Microdebrider eustachian tuboplasty: A preliminary report

Ralph Metson, MD, Steven D. Pletcher, MD, and Dennis S. Poe, MD, Boston, MA

OBJECTIVE: To evaluate microdebrider eustachian tuboplasty for treatment of patients with eustachian tube dysfunction.

STUDY DESIGN: A prospective study of 20 patients with eustachian tube dysfunction who underwent microdebrider eustachian tuboplasty (mETP) was performed at an academic medical center. Surgery involved use of a microdebrider to remove hypertrophied mucosa from the posterior eustachian tube cushion. All patients had concurrent sinonasal disease and underwent endoscopic sinus surgery at the time of mETP.

RESULTS: There were no surgical complications. Following mETP, subjective symptoms of ear blockage improved in 14 of 20 patients (70%). Mean pure tone average improved by 6 dB (27 dB pre-op vs 21 dB post-op; P = 0.013). Abnormal tympanogram improved in 11 of 17 patients (65%). Failure of the procedure correlated with severity of mucosal disease as measured by both elevated tissue eosinophil count and advanced sinus CT stage (P = 0.018 and P = 0.014, respectively). Mean follow-up was 13 months (range 3-34 months).

CONCLUSION: Microdebrider eustachian tuboplasty appears to be a safe procedure for the treatment of eustachian tube dysfunction.

Dysfunction of the eustachian tube results in inadequate pressure equilibration within the middle ear and mastoid cavities. This dysfunction can lead to a variety of otologic manifestations, including a sensation of aural fullness, persistent or recurrent otitis media with effusion, and conductive hearing loss. Multiple etiologic factors have been implicated as causes for insufficient eustachian tube dilation and resultant dysfunction. These factors include disorders of the peri-tubal mucosa such as chronic infection, allergic disease, laryngopharyngeal reflux, and primary mucosal inflammatory disease. Structural and dynamic disorders have also been implicated.1-8

Eustachian tube dysfunction refractory to medical therapy has been treated primarily by bypassing the eustachian tube and ventilating the middle ear directly through the tympanic membrane with a pressure equalization (PE) tube. While PE tubes serve to ventilate the middle ear and provide symptomatic relief, patients with chronic tubal dysfunction often develop recurrent symptoms following PE tube extrusion. A number of “permanent” PE tubes that have been developed in an attempt to increase the duration of relief are susceptible to crusting and infection.

Surgical treatments targeting the eustachian tube proper have historically focused on enlargement of the bony eustachian tube isthmus. Access to this region has been achieved through a variety of surgical approaches, ranging from a trans-canal, middle ear approach to a mini-temporal craniotomy.9-12 Despite aggressive drilling techniques and the use of stents, these approaches failed to restore long-term eustachian tube function. Because of these poor results and concern for injury to the adjacent carotid artery, surgery of the bony eustachian tube has largely been abandoned.

Technological advances that allow for dynamic imaging of the eustachian tube have suggested that much of the pathology in patients with eustachian tube dysfunction lies within the cartilaginous eustachian tube in a region termed the “valve.”7 This valve represents an approximately
Surgery targeting the cartilaginous eustachian tube to treat eustachian tube dysfunction was first performed in 1997. In a procedure termed laser eustachian tuboplasty (LET), Kujawski used a CO₂ laser to ablate mucosa, soft tissue, and cartilage along the posterior cushion and into the region of the “valve.” Three-year data of 108 procedures suggested surgical success with restored eustachian tube function in 65% of patients. Similar preliminary results for LETP were achieved by Poe et al using a trans-oral argon laser with trans-nasal endoscopic visualization. The purpose of the present study is to examine the use of the microdebrider with an exclusively transnasal approach for the treatment of patients with eustachian tube dysfunction.

**METHODS**

The study population consisted of 20 consecutive patients who presented with both chronic rhinosinusitis severe enough to warrant sinus surgery and symptoms of eustachian tube dysfunction. Selection criteria included a persistent sensation of ear blockage with an abnormal tympanogram or recurrent episodes of ear discomfort with altitude change, such as airplane flight or scuba diving. All patients had been treated with at least three courses of antibiotics for sinusitis over the previous year, as well as nasal steroid sprays, and were found to have evidence of sinus ostial obstruction on either nasal endoscopy or sinus CT scan. Patients underwent a unilateral microdebrider eustachian tuboplasty (mETP) targeting the most symptomatic ear. Surgeries were performed between November 2001 and September 2005. Patients were prospectively followed with pre- and postoperative audiograms and tympanograms, as well as symptom assessment. The pure tone average (PTA) was calculated using air conduction dB hearing level at 500, 1000, 2000, and 3000 Hz. For the analysis of results, a flat tympanogram (type B) was considered to be the most abnormal, followed by negative pressure (type C) and a shallow or stiff tracing (Type As). Improvement in the tympanogram wave form was reported if patients developed either a normal tracing or one considered to be less abnormal.

All patients underwent endoscopic sinus surgery at the time of mETP. Sinus surgery was bilateral in all but one patient. The CT stage of sinus disease was calculated prospectively using the Harvard staging system and retrospectively using the Lund-McKay staging system. Severe mucosal disease was defined as stage IV disease using the Harvard system and a score of 8 or higher using the Lund-McKay system. Tissue eosinophil count was obtained by averaging the eosinophil count of two high-power fields (HPF) from the patients' sinus surgery specimen. The eosinophil count was considered to be high when more than 50 eosinophils were noted per HPF. Results were analyzed using the Fisher exact test and paired t test. This study was approved by the Human Studies Committee of the Massachusetts Eye and Ear Infirmary.

**Surgical Technique**

In all patients, the eustachian tuboplasty was performed prior to the sinus surgery to ensure a drier operative field. Following induction of general anesthesia, a vasoconstrictive nasal spray (oxymetazoline 0.05%) was placed in either nostril. Endoscopes with 0- and 30-degree fields of view were used to evaluate the appearance of the eustachian tube. Submucosal injections of lidocaine 1% with 1:100,000 epinephrine were placed along the entire posterior eustachian tube cushion, as well as the superior aspect of the anterior cushion. All injections were placed posterior to the choanal arcade, a relatively consistent vascular landmark running from the choana along the lateral nasal wall immediately anterior to the eustachian tube (Fig 1).

Microdebrider blades of 0, 15, and 30 degrees were passed in a trans-nasal fashion to determine which blade angle best suited the patient’s anatomy by engaging the mucosa of the posterior eustachian tube cushion. Most surgeries were performed with a blade of 4 mm diameter; however, a 2.9-mm-diameter blade was used in patients with narrower nasal cavities. In some cases, surgery was performed with a 30-degree endoscope passed through the contralateral nostril into the nasopharynx to provide enhanced visualization and freedom of movement of the microdebrider.

The microdebrider was used to remove hypertrophic mucosa of the posterior eustachian tube cushion (Fig 2). Tissue removal started in the midportion of the posterior cushion directly overlying the J-shaped eustachian tube cartilage, which could be readily palpated with a straight suction. Care was taken to avoid injury to the mucosa along the anterior cushion in order to avoid postoperative scarring and stenosis of the eustachian tube orifice. The cutting surface of...
the microdebrider blade was always pointed towards the posterior eustachian tube cushion, while the guarded surface protected the anterior cushion.

Removal of mucosa and submucosa led to exposure of the underlying cartilage of the posterior cushion (Fig 3). Throughout the procedure, all tissue removal remained superficial to this cartilage, which served as the deep margin of surgical dissection. This firm landmark also provided a sturdy backstop, protecting the carotid artery, which lay posterior in the nasopharynx.

In most patients, the area of removal of diseased mucosa measured approximately 1 cm in diameter (Figs 4 and 5). In some cases, depending on the extent of mucosal disease, dissection continued superiorly along the posterior cushion into the area of the valve where mucosa of the anterior and posterior cushions come into contact.

Following completion of soft-tissue removal, a cotton pledget soaked in 0.05% oxymetazoline was temporarily placed over the surgical site to achieve hemostasis. In those cases where surgical dissection extended the valve region, a small absorbable gelatin sponge (Gelfoam; Pharmacia and Upjohn, Kalamazoo, MI) was placed in the eustachian tube orifice at the conclusion of surgery. Patients were discharged within 24 hours of surgery with oral anti-staphylococcal antibiotics and instructions to perform daily nasal saline irrigations until their postoperative visit the following week.

RESULTS

Patient Demographics

Gender distribution was 12 females and 8 males. Mean age was 49.1 years (range, 23–66 years). Five patients (25%) had a history of gastroesophageal reflux disease (GERD); four were being treated with proton pump inhibitors; and one had adequate symptomatic control with an H2 blocker. Sixteen patients (80%) had a history of sinonasal allergies, and all had failed treatment with antihistamines and nasal steroid sprays. Twelve patients (60%) had undergone prior sinus surgery, six of whom underwent two or more prior sinus procedures. Eight patients (40%) had undergone prior ear surgery; seven had prior PE tube placement (four with multiple prior PE tubes), and one had a previous myringotomy only. Mean follow-up time was 13 months (range, 3–34 months).

Surgical Outcomes

There were no surgical complications. The mean pure tone average decreased by 6 dB following surgery ($P = 0.013$).
Three patients were excluded from this calculation: two who had PE tubes placed postoperatively and one in whom a postoperative audiogram was not obtained. Subjective symptoms of ear blockage improved in 14 of 20 patients (70%) and abnormal tympanogram improved in 11 of 17 patients (65%). For the purpose of data analysis, surgical success was defined as resolution of subjective symptoms of eustachian tube dysfunction combined with either improvement of preoperative tympanogram or reduction of mean PTA of at least 10 dB. For the two patients with a normal preoperative tympanogram and PTA, but pain with flying (altitude change), resolution of the symptoms alone was considered a successful outcome. Overall, 14 of the 20 procedures (70%) were considered successful.

An elevated tissue eosinophil count correlated with failure of mETP ($P = 0.014$). Although all four patients without sinonasal allergies achieved surgical success, the sample size and overall high incidence of sinonasal allergies did not permit a statistically significant correlation between a history of sinonasal allergies and surgical failure ($P = 0.16$). A history of prior sinus surgery, however, did correlate with failure of mETP ($P = 0.042$). Furthermore, all six patients who failed mETP had a history of both prior sinus surgery and sinonasal allergies. Neither prior PE tube placement nor a history of GERD correlated with mETP outcome ($P = 0.64$ and $P = 0.62$, respectively).

A higher preoperative CT stage using the Harvard system$^{16}$ correlated with failure of the procedure ($P = 0.018$).
All patients with a Lund-McKay score less than 8 achieved a successful outcome. Four CT scans were unavailable for retrospective analysis with the Lund-McKay system and, with this limited data set, the correlation between Lund-McKay score and surgical failure did not achieve statistical significance ($P = 0.19$).

The presence of eustachian tube dysfunction was found to be predominately unilateral. Although 17 of 20 patients (85%) had a preoperative tympanogram that was abnormal in the operated ear, only 3 (15%) had abnormal tympanograms in the contralateral ear. After mETP, one of these three patients had no tympanometric improvement in either ear, another demonstrated improvement in both ears, and the third had improvement in the mETP ear only.

**DISCUSSION**

The present study highlights the importance of mucosal disease in the surgical treatment of eustachian tube dysfunction. Three objective measures of mucosal disease severity—advanced CT stage, elevated eosinophil count, and prior history of sinus surgery—all had a statistically significant correlation with failure of the procedure. Conversely, patients with limited mucosal disease, specifically those without sinonasal allergies and those with a low Lund-McKay CT score, uniformly had successful outcomes. Thus, mETP appears to be most promising for those individuals with eustachian tube dysfunction who have limited sinonasal mucosal disease at time of preoperative evaluation.

The findings of the current study for mETP are similar to those reported by Poe et al.[15] for LETP. He also described a 70% surgical success rate when a laser was used instead of a microdebrider to remove hypertrophic mucosa from the posterior eustachian tube cushion. It should be emphasized, however, that the entry criteria and thus the patient populations for these two studies were quite different. All patients who underwent LETP had failed at least two sets of PE tubes and had myringotomy with aspiration of middle ear fluid performed at the time of tuboplasty. Overall, mETP patients had less severe middle ear disease, with only four having undergone multiple prior PE tube placements and none requiring myringotomy at time of tuboplasty.

Because patients in the current study underwent both mETP and endoscopic sinus surgery, it is not possible to determine which of these procedures resulted in the improvement of eustachian tube symptoms. Ear blockage is a well recognized, although less common, symptom of chronic sinusitis thought to result from drainage of sinus secretions over the eustachian tube orifice. Successful treatment of sinusitis would be expected to resolve this drainage and the secondary tubal inflammation. In a retrospective review of 168 sinus surgery patients, Stokes and Dutton[18] suggested that endoscopic sinus surgery alone is helpful in improving symptoms of eustachian tube dysfunction in many patients. This report did not include objective data of eustachian tube function, relying solely on subjective response.

In the present series, unilateral mETP was performed in all patients while bilateral sinus surgery was performed in all but one patient. While the contralateral ear could serve as a natural control in these patients, the presence of eustachian tube dysfunction was frequently unilateral. In fact, only three (15%) patients had an abnormal preoperative tympanogram in their contralateral ear. With such limited data, clearly further studies are required to elucidate the relationship between sinus surgery and mETP in the treatment of eustachian tube dysfunction.

**CONCLUSION**

Microdebrider eustachian tuboplasty appears to be a safe procedure. Patients with severe sinusitis and diffuse mucosal disease are less likely to improve following surgery. Further controlled studies are necessary to elucidate the effectiveness of tuboplasty alone or in conjunction with sinus surgery for the treatment of patients with eustachian tube dysfunction.

**REFERENCES**