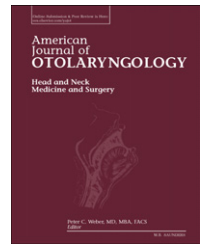


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# Endoscopic autologous cartilage injection for the patulous eustachian tube

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## ABSTRACT

Patulous eustachian tube (PET) can have a significant negative impact on a patient's quality of life. Several methods of surgical management can be an option to treat PET, and our objective is to evaluate the safety and efficacy of autologous cartilage injection in patients with PET. Thirty-three ears of twenty-five patients with chronic PET refractory to conservative treatment were enrolled to this study. Autologous tragal cartilage was harvested, and chopped into fine pieces to allow its injection using a 1 cc Bruening syringe. Endoscopic cartilage injection was performed submucosally into the anterior (0.5 mL) and posterior aspects (0.5 mL) of the nasopharyngeal ET under local anesthesia in an operating room. Patients were evaluated postoperatively by nasal endoscopy and by interview to document symptoms. Successful treatment was defined as complete relief or significant improvement plus satisfaction with treatment. The only complication that occurred was temporary otitis media with effusion in one ear. Inferior turbinate reduction was performed in three ears with accompanying nasal septal deviation or turbinate hypertrophy to allow better nasopharyngeal ET visualization. After autologous cartilage injection, the successful treatment rate, as determined by subjective autophony symptoms, was 69.7% (23/33). The average follow-up period was 25.2 months. Autologous cartilage injection is a minimally invasive technique that has been used by the authors to successfully treat patulous eustachian tube. The described procedure was found to provide a good overall success rate without long-term complications.

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## 1. Introduction

The eustachian tube (ET) is a short but complex hourglass-shaped osseocartilaginous structure that connects the

nasopharynx with protympanum of the middle ear cavity [1]. It is ordinarily closed at rest and opens during swallowing or yawning. When the ET cannot be closed completely, sound is transmitted from the pharynx to the middle ear via the ET with

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little attenuation. A PET is defined as an abnormal opening of the valve of ET at rest, and causes symptoms of autophony, aural fullness, and hearing one's own breathing sounds [2]. PET seems to be caused by a longitudinal concave defect in the tubal valve at the superior portion of the valve's anterolateral wall [3]. Diagnosis of PET can be challenging when symptoms are ambiguous. However, it can be made by visualizing outward movement of tympanic membrane during regular nasal expiration and inward movement during nasal inspiration. These movements indicate abnormal patency of the ET enabling air to pass to and from the nasopharynx into the middle ear.

Several methods of surgical management can be used to treat PET with the common goals of restoring normal convexity to the valve wall and providing secure symptom relief. In a previous report, we described two cases successfully treated by autologous cartilage injection for volumetric augmentation in PET [4]. Here, we evaluated outcomes of our novel technique of volumetric augmentation of nasopharyngeal ET by autologous cartilage injection for the management of chronic PET refractory to conservative treatment.

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## 2. Materials and methods

### 2.1. Patients

This study was performed with approval from the Pusan National University Hospital Institutional Review Board. A retrospective review was conducted on patients that underwent ET injection with autologous cartilage between March 2009 and February 2012. Inclusion criteria were based on the presence of three characteristic aural symptoms (autophony, aural fullness, and audition of loud breathing sounds), as well as verification of synchronous medial and lateral movement of the tympanic membrane coincident with forced breathing or sniffing. A contrast enhanced CT scan of the paranasal sinus was performed in all cases to rule out internal carotid artery dehiscence (a contraindication to injection). Unsuccessful conservative treatment with saline nasal irrigation and an anticholinergic nasal spray for at least 6 months was stipulated before surgical intervention. Patients that had undergone any other surgical procedure related to PET were excluded. Postoperative symptom improvement was assessed using the autophony scoring system adapted by Poe [3]. Scores were allocated as follows; (1) complete relief; (2) significant improvement, satisfied; (3) significant improvement, dissatisfied; (4) unchanged; or (5) worse. All 25 patients were reevaluated every 6 months postoperatively, and the final evaluations were generally finished at 3 years after surgery unless the patient did not feel any discomfort about PET. If a patient could not visit postoperatively a telephone interview was conducted. Patients underwent audiometric and tympanometric workups as a part of their workup. All the patients were informed about alternative treatments and of the risks and benefits of this surgery, and all provided written informed consent.

### 2.2. Surgical technique

Surgery was performed in an operating room under local anesthesia with the patient lying supine position. The ear was

prepared and draped in the normal sterile fashion. A tympanomeatal 1% xylocaine plus 1/100,000 epinephrine block was administered. Briefly, a cartilage block was harvested from the tragus and cut into pieces using a scalpel and scissors that were fine enough to pass through a 19 gauge needle (Fig. 1). A 1 cc syringe loaded with paste-like minced cartilage was attached to Bruning injector. Under endoscopic guidance, nostrils were decongested and anesthetized. The torus tubarius was visualized with a 30-degree, 4-mm endoscope and infiltrated with local anesthetic using a spinal needle. Inferior turbinate reduction was performed to improve visualization in cases with accompanying nasal septal deviation or turbinate hypertrophy that might restrict access to the nasopharynx and ET. Cartilage was injected submucosally into the anterior (0.5 mL) and posterior aspects (0.5 mL) of the nasopharyngeal ET (Fig. 2). Patients were discharged from hospital on the day of surgery.

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## 3. Results

Autologous cartilage injection was performed in 33 ears of 25 patients (19 males and 6 females). Eight patients had bilateral PET and 17 unilateral PET (right side 12 ears, left side 5 ears). The average duration of preoperative autophony symptoms was 6.7 years (range 2 to 26 years), and average follow-up duration was 25.2 months (range 12 to 40 months). No major intraoperative or postoperative complications occurred; one patient experienced transient otitis media with effusion for a month. Three patients required inferior turbinate reduction due to nasal septal deviation or inferior turbinate hypertrophy. Telephone interview was conducted with 13 patients. Final outcomes for relief of autophony, based on the Poe scoring system, are presented in Table 1. We regarded symptom resolution as a successful outcome. Overall, 23 of the 33 procedures (69.7%) were considered successful at final follow-up period (Fig. 3). No patient experienced symptom worsening after ET cartilage injection. Pure tone audiometry and tympanometry findings were not altered following surgery.

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## 4. Discussion

The goal of this study was to demonstrate the efficacy and safety of our novel surgical method for the treatment of PET. The endoscopic autologous cartilage injection technique was found to provide volumetric ET augmentation and improve autophony symptoms in most patients (69.7%). Furthermore, the proposed technique is not technically difficult, carries minimal complications, and most meaningfully provides lasting symptom relief. Final outcomes regarding relief of autophony were determined using the Poe scoring system, which is widely cited in studies that evaluated symptoms in patients with PET [4].

Surgical methods of treating PET include ET injection, endoluminal cauterization, shim placement, surgical closure of the tubal orifice, surgery on the tensor veli palatine (TVP) muscle, and patulous ET reconstruction (PETR) [1,5]. Although Poe introduced the PETR technique using an autologous

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