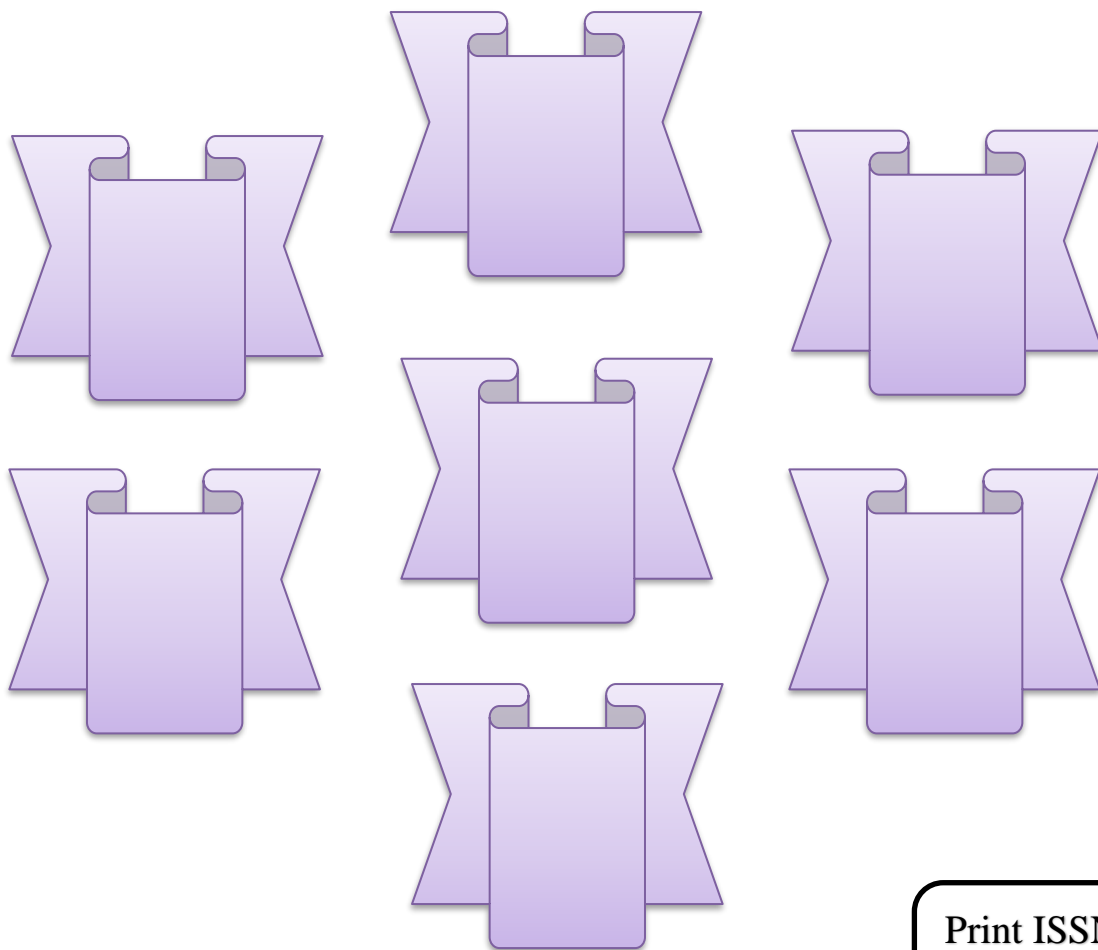


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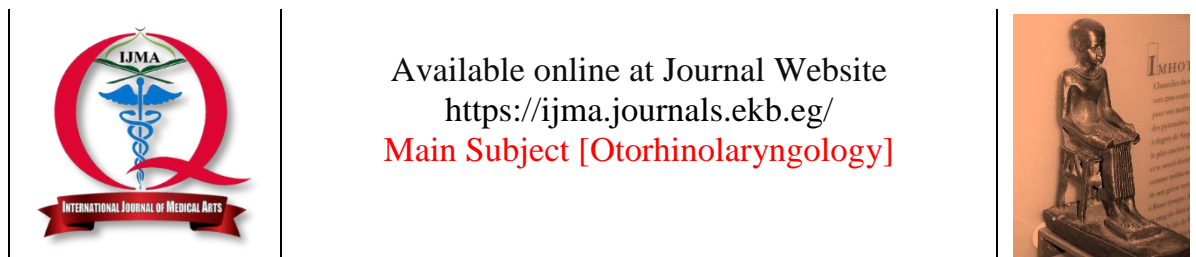
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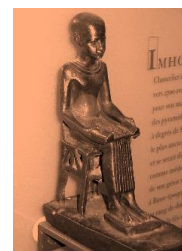


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Original Article

Endoscopic Tympanoplasty Using Tragal Cartilage Perichondrium: Elevated versus Non-Elevated Tympanomeatal Flap

Abo Alyazeid Abd Al Baseir Abo Taleb ^{*1}, Salah eddin Saeed Mohamed ², Amr Hamdino Youssef ²

¹ Department of Otorhinolaryngology, National Hearing and Speech Institute, General Organization for Teaching Hospitals and Institutes, Giza, Egypt

² Department of Otorhinolaryngology, Faculty of Medicine, Al-Azhar University, Cairo, Egypt

ABSTRACT

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*Corresponding author

Email: dryazeidabotaleb@gmail.com

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Background: Tympanoplasty aims to restore hearing by fixing a perforated eardrum. This procedure can be carried out using various techniques and tissue grafts. While there is no agreement on the specific technique or graft to be used, the surgeon's experience and preferences are crucial in determining which repair method to select. Endoscopy allows for sufficient visualization, and even if there are exostoses [bony growths] in the external auditory canal [EAC], the margins of the perforation can be distinctly assessed.

Aim of the work: This study aims to compare two surgical techniques of endoscopic type 1 tympanoplasty; Trans canal with or without tympanomeatal flap elevation.

Patients and Methods: Fifty-two Patients with tympanic perforation attending Al-Azhar University Hospital, Otorhinolaryngology outpatient clinic with chronic tympanic membrane perforation and they were divided into two equal groups: Tympanoplasty with and without Elevation of Tympanomeatal Flap. The main studied outcomes were success rate of surgery and improvement of hearing.

Results: We found significant decrease in post-operative Air Bone gap in group A than group B [p=0.015]. Mean operative time was statistically significant lower operative time in group B than group A [p=0.001]. High success rate was reported in both group without statistically significant difference.

Conclusion: The trans-tympanic tympanoplasty is a straightforward method that has success rates similar to those of the tympanomeatal flap technique.

Keywords: Endoscopic, Tympanoplasty, Tragal Cartilage, Tympanomeatal Flap.



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INTRODUCTION

In adults, chronic otitis media [COM] and trauma often lead to persistent perforation of the tympanic membrane [TM]. This perforation can be treated with surgical closure through a procedure called myringoplasty [1].

Tympanoplasty is a surgical intervention carried out to address hearing loss by fixing a perforated eardrum. There are various techniques and tissue grafts that can be utilized in performing tympanoplasty. While there is no universally agreed-upon surgical technique or graft choice, the surgeon's know-how and preferences are crucial in choosing the appropriate repair method [2].

There are swift advancements taking place in modern otologic surgery with regard to tympanoplasty. A significant number of studies focused on tympanoplasty can be found in the literature. These studies mainly cover topics such as the techniques used in tympanoplasty and the important factors in selecting graft materials. Thanks to the development and widespread adoption of contemporary tympanoplasty techniques, the success rate of tympanoplasty has surpassed 90% [3].

The utilization of microscopes marked the commencement of contemporary tympanoplasty techniques, and presently, the endoscopic tympanoplasty approach is regarded as a minimally invasive surgical procedure [4].

In ear surgery, the endoscopic approach has gained popularity. This technique offers sufficient visualization, even if there are bony growths [exostoses] in the external auditory canal [EAC], allowing for clear evaluation of the perforation margins. The endoscopic inlay butterfly cartilage tympanoplasty is a successful procedure that does not require canaloplasty or elevation of the tympanomeatal flap. However, it is technically more difficult as it requires precise measurement of the perforation size and shape and accurately sizing the cartilage graft. Yet, it has an excellent graft success rate [5].

The endoscopic tympanoplasty method was introduced in the 1990s and has gained widespread acceptance in otology. Through the trans-canal route, the endoscopic approach can elevate the tympanomeatal flap, while also enabling tympanoplasty to be performed without elevating the tympanomeatal flap [6].

The endoscopic method provides enhanced imaging of the anatomic structures in the middle ear, including the anterior and posterior epitympanic space, sinus tympani, and the fascial recess [7].

One of the fundamental stages of tympanoplasty is the elevation of the tympano-meatal flap. Various incisions have been described in the literature for this purpose. The most commonly preferred method is to elevate a superiorly based flap with a radial incision. The extent of elevation required for the tympano-meatal flap depends on the size of the perforation [3].

Ayache identified various types of tympanomeatal flap incision based on the size and location of the perforation. By using different grafts and minimizing the elevation of the tympanomeatal flap, it is possible to achieve a satisfactory level of anatomic and functional success [3].

In this study, the main aim was to determine whether the Trans tympanic method produces outcomes similar to those achieved through the tympanomeatal flap elevation approach.

PATIENTS AND METHODS

In this prospective clinical study, we recruit 52 patients with tympanic perforation from Al-Azhar University Hospital, Otorhinolaryngology Department, Faculty of Medicine.

Sample size was calculated by epi program, prevalence of tympanic perforation was 0.09% based on **Pap et al.** [8] study. We used 95% as confidence level and 80% power with α error 10%.

Inclusion criteria: Small and medium sized central dry perforations with conductive hearing loss [air bone gap < 35 dBs], with no mucosal discharge for at least 3 months. Size of perforation was calculated by measuring the percentage of perforated area in relation to the total area of tympanic membrane [9].

Exclusion criteria: Patients suffering from total/subtotal or peripheral perforation. Presence of active discharge or Cholesteatoma.

Randomization: Patients have been divided into two group: **Group A** [odds number; 26 patients]: Tympanoplasty with Elevation of Tympanomeatal Flap, and **Group B** [even

number; 26 patients]: Tympanoplasty Without Elevation of Tympanomeatal Flap [Trans canal Trans tympanic].

Ethical Consideration: The local Ethics Board of Al-Azhar University approved the study. This research was concluded in accordance with [Declaration of Helsinki] The Code of Ethics of the World Medical Association for studies involving humans.

Data collection: Each patient included in the study was subjected to full history taking. Examination of ear by otoscope and ear endoscope. Pure Tone Audiometry and Tympanogram were done for each patient.

Surgical techniques

The patient underwent surgery while under general anesthesia and in a comfortable supine position. The ear surgery was carried out according to established principles, and in all cases, the tympanic membrane perforation was examined endoscopically using a 3 mm 18 cm rigid endoscope before graft extraction. After the perforation edges were debrided, grafts were

obtained. Both groups were grafted by flap of tragal Perichondrium graft. The grafts were acquired by harvesting the anterior and/or posterior peri-chondrium of the tragal cartilage [Figure 1].

In **Group A**, the endoscopic tympanoplasty type 1 procedure was performed with the elevation of the Tympanomeatal flap. The middle ear was accessed by lifting the tympanomeatal flap 5 mm lateral to the tympanic membrane annulus. The ossicular chain in the middle ear was examined, and the grafts obtained were shaped to fit the perforation of the tympanic membrane. They were then placed using the over-underlay technique while checking the ossicular chain. Finally, the tympanomeatal flap was repositioned [Figure 2].

In **Group B**, patients underwent endoscopic Trans canal Trans tympanic myringoplasty, after the trimming of edges the graft was put superficial to gel foam and the edges of it repositioned under the edges of tympanic membrane perforation [Figure 3]. Gel foam was used to provide medial and lateral support to the grafts.

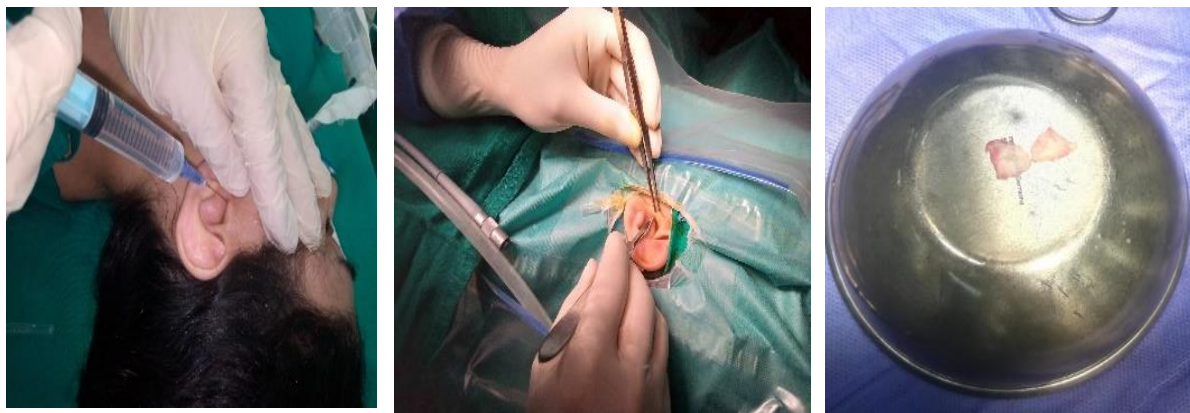


Figure [1]: Harvesting of tragal perichondrium graft



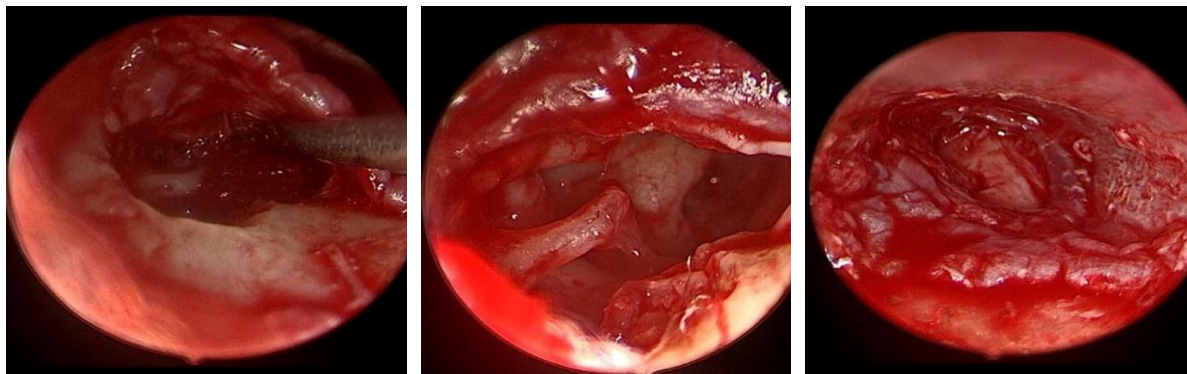


Figure [2]: Group A were undergone endoscopic tympanoplasty type 1 with elevation of Tympanomeatal flap. Showing steps applied for the first group surgery which were 1, trimming of edges 2, elevation of tympanomeatal flap 3, putting of gel foam 4, and putting of tragal perichondrium graft



Figure [3]: Group B were undergoing endoscopic Trans canal Trans perforation, and the steps of the second group surgery which were 1, trimming of edges 2, putting of gel foam 3, putting of tragal perichondrium graft

A comparison is held between both groups according to operation time [starting after adrenaline injection till butting gel foam], audiological outcomes after three months, complications [infection and pain] and success rate.

Post-operative follows-up: Otological endoscopic examination after 1 week, 2 weeks, one month and 3 months. Pure Tone Audiometry and Tympanogram after 3 months.



Figure [4]: Healed TM after endoscopic tympanoplasty type 1 by Trans canal Trans Perforation technique

Statistical analysis: we used SPSS 23.0 program in summarization and testing of significance, in categorical data we used chi square or exact fisher test according to eligibility of test. And for numerical data we used t-test. We summarize data in form of mean and SD for continuous data that are normally distributed and frequency [%] for categorical data. We consider p value less than 0.5 significantly.

RESULTS

In our study, the mean age of group A was 28.9 years, while for group B, it was 29.2 years, and the difference between the two was not statistically significant.

In group A 50% [13] were male and in group B 46.2% [12] were male. In group A 53.8% [14] complaining from Lt side perforation. While in group B 53.8% [14] cases were complaining from Rt side perforation, table [1].

We found medium size perforation was the most frequent in both studied groups 15 [57.7%] and 14 [53.8%] respectively without statistically significant [p=0.2]. Also, we found most frequent type of hearing impairment was mild

CHL in both groups 20 [76.9%] and 18 [69.2%] without statistically significant differences [p=0.9], table [2].

As regard to preoperative Air Bone gap in group A was 17.04 dB while in group B, it was 19.2 dB. While post-operative Air Bone gap was 11.9 db in group A and 15.2 db in group B with significant decrease in post-operative Air Bone gap in group A than group B [p=0.015], table [3]

In our study mean operative time in group A was 53.7± 2.2 min while in group B was 36.2±4.4 min; with statistically significant lower operative time in group B than group A [p=0.001].

As regard to comparison of Air bone gap between studied groups; preoperative Air bone gap in group A was 17.04 db while post-operative showed significant decrease to 11.9 db [p=0.001]. Also, in group B showed significant decrease from 19.2 db preoperative into 15.1 db post-operative [p=0.001], table [4].

Our study showed highly success rate in both group without statistically significant [p=1]. And no cases of postoperative complications were founded, table [5].

Table [1]: Comparison of General information of study participants

		With Elevation		Without Elevation		P value
Age [years], mean ± SD		28.9	9.7	29.2	10.9	0.9
Sex, No. [%]	Male	13	50	12	46.2	0.7
	Female	13	50	14	53.8	
Side, No. [%]	Right	12	46.2	14	53.8	0.5
	Left	14	53.8	12	46.2	

Table [2]: Comparison between the Clinical data of studied groups

		With Elevation		Without Elevation		P value
		No.	%	No.	%	
Size of Perforation	Small	11	42.3	12	46.2	0.2
	Medium	15	57.7	14	53.8	
Hearing Impairment	Minimal CHL	6	23.1	8	30.8	0.9
	Mild CHL	20	76.9	18	69.2	

Table [3]: Comparison between Air Bone Gabe between studied groups

		With Elevation		Without Elevation		P value
		Mean	SD	Mean	SD	
Air bone gap [dB]	Pre	17.04	3.2	19.2	7.8	0.2
	Post	11.9	3.2	15.2	5.7	

Table [4]: Comparison between pre and post-operative Air Bone gap between studied groups

		Pre		Post		P value
		Mean	SD	Mean	SD	
Air bone gap	With Elevation	17.04	3.2	11.9	3.2	0.001*
	Without Elevation	19.2	7.8	15.1	5.7	0.001*

Table [5]: Comparison of Success rate between studied groups

Success Rate	With Elevation		Without Elevation		P value
	No.	%	No.	%	
Complete healing of TM	23	88.5	23	88.5	1
Residual Perforation	3	11.5	3	11.5	

DISCUSSION

By utilizing various grafts and minimizing the elevation of the tympanomeatal flap, it is possible to attain a satisfactory level of anatomic and functional success [3]. Various tympanoplasty techniques that do not require tympanomeatal flap elevation can achieve a success rate of 82-87%, along with acceptable audiometric outcomes [10].

We believed that the trans-tympanic tympanoplasty technique was faster and less complicated than the tympanomeatal flap elevation approach.

The patients were divided into two groups before the operation, and their tympanoplasty success rate and operative duration were compared. It was discovered that both groups achieved similar outcomes for small and medium-sized perforations.

To evaluate audiologic success, we measured the air-bone gap before and after the operation. Upon comparing the hearing outcomes of both groups, it was observed that the group that did not undergo elevation had a higher gap.

As regard to comparison of Air bone gap between studied groups; group A had preoperative Air bone gap equal to 17.04 db. while post-operative showed significant decrease to 11.9 dB [p=0.001]. Also, in group B showed significant decrease from 19.2 db preoperative into 15.1 db post-operative [p=0.001]. This was unlike study of *Alzoubi et al.* [11], where their results showed comparable results in both groups.

Also, *Ha et al.* [12] disagree with our finding as they showed insignificant difference between both groups as regard postoperative air-bone gap.

Alzoubi et al. [11] suggested that the improvement in air-bone gap observed in the group that did not undergo elevation is the result of less manipulation of the middle ear cavity, resulting in fewer adhesions and better hearing outcomes.

In our study, trans tympanic [without elevation] procedures had significant shorter operative duration. Also, *Alzoubi et al.* [11], in their study, reported that trans-tympanic procedure was approximately 9 min shorter than stander elevated technique with statistically significant. *Ha et al.* [12] agree with our finding reporting that trans tympanic had shorter operative duration.

A comparative study of tympanomeatal flap elevation versus non elevation stated that the difference of success rate was statistically insignificant [13].

Several authors have supported the use of trans-canal cartilage inlay tympanoplasty for mending perforations in the tympanic membrane. This procedure is minimally invasive and does not require postauricular or endaural incisions [2].

Some recent authors have also reported on endoscopic myringoplasty performed without elevating the tympanomeatal flap, achieving graft success rates ranging from 85% to 92.9% [14, 15].

Our study showed success rate of 88.5 % [23 cases] in each group, with complete healing of tympanic membrane, whereas 11.5% [3 cases] in each group had residual crescentic perforation without statistically significant [p=1]. No cases of postoperative complications were founded.

Elevating the tympanomeatal flap not only extends the duration of the operation but also heightens the likelihood of postoperative complications [16]. *Niazi et al.* [14] showed a success rate of 80% and 85% for without- and with-elevation techniques respectively. They concluded that the without elevation technique is less invasive, less traumatic and associated with shorter operative duration and hospital stay.

Conclusion: The trans-tympanic tympanoplasty technique is a straightforward and rapid procedure that achieves comparable success rates to the tympanomeatal flap approach. Therefore, we recommend it for small to medium-sized perforations. Endoscopic trans-canal trans-

perforation tympanoplasty provides a convenient and minimally invasive method for performing tympanoplasty. It eliminates the need for post-auricular or end-aural incisions, tympanomeatal flap elevation and canal-plasty.

Conflict of Interest and Financial Disclosure: None.

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