# Audiometric results after type I tympanoplasty: retrospective study

Original Article


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## Abstract

Type I tympanoplasty is a common surgery in otorhinolaryngology. The main objective is to restore the integrity of the tympanic membrane, preventing infections, and improving hearing.
This is a retrospective study of all patients who underwent Portmann type I tympanoplasty at the Garcia de Orta hospital in the last 10 years. The types of graft used and the pre- and postoperative audiometric results were recorded and the anatomical and audiometric success rates were analyzed.
72 patients were included, with a mean age of 54 years. The study revealed a success rate of 70% in relation to closing the perforation and 60% in relation to closing the air-bone gap. The best graft in terms of closure was the temporal fascia + cartilage, a statistically significant result. In terms of closure of the air-bone gap, it was the temporal fascia, but it was not statistically significant.
The anatomical and audiometric results are comparable to those published in the literature.


Keywords: Type I tympanoplasty, Grafts, Audiological result, Hearing tests, Tympanoplasty, Cartilage, Fáscia, Treatment outcome


## Introduction

Chronic otitis media (COM) is a common pathology in otorhinolaryngology. It is characterized by persistent inflammation in the middle ear that may lead to irreversible changes, such as tympanic membrane (TM) perforation, conductive hearing loss, recurrent infections, and chronic or recurring otorrhea, with a significant socioeconomic impact[1,5].
Tympanoplasty is one of the most frequent surgical otologic procedures performed for closing TM perforations, and it is also used for the treatment of stable and non-suppurative COM[1,6]. In Portmann's type I tympanoplasty, the TM is closed by elevating the tympanomeatal flap and accessing the middle ear without manipulating the ossicular chain[1]. This procedure aims at reconstructing the TM, thus


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preventing recurrent otorrhea and, whenever possible, restoration of hearing[1].

Tympanoplasty can be performed using different techniques, particularly regarding the type of graft used. Specific properties of different graft materials (cartilage with tragal perichondrium, cartilage with temporalis fascia, temporalis fascia, or lyophilized fascia) may help in achieving specific outcomes. Various prognostic factors have been described in the literature in relation to anatomical and audiometric success, including the perforation size or location, patient age, and the graft type. Cartilage reportedly demonstrates a higher success rate for perforation closure than temporalis fascia[2].

## Objectives

This study aimed to evaluate the therapeutic success of Portmann's type I tympanoplasty, specifically with regard to TM perforation closure and audiometric outcomes in patients operated using different graft types at the department of otorhinolaryngology of Garcia de Orta Hospital (HGO) from 2013 to 2023. The secondary objective was to identify the potential predictive factors for surgical success associated with the type of graft used.

## Materials and methods

This retrospective study analyzed 72 patients who underwent Portmann's type I tympanoplasty and was conducted over a 10-year period at the HGO department of otorhinolaryngology. The exclusion criteria were an indication for ossicular chain reconstruction or absence of pre- or postoperative audiometric evaluations. All included patients underwent a preoperative evaluation, which included pure-tone audiometry. During the postoperative follow-up visit, the status of TM closure was recorded, and a repeat audiometric evaluation was requested. The graft materials used included cartilage with tragal perichondrium, cartilage with temporalis fascia, temporalis fascia, and synthetic lyophilized fascia. All procedures were performed by junior surgeons using the underlay technique for graft placement.

Audiometric outcomes were compared between the preoperative and postoperative periods, including the average air conduction and average air-bone gap thresholds at 0.5, 1, and 2 kHz. Therapeutic success was defined as complete TM closure, which was calculated as the proportion of patients with an intact neo-tympanum among those who were followed up postoperatively, and an air-bone gap ≤5 dB. Outcomes were compared according to the type of graft used. The follow-up period was 6 months. The data were collected in an Excel® spreadsheet for statistical analysis. The Kruskal–Wallis test was used to evaluate audiological outcomes due to the non-normal distribution of the data, while the chi-square test was used to evaluate TM closure outcomes.

## Results

The median age of the 72 patients included in the study was 54 years (range 15–82 years).

The success rate was 70% for TM perforation closure and 60% for air-bone gap closure at six months. The median preoperative air conduction threshold was 40 dB (30–50), while the postoperative threshold was 30 dB (20–35). The mean air-bone gap was 15 dB (10–20) preoperatively and 5 dB (0–10) postoperatively. The highest surgical success rate for perforation closure was achieved with the combination of cartilage and temporalis fascia, reaching 100%. Lyophilized fascia had a success rate of 65%, temporalis fascia 61%, and cartilage with perichondrium 50%. Statistical analysis using the chi-square test confirmed that the graft type significantly affected the perforation closure rate ($p = 0.0023$).

Regarding air-bone gap closure, temporalis fascia yielded the best results, whereas cartilage combined with perichondrium or temporalis fascia showed the worst audiometric outcomes. Statistical analysis of the non-normal sample using the Kruskal–Wallis test indicated no statistically significant difference in audiometric outcomes among the different graft types ($p = 0.815$).

## Discussion

According to the literature, the success rate of type I tympanoplasty ranges from 35% to 95%[1]. This variation may be due to different success criteria and significant heterogeneity in postoperative follow-up. In this study, the perforation closure rate was high and consistent with the rates in the current scientific literature .

Regarding the graft type, the combination of cartilage and temporalis fascia showed the highest closure rate. A systematic review by Jalali et al. demonstrated a significantly higher perforation closure success rate with cartilage grafts than with fascia grafts[7]. Thus, cartilage may be the most appropriate graft in cases of TM perforation at high risk of recurrence[8] because of its greater stability than other grafts when subjected to negative pressure changes in the middle ear[1].

The audiological outcomes in this study were also positive, with a 60% success rate, which is slightly lower than the rates reported in the literature (62–66.8%)[2,3].

The grafts with the best audiological outcomes were the temporalis fascia and perichondrium; however, there was no statistically significant difference.

This study has some limitations, primarily because of its retrospective design, the variable timing of postoperative audiological evaluations, and involvement of multiple surgeons with different levels of experience.

## Conclusion

For Portmann's type I tympanoplasty, several effective approaches are available, particularly regarding the choice of graft material. Although new graft options have emerged, the combination of cartilage and temporalis fascia continues to demonstrate high closure rates and favorable audiometric outcomes, as observed in this study.

### Conflicts of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

### Data Confidentiality

The authors declare having followed the protocols used at their working center regarding patient data publication.

### Protection of humans and animals

The authors declare that the procedures were followed according to the regulations established by the Clinical Research and Ethics Committee and the 2013 Helsinki Declaration of The World Medical Association.


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### Availability of scientific data

There are no datasets available, or publicity related to this work.

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