The Laryngoscope

Transantral Balloon Dilation Plus Posterior Ethmoidectomy

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Objectives/Hypothesis: Transantral endoscopic balloon dilatation (TABD) was recently introduced for the management of limited mild maxillary and ethmoid disease. An expanded approach by inserting surgical tools into the antrum via a second port, directed toward the maxillary ostium, ethmoid infundibulum, and posterior ethmoids will allow for the treatment of moderate disease as well.

Study Design: Retrospective data review.

Methods: A study including all TABD procedures performed between January and December 2009 was performed. Sublabial approach with two working channels, one for the endoscope and a second port for balloon dilatation or other surgical instrumentation, was devised. Both channels were created via mini-trephine aimed toward the osteo-meatal complex (OMC) with different angulations. The same approach was used for transantral posterior ethmoidectomy (TAPE). Data collected included demographics, Sino-Nasal Outcome Test (SNOT) scores, Lund-Mackay score, and complications.

Results: Thirty-five patients with 64 dilated sinuses and 10 TAPE procedures were enrolled. All SNOT scores showed statistically significant improvement decreasing from 1.77 to 0.83. Complication rate was minimal. Only a small number of procedures were converted to standard endoscopic septoplasty (ESS) owing to severity of OMC disease. TAPE proved to be a minimally invasive procedure.

Conclusions: Two trocars inserted through the canine fossa can achieve a successful result in moderate antral disease for TABD and allow TAPE to be performed, thus creating a bridge between mild disease and one requiring standard full ESS. The minimally invasive approach proved to be particularly useful.

Key Words: Chronic rhinosinusitis, SNOT20, trans antral, posterior ethmoidectomy, balloon dilatation, maxillary cyst, laser, minimally invasive.

Level of Evidence: 2b.

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INTRODUCTION

A new method, FinESS sinus treatment (Entellus Medical, Maple Grove, MN), for treating chronic rhinosinusitis (CRS) limited to maxillary and ethmoid sinuses that uses transantral balloon dilatation (TABD) was recently introduced. TABD promises to be a safe technique performed for mild to moderate disease of the maxillary sinus (MS) or ethmoid infundibulum sparing intranasal structures and mucosa.[1] Patency using balloon dilatation for frontal sinusotomies has been shown to last at least 12 months.[2]

The MS, ostium, and the ethmoid infundibulum are better visualized and explored via a direct transantral access procedure rather than a limited or partial view in a transnasal approach. The FinESS technique couples the direct antral route with TABD under endoscopic guidance via trocar and sheath inserted trans–canine fossa. Although it allows superior MS visualization, it can be hampered by obstructing pathology.

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The posterior ethmoid (PE) cells drain into the superior meatus, and their anterior extent is marked by the ground lamella of the middle turbinate. With a sloping skull base, penetration of the skull base at the level of the PE is more common than at the level of the anterior ethmoids. Additional care must be taken of the PE artery traversing the roof of the PE cells, which if injured can cause significant bleeding.[3] Deemed impossible as a single endoscopic procedure by Wigand,[4] and aforementioned perils, it is not surprising that the PE may be the cause for up to 41% of ESS revisions.[5]

A new technique of a double MS puncture and two sheaths inserted through the trans–canine fossa approach will allow treatment of antral disease (including most inflammatory or polypoid obstructive pathology that may endanger the patency of the dilated ostium in the future) with the option of approaching the PE through transantral posterior ethmoidectomies (TAPEs).

MATERIALS AND METHODS

Records of 35 patients with CRS failing medical management treated with TABD were studied after exempt institutional review board approval. This new method treats MS and OMC. Initially a single trocar is inserted through canine fossa and the maxillary cavity is inspected. The first puncture is performed at the crossing of a line dropped vertically downward from the pupil and a transverse line passing through the maxillary floor.[6] The second puncture is performed lateral and higher to the previous one. As the canine fossa

Fig. 1. Two working ports through canine fossa with different angulations (note small slit in sheath).

contains no dental roots, dental injury is avoided. If TABD cannot be achieved, MS pathology such as cysts or polyps are encountered (including potentially endangering the dilated ostium), or TAPE is planned, a second puncture with sheath insertion is performed. The two sheaths with an internal diameter of 2.7 mm (Entellus Medical) and an external diameter of 2.9 mm are placed with different angulations to facilitate instrumentation under endoscopic control (Fig. 1).

After the MS pathology has been treated, the balloon is inserted through the maxillary ostium and inflated. This modification from the single port (as in the FinESS system) to a double working channel approach allows introduction of various tools (such as pediatric ESS, laser fibers, microdebrider, or otologic tools) inside the MS.

TAPE: The anatomy of the antrum is fairly constant with the ostium located medial to the medial ridge on the medial wall (Fig. 2). Location of the PE is at the most superomedial corner of the antrum lateral to the ostium; its thin boney lamina can be easily identified under direct vision.[7] After penetration and localization of the PE, additional bone is removed and PE drainage is achieved. The anterior ethmoids can also be opened by continuous exanteration in a medial-anterior approach. The PE are drained to the antrum, and diseased

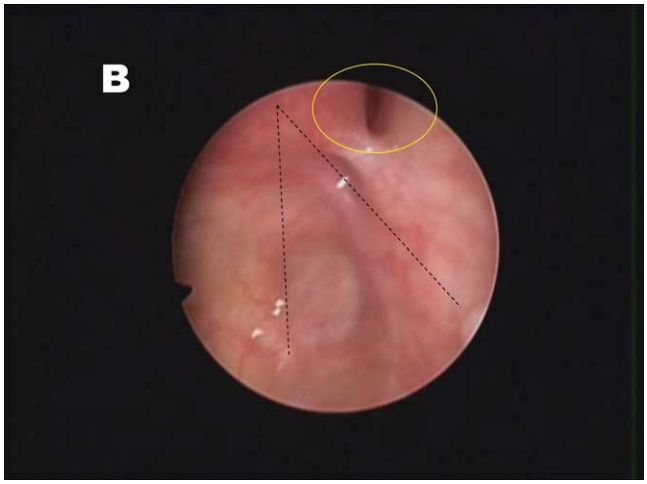

Fig. 2. Antral anatomy delineating location of the posterior ethmoid relative to the maxillary ostium.

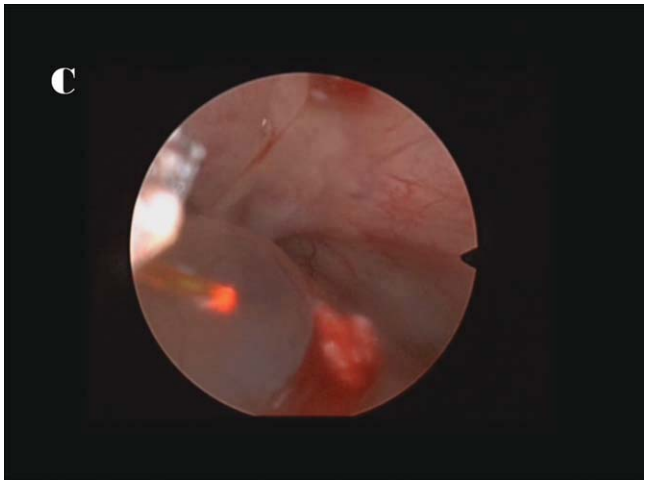

Fig. 3. Obstructing OMC cyst with laser fiber.

tissue can be suctioned or debrided. Intranasal drainage can be achieved by medial opening.

Preoperative Lund-Mackay scores (LMSs) and Sino-Nasal Outcome Test-20 (SNOT20) scores before surgery and at 1-month follow-up were recorded; patient demographics, intraoperative findings, postoperative complications, and intranasal endoscopic findings were collected.

RESULTS

A total of 25 patients having TABD alone and 10 undergoing TABD with TAPE were reviewed. Patients included 19 females and 16 males with ages ranging from 11 to 67 years; general anesthesia (n = 33) or sedation with local infiltration (n = 2) was used. One patient had revision surgery. Four patients had one-sided planned ESS due to severe polyposis, having the MS inspected directly through transcanine approach after ESS completion with the other side treated with TABD. Two patients planned for TABD were converted to standard ESS owing to disease severity. Overall, 64 MS ostia were dilated with the FinESS procedure. Six patients had an intra–maxillary cyst (MC) near the OMC and partially obstructing the OMC (Fig. 3). The cysts were ablated or marsupilized with a 980-nm near-infrared diode laser by using 5 W in continuous mode and a flexible 300 micron fiber and a fiber manipulator. Polypoid disease encountered in five additional patients was approached with a microdebrider or laser. Ten TAPEs were performed. During the operation, polypoid structures or thick retained secretions were removed from the PE (Fig. 4). In all cases, there were no intracranial or intraorbital complications. Several TAPE procedures were performed with navigation assistance (Fig. 5). As the middle turbinate and anterior ethmoids were intact, no packing, postoperative debridement, or cleaning was needed. Two patients had mild facial swelling that subsided in 3 days. Two patients had transient dysesthesia over the upper lip lasting 1 week. Dental and wound complication incidence was zero.

The average preoperative LMS was 6.4 (confidence interval 100-95%=0.03). SNOT20 scores when compared by using a two-tailed *t* test (Microsoft Office Excel 2007;

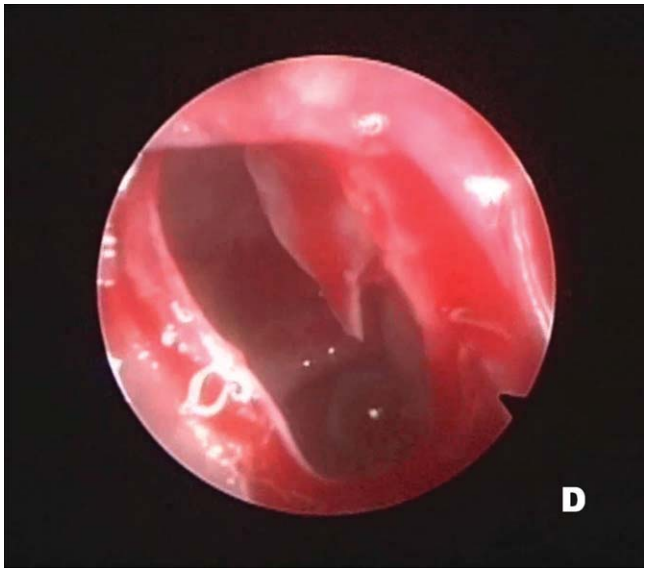

Fig. 4. Posterior ethmoid exenterated to the antrum after removal of thick olypoid secretion.

Microsoft Corp., Redmond, WA) decreased from 1.77 to 0.83 ($P < .05$). MS cultures were sterile in most patients (when collected), but three were positive for *Haemophilus influenzae*, *Streptococcus pneumoniae*, and *Staphylococcus epidermidis* (cultures were obtained from the OMC during surgery under sterile conditions). Patient work productivity loss after TABD using single or double puncture was no longer than 3 days. The recovery was longer for patients who underwent standard ESS. No postoperative nasal packing was used, and minimal crusting was observed. Only a single transnasal postoperative debridement visit was necessary.

DISCUSSION

In regard to TABD, significant improvement in SNOT20 scores was achieved while maintaining a low complication rate. This new approach treats most maxillary and OMC pathology through dual canine fossa MS puncture. Because indication for FinESS came to include moderate maxillary and ethmoid disease, patients underwent a dual puncture on at least one side. The only current limitation is the size of the two working channels, limited to 2.7 mm in diameter, restricting the available working instruments (pediatric or otologic) through the sheaths. Side effects, such as transient dysesthesia, were minimal and lasted no more than a week. Work productivity loss was a maximum of 3 days. We did not observe any teeth dysesthesia. The intranasal recovery was fast, without a need for packing. Repeated postoperative debridement was not necessary, significantly contributing to patient satisfaction.[8]

Although Harar et al. proposed a higher incidence of LMS and CRS in patients with MC,[9] others have shown no correlation between LMS and MC.[10] Contrary to prior findings indicating that MCs do not represent any additional manifestation to CRS, we found that 25% of our patients had MC that obstructed the ostium and were successfully treated with TABD through one or two ports via the canine fossa.

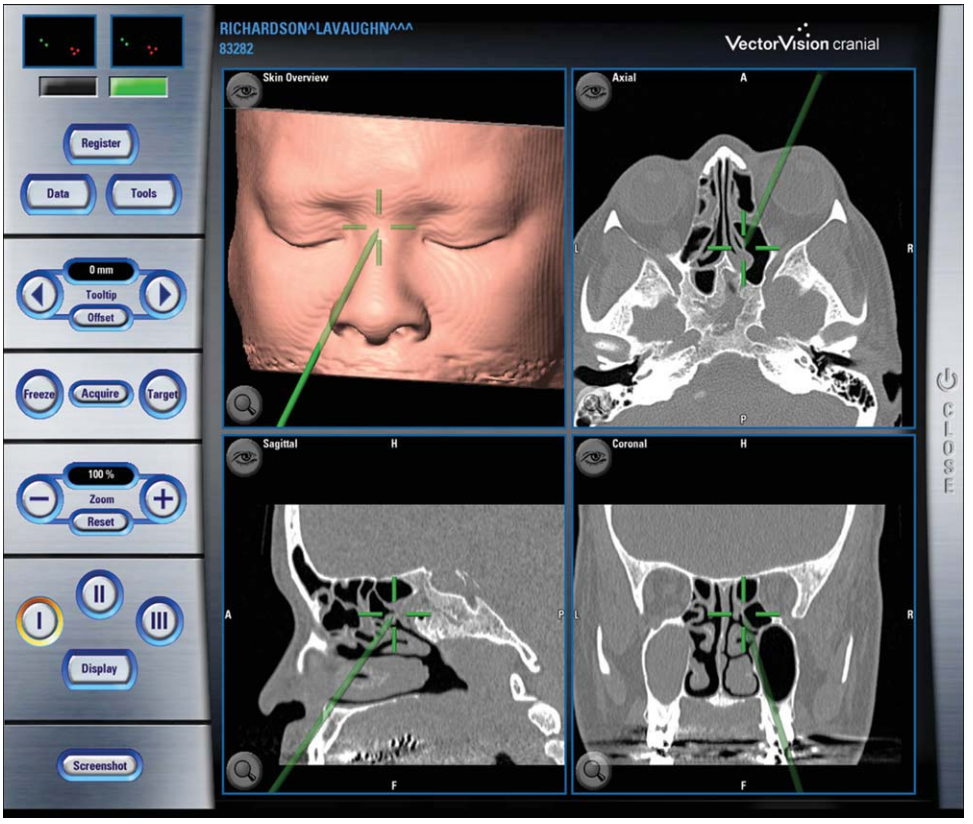

Fig. 5. Navigation image of transantral posterior ethmoidectomy.

We believe that the dual puncture approach solves the only limitation for FinESS TABD, expanding its indications beyond mild maxillary and ethmoid disease to a possible transantral access of PEs, limited surgery of the pterygopalatine fossa, orbital floor surgery, and trauma repair. The second working channel allows manipulation of additional instruments, such as the introduction of laser fibers, microdebrider, or therapeutic irrigations, and obtainment of direct cultures. With access sheaths as wide as 3 mm, most pediatric ESS equipment can be used inside the sinus, making the a broader FinESS approach potentially applied to patients with polyps, cysts, and fungal disease.

TAPE is not a new approach. It has been performed before and during the ESS era.[11] The current transantral approach is performed for orbital decompression, tumors, or skull base surgery. However, using TAPE may prove advantageous even for simpler tasks. As it has been shown that the PE may be the source for polypoid disease[12] and CRS is unlikely to be present in the PE without anterior ethmoid disease, it seems prudent to exenterate isolated opacified PE on a computed tomography (CT) scan. In our series, both cases of isolated PE disease proved to be polypoid disease. TAPE harbors additional benefit for the patient as additional visits for postoperative debridement are spared. It is assumed that the strong maxillary ciliary motion will be able to clear PE now draining to the antrum; however, only a CT scan can ascertain disease recurrence. TAPE is beneficial in recurrent ESS, especially when familiar landmarks are missing. As it was shown that at times even navigation precludes a total ethmoidectomy, TAPE maybe a solution for those cases, especially with a lateral PE cell.[13] Contrary to revision ESS, where appreciation of the constant landmarks may be challenging, the posterior antral wall is immediately noted. However, when a sphenoidotomy or fronto-ethmoidectomy or a high ethmoid requiring drainage (generally anterior ethmoids) is attempted, a standard approach is more suitable. Although balloon dilatation of sinuses applies to all sinuses except the PEs, combining balloon dilatation with exclusive transantral posterior ethmoidectomy (TAPE) can be beneficial in limited disease, including limited PE disease.

Our study merits mentioning a few limitations. The follow-up period was only 1 month, we assumed the MS to clear the draining ethmoid, a learning curve exists even for an experienced otolaryngologist, and we relied on previous studies claiming ostial patency.

Therefore, we conclude that the following indications are most amenable to TAPE: isolated PE disease, PE disease with mild anterior ethmoid disease amenable to balloon sinuplasty, a lateral PE cell, revision ESS with PE disease, particularly when the middle turbinate is resected, the patient has difficulties in future appointments for debridement, or the patient is unwilling to have septoplasty for ESS facilitation. The contraindications are as follows: hypoplastic MS, significant maxillary disease and orbital exophthalmos, moderate to severe antral or anterior ethmoid disease, and children without completely erupted canine teeth.

CONCLUSION

A dual puncture of the canine fossa is a suitable solution when TABD attempt fails with a single port owing to maxillary disease. This approach allows TAPE, thus expanding the indications beyond balloon sinuplasty and occasionally avoiding ESS while maximizing patient satisfaction.

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