

## Transcanal tragal cartilage plug tympanoplasty: An alternative approach for management of small and medium sized ear perforations

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**Abstract:** *Background:* Tympanoplasty is the most common ear surgery that is performed worldwide. From time immemorial, otolaryngologists worldwide used to perform this operation through the conventional post aural route. This technique no doubt is still the most popular, but it also brings in a lot of disadvantages like post-operative scar, increase morbidity and hospital stay. Hence, the need arised for a more effective, quick and robust technique. *Aim:* This study is to assess the clinical and audiometric success rate of the new tragal cartilage plug or butterfly technique tympanoplasty. *Materials and Methods:* We assessed 30 patients (ages between 16-55 years) who underwent tragal cartilage plug tympanoplasty. It was a one year prospective clinical study. *Results:* Out of 30 patients, graft was taken up in 27 and in rest 3 there was residual perforation with an overall success rate of 90%. The anatomical success was assessed by otoscopy with graft well set in place. While functional success was analysed by audiogram, which showed decrease in Air-Bone (A-B) gap in 25 patients (83.3%). *Conclusion:* Considering the results attained, this method of tympanoplasty should be considered as a good alternative treatment option for repair of tympanic membrane perforations.

**Keywords:** Tragal Cartilage, Butterfly Technique, Tympanoplasty

### Introduction

The surgical repair of tympanic membrane perforation still remains a topic of debate and discussion inspite of so many years since Zollner [1] and Wullstein [2] described its various types. The procedure itself has seen so many variations with respect to the variety of graft materials that has been used right from fat or adipose tissue, tragal or conchal cartilage and or perichondrium to using the most common material like temporalis fascia. The technique has also undergone a sea of changes viz. underlay, overlay and interlay [3].

A significant disadvantage of these techniques is that they require elevation of the tympanomeatal flap, which increases the morbidity of the procedure and the degree of post-operative care. Here comes the role of transcanal tragal cartilage plug tympanoplasty using Eavey's butterfly technique [4]. This technique bypasses the need for elevating a tympanomeatal flap and hence its associated morbidity features like pain, bleeding

and increase hospital stay. The stiffness of the cartilage and its locking edges provide the graft considerable stability.

The purpose of this study is to evaluate this new technique in terms of its anatomical success as determine by the rate of complete perforation closure and also its functional as measured by post-operative hearing improvement through audiometry. We will also compare it with results of tympanoplasties done with other graft materials.

### Material and Methods

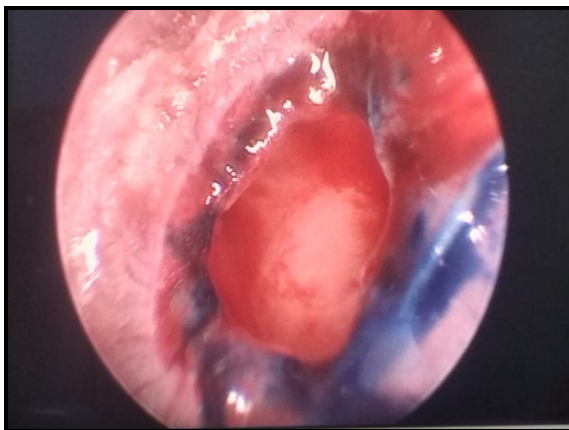
It is a prospective one year study done in our Hospital aimed to analyze the results of endoscopic trans canal "cartilage plug or butterfly" underlay cartilage tympanoplasty technique performed in patients with small to medium sized central tympanic membrane perforations between January 2018 to December 2018. The inclusion criteria were:

presence of single or double quadrant small to medium sized central perforation with possibility to visualize all its borders, a dry ear in the previous 3 months, absence of a cholesteatoma, age above 16 years and  $\leq 25$  dB air-bone gap (ABG) in the preoperative audiogram with no sensorineural loss. Thirty patients who fulfilled these criteria were selected and operated upon in this study.

All the patients were assessed through a thorough general and otorhinolaryngological examination, audiometry, CT Scan when necessary and preoperative tests. The results were evaluated based upon the perforation closure, post-operative hearing improvement checked by means of audiometry test at 3 months and 6 months and presence of any post-operative complications. Follow up was done till 6 months of post-operative period. Statistical analysis were carried out using the Chi- Square with correction by Fischer's exact test.

**Technique:** Surgery was performed under general anesthesia in all the cases to maintain an uniformity and also as a day care case. First, the perforation edges were visualized with a  $0^\circ$ , 2.7 mm rigid otoendoscope. The edges of the perforation were freshened using an angled pick. The size of the perforation was measured by applying methylene blue solution along the edges of margins of the perforation using a Jobson Horne probe [Fig.1].

**Fig-1:** Size of perforation by applying methylene blue solution



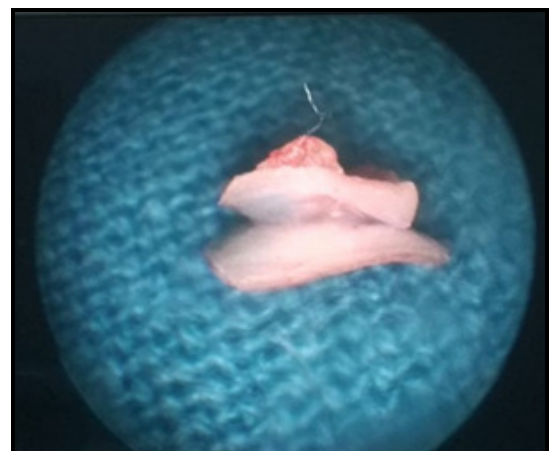
**Fig-2:** Impression of dry gel foam piece



Then an imprint of the perforation was taken over a dry gel foam piece and a mould of appropriate size created [Fig.2]. A small, 1-1.5-centimeter incision, was then made across the tragus using 15 sized scalpel blade. An island of cartilage covered with perichondrium on both sides about 2 mm bigger than the freshened perforation was harvested.

The graft was held vertically between the thumb and forefinger and while rotating the graft, a 1 mm deep groove along the circumferential border of the cartilage disc was made using the same 15 sized scalpel blade allowing the cartilage flanges to spring open. The spreading of the two cartilage surfaces resembled the "Butterfly" and hence the name of the technique. [Fig.3] The skin incision was sutured up with 3-0 mersilk.

**Fig-3:** Butterfly technique of two cartilage



**Fig-4:** Graft manipulation of tympanic membrane

The graft was held with a crocodile forceps and was inserted transcanally and placed over the perforation. The groove in the cartilage was engaged with the anterior rim of the perforation so that the medial flange was medial to the tympanic membrane and the rest of the graft was manipulated into place so that the tympanic membrane sat in the groove of the cartilage graft very much like a grommet. To confirm the proper locking of the graft onto the perforation, it was gently moved with a ball probe [Fig.4]. On top we placed a thin gel foam layer soaked in antibiotic solution, and a cotton ball was used to seal the external auditory canal.

### Results

From a total of 30 patients submitted to tympanoplasty with cartilage plug, 23 were males (76.7%) and 7 (23.3%) were females. The mean age of patients was 32 years (range 16 to 55 years). All data were analysed by paired sample t test. Out of 30 patients, graft was taken up in 27 and in rest 3 there was residual perforation with an overall success rate of 90%. The anatomical success was assessed by otoscopy with graft well set in place. While functional success was analysed by PTA, which showed decrease in Air-Bone (A-B) gap in 25 patients (83.3%). This decrease in A-B gap was more than 20 dB (pre-op AB gap =33.75db, post op AB gap was 13.5db with  $p < 0.05$ ). In five patients, which included the three failure cases also, there was no gap improvement after tympanoplasty and all of them belonged to the 51-55 age group.

Out of 3 patients in whom the graft was not taken up and there was persistent perforation, 2 patients

had upper respiratory tract infection in the immediate post-operative period and there was discharge in external canal. In one patient graft was lying in external auditory canal. All patients were followed regularly every week for first month and then monthly for next 6 months.

### Discussion

Since the introduction by Wullstein [2] of the types and techniques of tympanoplasties, many studies have been conducted and reported in world literature. At the same time, different graft materials have been used. These included the most common temporalis fascia, tragal perichondrium and tragal cartilage and even conchal cartilage grafts [5].

Temporalis fascia and tragal perichondrial graft has the closest resemblance to the tympanic membrane and gives excellent results both anatomically and functionally. There are studies conducted by Jyoti P Dabholkar (2007) [6] whose postoperative graft uptake rate with temporalis fascia was 84% and tragal perichondrium showed 80%. P.K Parida, *et al* (2012) [7] in their study found 80% uptake rate with temporalis fascia. Ahad SA (1986), [8] reported 83.30% success with homologous temporalis fascia.

With regards to tragal cartilage graft, many studies have been reported in world literature. Sözen *et al.*[9] in a series of 246 patients compared conchal cartilage, tragal cartilage, and temporalis muscle fascia and found corresponding graft success rates of 100%, 88.5%, and 80.5%, respectively. In a study of Dündar *et al.* [10] the success rate with a boomerang-shaped chondroperichondrial graft was 95% (99 cases). Debasish *et al.* [11] reported overall graft take-up rate of 93.33% with composite graft comprising perichondrium and peripheral ring of tragal cartilage.

This technique of Cartilage plug or butterfly cartilage tympanoplasty is relatively new and was first described by Eavey in 1998. Graft act as a bridge, squamous epithelium migrates on its lateral side, while middle ear mucosa on its medial side. The graft becomes part of membrane. The basic aim of myringoplasty is

to make the ear safe and at the same time improve the hearing. According to Ghanem *et al.*[12] the instant “locking” of the graft provided by the butterfly edge diminishes concerns about graft lateralization and displacement caused by patient activities success rates of tympanic membrane perforation closure with cartilage plugs are high. In 2002, Testa *et al.*,[13] published a closure success rate of 96.8% with hearing improvement in all the cases. Lubianca-Neto *et al.* [14] in 2000, published success rates of 90% and 94.4%, respectively.

In this study, we selected small to medium sized perforations in clean & dry ears with inactive mucosal disease. We reported an anatomical success rate of 90 % and a functional success rate of 83.3% which was at par with studies conducted worldwide.

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## Conclusion

Cartilage plug or butterfly technique tympanoplasty appears to be effective and safe in terms of anatomical & functional success with closure of perforation to make the ear safe. This technique bypasses the need for elevating a tympanomeatal flap and hence its associated morbidity features like pain, bleeding and increase hospital stay At the same time, Air Bone gap can also be decreased and a good hearing can be achieved. The results are also comparable with those studies in which temporalis fascia, tragal perichondrium grafts were used. Effectiveness and simplicity makes this technique a better option.

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