function study is shown in Figure 2. In October of 2006 she presented with increased dyspnea on exertion. Her peak flow meter values had dropped from 300 to 175, and this was correlated with her pulmonary function study as seen in Figure 3. She was subsequently taken to the operating room and underwent CO2 laser excision and resection of her stenosis with local Kenalog injection and Mitomycin-C application. Her preoperative endoscopic photo is seen in Figure 4. There was a direct correlation between her symptoms, pulmonary function studies, and decrease in her peak flow values.

DISCUSSION
Recurrent subglottic stenosis (RSS) is a rare problem for which patients require multiple surgical procedures to maintain an adequate airway. Many causes of subglottic stenosis have been previously described and which include mechanical trauma from intubation, Wegener’s granulomatosis, collagen vascular diseases, external trauma, surgery, and upper respiratory tract infections. In recurrent RSS, aside from non-specific etiologies like acid reflux disease, most likely, this can be attributed to the yet unknown cause of this problem.

Typically, patients with RSS are followed on a routine basis and as needed in accordance with their symptoms. There are only few predictors to help establish a time interval for the treatment of RSS. Some patients will have long asymptomatic intervals whereas others may require intervention after a short period of time. Most patients will be treated once they become symptomatic. Symptoms usually present as exercise intolerance, shortness of breath, and frank stridor. Many patients will return to their otolaryngologist with significant airway narrowing and symptoms with the need for immediate intervention.

CONCLUSIONS
A home based peak flow meter is a safe and inexpensive tool that can assist in identifying progressive subglottic narrowing prior to significant clinical manifestations. Poor patient selection, as well as detailed patient education, allows early intervention in this population. Prospective long term trials will allow further assessment of this device in managing patients with recurrent subglottic stenosis.

REFERENCES

Figure 1: Peak Flow Meter. The forest vital capacity (FVC) is the volume of gas exhaled from maximal inspiratory effort followed by the most forceful and rapid exhalation a subject can produce. The rate of airflow during this rapid, forceful exhalation indirectly reflects the flow resistance properties of airways. When airway obstruction occurs the FVC tends to be less than the standard Vital Capacity (VC) because airways reach flow limitation early and air trapping occurs.

The maximum flow rate during FVC occurs in the initial 0.1 second and is referred to as the forced expiratory flow (FEF). Peak flow is markedly affected by obstruction of large airways. Because repeat measurements are convenient to obtain, the peak flow rate can be easily reproducible and allow serial measurements to record a baseline and change in the obstructive component.

Figure 2: Postoperative respiratory Flow loop prior to using the peak flow meter.

Figure 3: Respiratory flow loop after a drop in the peak flow value from 300 to 175.

Figure 4: Preoperative endoscopic view of the subglottic stenosis.