

Endoscopic butterfly inlay tympanoplasty for large perforations under local anesthesia at a single hospital

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Introduction

In 1998, Evavey proposed the inlay technique with a butterfly cartilage graft for tympanic membrane repair [1]. This method involves trimming auricular concha cartilage into a butterfly-shaped graft, which is then directly inserted into the site of tympanic membrane perforation through the ear canal. The advantages of this technique include shorter surgical time, avoidance of postauricular incisions, and elimination of the need for mastoid dressing postoperatively. Additionally, it is typically suitable for outpatient procedures under local anesthesia.

Traditional methods for tympanic membrane repair, such as the overlay or underlay technique, require creating wounds in the external auditory canal, which can lead to postoperative granulation tissue and wound pain. In contrast, the inlay technique performed through the ear canal does not necessitate incisions behind the ear or within the ear canal, resulting in reduced surgical time and decreased use of intra-tympanic antibiotic agents. Compared to traditional surgical approaches, the donor site for the graft, i.e., the auricular concha wound, carries a lower risk of complications and produces less noticeable scarring [2].

Several studies have already discussed the effectiveness of the inlay technique with butterfly cartilage graft for tympanic membrane repair. A literature review conducted in 2015 encompassed 12 studies comprising a total of 453 surgeries. The review concluded that the degree of postoperative hearing improvement was similar between the inlay technique and the traditional underlay technique [3]. Other studies have indicated that the surgical efficacy of the inlay technique with cartilage graft is comparable to that of the traditional underlay technique [4,5].

Literature review reveals limited discussions on inlay cartilage tympanoplasty performed under local anesthesia with endoscopic assistance. In this study, we present our single-center experience and discuss the efficacy of inlay cartilage tympanoplasty with endoscopic assistance.

Methods and Materials

This study aimed to retrospectively analyze cases of inlay cartilage tympanoplasty performed by a single surgeon at a hospital in Hsinchu, Taiwan, between September 2019 to August 2022. Data were collected, including patient age, gender, size of tympanic membrane perforation (measured using the traditional quadrant method with 25% as the cutoff), surgery duration, anesthesia method (general anesthesia or local anesthesia), pre- and postoperative hearing thresholds and air-bone gaps (expressed as the mean \pm standard deviation at 500, 1000, 2000, and 4000 Hz), and postoperative tympanic membrane healing.

Preoperative assessments included medical history inquiry, physical examination, and pure tone audiometry. The inclusion criteria for surgical patients were chronic otitis media with tympanic membrane perforation, stable perforation size persisting for more than six months, and dry ears without otorrhea in the four weeks preceding surgery. With the exception of three patients who underwent surgery under general anesthesia due to communication difficulties and excessive anxiety, all other patients underwent the procedure under local anesthesia.

Sterile preparation was performed prior to surgery. Lidocaine with epinephrine (1:100,000) was injected subcutaneously into the external auditory canal and the anteromedial aspect of the auricle. The damaged tympanic membrane and middle ear cavity were visualized using an endoscope (Storz 0°, 3 mm, 14 cm), and denudation was performed using a fine needle to create a fresh wound bed. A 1-1.5 cm incision was made from the anteromedial aspect of the auricle, avoiding the top (dome) to maintain the shape of the auricle. After achieving hemostasis, the wound was closed using 4-0 nylon sutures, which were removed one week later. The harvested auricular cartilage, with its perichondrium intact, was then divided into a butterfly-shaped graft using a No. 15 blade. The graft's upper edge was clamped with alligator forceps, and it was inserted (inlayed) into the perforated tympanic membrane through the ear canal. The position of the graft was adjusted using a Rosen needle, similar to the procedure for inserting a middle ear ventilation tube. The external auditory canal was packed with antibiotic-soaked gelfoam, and the auricular wound was covered with gauze to complete the surgery.

Results

The present study included 11 patients with an average age of 60.5 (19-80 years), 5 male and 6 female. All of the patients had eardrum perforations over 40% and accepted endoscopic inlay tympanoplasty under local anesthesia. The graft take rate was 100%. Ten patients accepted pre- and postoperative hearing test. The mean pre- and postoperative hearing thresholds were 56.3 ± 14.9 dB and 43.4 ± 17.7 dB, respectively. The average air-bone gap closure was 10.6 ± 5.8 dB. The average operative time was 45.5 (33-57 minutes).



Figure 1. Large perforation



Figure 2. Tragus cartilage



Figure 3. Tragus wound



Figure 4. Graft in place

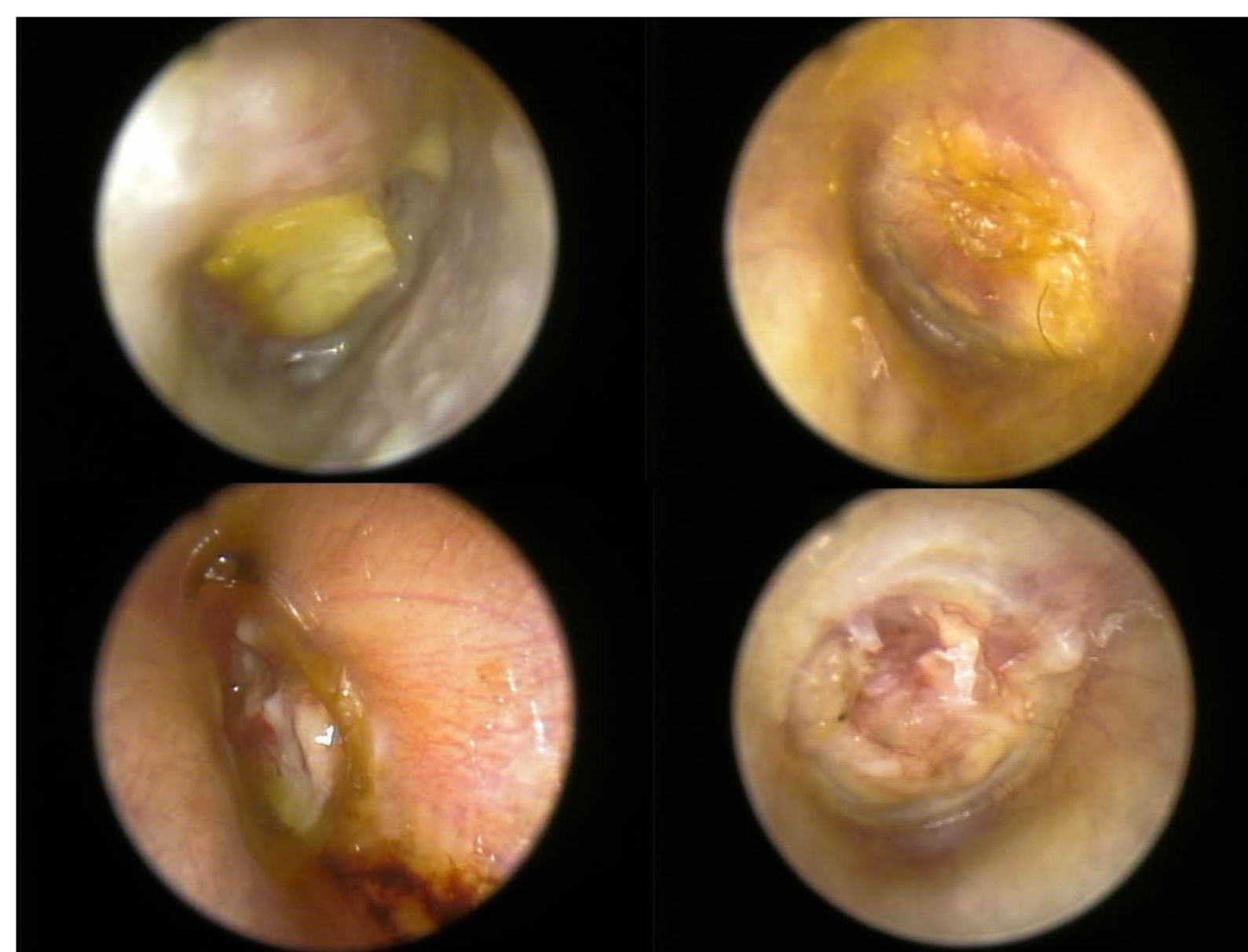


Figure 5. Graft intact

Discussion

The results of this study showed a significant improvement in postoperative hearing in patients, reduction of 9.9 ± 8.4 dB in air-bone gap. According to the literature review, endoscopic cartilage tympanoplasty has been reported to result in an average improvement of approximately 7 to 12 dB in air-bone gap. While cartilage grafts provide better graft stability, they may have a negative impact on sound conduction as well. However, some studies have indicated that if larger tympanic membrane perforations undergo endoscopic cartilage tympanoplasty, continued hearing improvement can be observed up to one year postoperatively [6].

Age is one of the factors that can influence surgical outcomes. In the early days, some researchers believed that patients over the age of 75 had poorer healing ability and should avoid surgery [9]. However, with the aging population, the number of elderly patients has been increasing, and tympanoplasty procedures can improve their quality of life by addressing hearing loss and ear discharge. Some elderly patients with chronic middle ear inflammation may not be suitable for general anesthesia surgery due to medical comorbidities. Therefore, for middle ear inflammation patients over the age of 70, consideration can be given to endoscopic cartilage tympanoplasty under local anesthesia [3].

Large perforations are currently not considered a contraindication for surgery. One study collected 26 cases with perforations larger than two-thirds of the tympanic membrane, and the success rate of endoscopic cartilage tympanoplasty was 96% (25/26) [8]. In cases of larger perforations, the shape of the perforation may appear as a heart shape due to the influence of the manubrium. The mentioned literature suggests that by trimming the cartilage graft to match the shape of the perforation and creating a notch, this issue can be overcome.

One limitation of this study is the small number of cases and insufficient follow-up time. In the future, more samples and longer follow-up periods are needed to demonstrate the long-term effects of endoscopic cartilage tympanoplasty.

Conclusion

In this preliminary analysis, endoscopic butterfly inlay tympanoplasty was performed under local anesthesia with satisfactory results. It can be an office-based procedure as an alternative to traditional tympanoplasty. Long term follow-up and greater number of cases are required for further verification of the results.

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