

A comparative study of Post-aural approach and End-aural approach for Type-1 tympanoplasty.

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Abstract:

Background & Objectives: Tympanoplasty is preferred procedure of choice for repair of tympanic membrane by otologists. No single technique is best for tympanoplasties as several variables come into play that affect surgical outcomes like size of meatus and perforation, site of perforation, graft source and its placement technique, disease extent which determines the approach to middle ear. Postauricular, Endaural and Permeatal approach are commonly used. We compared postaural and endaural approach to study the outcome in type-1 tympanoplasty in relation to graft uptake, Hearing improvement, Success in various age groups. **Materials and Methods:** This prospective study data was collected from 50 randomly selected patients admitted in ENT department of Shardaben General Hospital. 25 patients underwent type-1 tympanoplasty with postaural approach and 25 with endaural approach. Grafts were all Temporalis Fascia for purpose of uniformity. All grafts were kept by Inlay technique for ease of comparison. **Results:** Percentage of graft taken up in case of endaural approach is 92.0% and in case of postaural approach is 88.0%. Percentage of rejected graft in case of endaural approach is 8.0% and in case of postaural is 12.0%. Hearing gain in case of endaural approach is 11.62 db and in case of postaural approach is 11.24 db. **Conclusion:** Both postaural approach and endaural approach have excellent outcomes and gives equivalent results irrespective of age or sex of the patient or size of perforation. We concluded hearing improvement is same in both endaural and postaural approaches irrespective of other factors.

Key Words: End-aural, Post-aural, Tympanoplasty type-1.

Introduction:

Amongst the special senses bestowed by nature to humans, AUDITORY SENSATION is a vital sensation for existence. A person deprived of hearing makes him handicapped and isolated. Ear pathologies can also cause hearing impairments. Our country being a developing nation with poor socioeconomic status and low environmental conditions, chronic otitis media accounts for 5% of population.

Chronic otitis media (COM) is the most common condition seen in otolaryngology clinics and is an important public health problem too. With the advent of antibiotics and its frequent use, complications related to COM have decreased but persistent

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defects required reconstruction. Hence middle ear surgeries are commonest performed surgical procedures in otology. Restoration of hearing by correction of conductive hearing loss and to make patients free of discharge as well as to provide functional benefits to patient are the basic goals to perform middle ear surgeries.

Tympanoplasty is the preferred procedure of choice for repair of tympanic membrane by otologists. There is no single technique that is best for all tympanoplasties, as several variables come into play that affect surgical outcomes such as size of meatus, size of perforation, site of perforation, graft source, placement of graft and extent of the disease which determines the approach to middle ear.

Three classical approaches that have been developed are post auricular, endaural and permeal approach. Each of them has its own merits and demerits, so with this in mind, we undertook this study to find out the efficacy of two different approaches (postaural and endaural).

In our present study, we are comparing and evaluating results of type-1 tympanoplasty through postaural and endaural approach. Study aimed to compare postaural approach and endaural approach in type 1 tympanoplasty in relation to

- Graft uptake.
- Hearing improvement.
- Success in various age groups.

We analyzed influence of Sex and Age of the patient & Size of the perforation on the outcome of type-1 tympanoplasty with postaural and endaural approach. Analysis was done to identify the complications of surgery if any, with endaural and postaural approach.

Background

The era of surgical repair of the tympanic membrane dates as far back as the 19th century. Wilde¹ (1853) showed the use of post auricular incision to expose mastoid. Later first mastoidectomy operations performed in United States by turnbull² (1862), St. John Roosa (1870) and Buck (1871) also used post auricular route. Schwartze³ (1873) taught Mastoid operation in Europe using post auricular incision.

Since 1938, endaural incision has been used for the lempert⁴ fenestration operation, and used by a large no. of surgeons. Kessel⁵ in (1885) started Endaural mastoidectomy, Lempert (in 1929) and Heerman (in 1930) advocated antero-superior extra cartilaginous endaural incision for radical mastoidectomy. Shambaugh and others modified the classical endaural incision to permit easier visualization with endomeatal incision made within the EAC by vertical relaxing incision first. Shambaugh⁶ (1967) said, the endaural incision gives good access to posterior perforations while the post auricular incision gives good anterior exposure (Glasscock & Shambaugh 1990, Mills et al 1997, Ludman & Wright 1998) said Kartush et al⁷ (2002).

Materials and Methods:

The study was a prospective review of 50 patients who were admitted and underwent

tympanoplasty in our ENT department of Shardaben General Hospital, Ahmedabad, India from July 2018 to December 2019. An informed and written consent was obtained from all patients who were included in the study and underwent surgery after proper written consent only.

Inclusion criteria

- Patients above age of 15 years having Unilateral or Bilateral chronic otitis media (Tubotympanic type or mucosal type).
- Patients having dry ear for at least 6 to 8 weeks.
- Patients with mild to moderate degree of conductive hearing loss.
- Patients willing to give informed and written consent.

Exclusion criteria – If patient had

- Squamous type of chronic otitis media (Atticoantral).
- Active mucosal chronic otitis media.
- Sensorineural hearing loss element.
- Extra cranial or intracranial complications.
- Below 15 years.
- Patients not giving written and informed consent

A proforma was prepared for all the cases, findings were noted and treatment and follow up were charted. All patients were thoroughly examined and underwent pure tone audiometry (PTA) and X-ray Bilateral mastoid with complete hematological investigations (CBC, Blood Sugar, liver function test, and renal function test with electrolytes). All surgeries were carried out under either local or general anesthesia. Homologous Graft material, Temporalis Fascia was used for the purpose of uniformity. All grafts were kept by Inlay technique for ease of comparison.

Results :

A total of 50 tympanoplasties were performed during the period of this study, with a Male: Female ratio of 1:1.5 (**Image 1**). The patients included were of age ranging from 16 years to 55 years. The average mean age is 31.72 years (**Image 2**). Most of the cases in our study were having unilateral pathology while 14 cases were having bilateral chronic otitis media, out of which dry and more affected ear was selected for surgery.

All patients (100%) had presenting complaint of ear discharge either in present or past. Although they were taken in surgery after making the ear dry. 59.37% patients who were selected for surgery had complaint of ear discharge for more than 5 years (**Image 3**). 41 patients (82.0%) complained of some degree of deafness. Some were not aware of their deafness, reason might be due to unilateral mild deafness, which was manifested on pure tone audiometry. 26 (52.0%) patients had associated earache.

Image 1: Gender distribution of patients

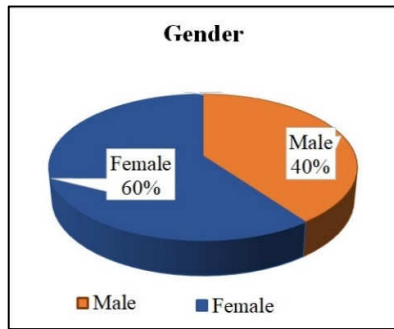


Image 2: Age distribution of patients

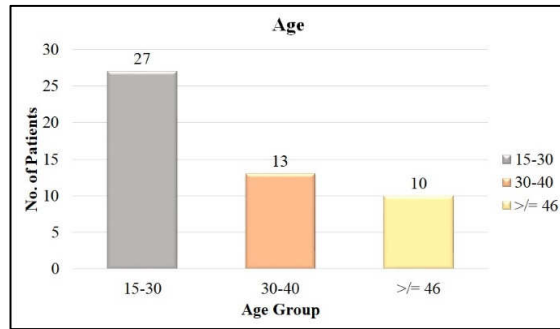


Image 3: Presenting/chief complains

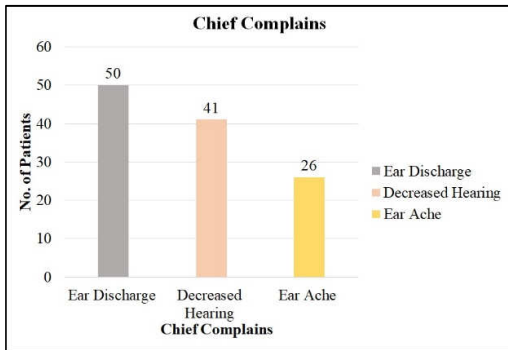


Image 4: Status of graft

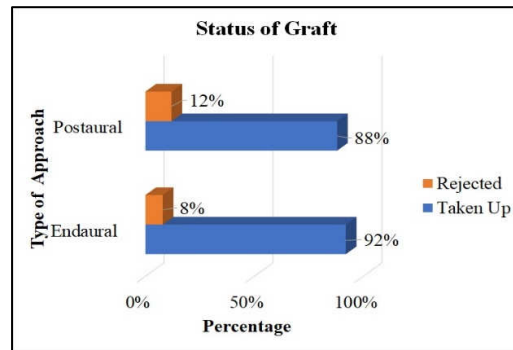
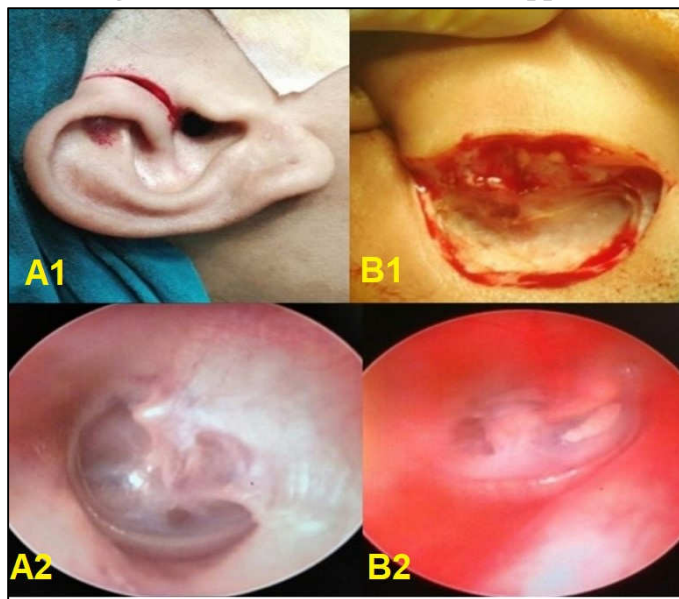


Image 5: End-aural v/s Post-aural Approach



A1,A2 – End-aural approach, B1,B2 - Postaural Approach

The relation between tympanic membrane perforation size and hearing loss is linear i.e. large perforation results in larger hearing losses. Mean hearing loss in large perforation was 42db and subtotal perforation was 48db in correspondence to size of perforation. >75% patient approached for surgery were having moderate to large perforation. 11 cases of small

perforation (with history of recurrent discharge even after extensive conservative management), those who failed to heal, were advised surgery during the quiescent stage (**Table 1**). Majority of patients had mild to moderate hearing loss (26 db-40 db). 17 out of 18 patients in 41db to 65db hearing loss group had moderate hearing loss (below 55 db), But only 1 patient with 65db hearing level was seen who had extensive tympanosclerosis with intact ossicular chain (**Table 2**). 25 cases were equally selected for both postaural and endaural approach for uniformity.

Table 1 Size of Perforation

Size of Perforation	No. of Patient	%
Small	11	22.0%
Moderate	26	52.0%
Large	12	24.0%
Subtotal	1	2.0%

Table 2 Hearing Loss

Hearing Level	No. of Patient
<25 db	3
26 db-40 db	29
41 to 65 db	18

Table 3 - Total Hearing Gain In Successful Graft Taken Up

Type of Approach	Pre-op (db) Hearing Level	Post-op (db) Hearing Level	Hearing Gain(db)
ENDAURAL	37.28	25.66	11.62
POSTAURAL	40.75	29.51	11.24

Table 4 - Post Operative Complications

Post-Operative Complications	Postaural	Endaural
Wound Infection	1	2
Persistent Perforation or Graft Rejection	3	2
Posterior canal wall granuloma	3	0

In both the groups, overall graft uptake rate is around 90% and there was no significant difference between uptakes of grafts with two approaches (**Image 4,5**). There was almost similar mean improvement in hearing using either endaural approach (25.66db) or postaural approach (29.51db). In present study hearing gain in endaural is 11.62db and postaural is 11.24db (**Table 3**).

All the tympanoplasties were targeted with high accuracy and precision. However, being a surgical procedure, few tympanoplasties were associated with complications (**Table 4**). Both endaural and postaural approaches had minor complications which were justified.

The results were further analyzed to draw a comparison using the above same parameters to understand the endaural and postaural approach and its outcome for type -1 tympanoplasty.

Discussion:

Tympanoplasty is one of the oldest otological surgeries. It has various types, techniques, methods and approaches. Approach can be considered on the basis of

- Size of ear canal
- Localization and size of the perforation

- Surgeons training and experience

*Types of incisions/approaches*⁸

1. Retroauricular Approach [Wilde's Incision]

Most commonly used approach worldwide. It can be preferable for large perforations necessitating total replacement of tympanic membrane. WILDE'S incision is made along the hairline and behind the mastoid tip and pinna reflected anteriorly. It is used for all perforation sizes, offers a better angle of visualization of anterior tympanic membrane and allows for sufficient canaloplasty in bulging of anterior bony wall.

2. Endaural Approach [Lempert's Incision]

A small incision is made between the tragus and the helix, therefore entrance of the canal is enlarged with endaural retractors. It can be used for all perforations, but provides good exposure for posterior perforations. More anterior perforations and middle ear cleft in presence of narrow external auditory canal are difficult to assess hence tendency to stenosis formation are more.

First incision is made along the entire posterior half of the ear canal at the bony-cartilaginous junction.

Second incision is a vertical incision made in incisura and connects the previous incision and area between tragus and the root of helix.

3. Transcanal Approach [Rosen's Incision]

It is good for small posterior perforation and middle size central perforation, with sufficiently widely open canal to allow complete visualization of perforation. ROSEN'S incision kept to raise the tympanomeatal flap. Overhanging canal walls can obscure anterior margins.

The present study observed a female preponderance with maximum (54.00%) no. of patients belongs to 15 to 30 yrs age group. This agreed with the reports from previously published studies done by J D Wasson et al⁹, B.K Roychaudhuri et al¹⁰ and Saha A K et al¹¹. This may be related to more incidences of malnutrition and anemia in association with upper respiratory tract infection in females. Also unhygienic practices with lack of self-care and females being ignorant about their own deafness, thus makes them more vulnerable and late presentation is noticed. The chief complaints were ear discharge (100%) and hearing impairment (82.0%). More than 5 years of duration of disease can be due to ignorance, insistence for conservative treatment initially and fear of surgery and its complications.

Size of the perforation of tympanic membrane with middle ear space volume is an important determinant of the conductive hearing loss. We found a linear relationship between tympanic membrane perforation size and hearing loss i.e. large perforation results in larger hearing losses. All patients in our study are having mild to moderate hearing loss. Clinically we selected the patients with anterior canal wall bony hump and narrow external auditory canal for postaural approach. Postoperatively mastoid bandage was kept for at least 7 days in postaural approach. In endaural approach bandage was kept for 2 days followed by minimal

dressing at wound site.

Though no comparative criteria were applied, it was observed that canal wall elevation is relatively easier to perform in postaural approach compared to endaural approach. 92.0% was graft uptake rate in endaural while 88.0% in postaural approach. Graft taken up rate is almost equal with both the approach in all studies [Table 5,6].

Table 5 Comparison of taken up rate of graft in Post-aural Approach

Author	Postaural (%)
Present Study	88.00%
Saha A K et al ¹¹	100%
Shireen Samargandy et al ¹⁷	81.25%
J D Wasson et al ⁹	75%
NaderpourM et al ¹⁵	93.3%

Table 6 Comparison of taken up rate of graft in End-aural Approach

Author	Endaural (%)
Present Study	92.00%
Saha A K et al ¹¹	75%
Shireen Samargandy et al ¹⁷	100%
J D Wasson et al ⁹	82.2%
Roychaudhuri et al ¹⁰	94.44%

As per hearing is concerned, type of approach has no impact over end result. Both approaches resulted in equivalent hearing gain. This is in accordance with studies by Saha A K et al¹¹ and M Z Sarker et al¹².

With comprehensive preoperative planning, thorough knowledge of external ear anatomy and applying meticulous surgical techniques and regular postoperative follow up, most of the tympanoplasty complications are avoidable¹³. The post-operative complications were mainly wound infection (6.0%), graft rejection (10.0%) and posterior canal wall granuloma (6.0%). In endaural approach the chances of cartilage getting exposed are more than postaural approach and so are probabilities of infection. But none were observed in present study. V.Krishna Chaitnya et al¹⁴ also noted similar complications with comparable complication rates to our study (Table 4). Subjectively numbness over incision site was observed more with postaural approach. No other complications were observed in this study.

Perforation of tympanic membrane causes a conductive hearing loss that can range from negligible to 60db. In present study small perforations cases has 100% uptake rate in both approaches while percentage of success decreased slightly in moderate to large perforation (75 to 80%) but without significant difference in chosen approach.

Tympanoplasty can be done in less than 12 years of age, but significant higher rate of failures are noticed. This can be due to increased incidence of upper respiratory tract infection and impaired Eustachian tube function. We studied that the incidence of graft failure and failure to restore hearing were higher in older age group. So the ideal age group for undergoing surgery is between 15-45 years in accordance with findings of our study. However Naderpour M et al¹⁵ reported 96.6% of graft uptake in young and middle age while 93.7% in older age group.

Thus, it could be inferred that both approaches have equivalent outcomes irrespective of age or sex of the patient or size of perforation. However, there is a need for further studies in respect of other different criteria and broader participation.

Conclusion :

Both postaural approach and endaural approach have excellent outcomes and gives equivalent results irrespective of age or sex of the patient or size of perforation. In our study hearing improvement is same in both endaural and postaural approaches irrespective of other factors. Endaural approach is more comfortable to patient, subjectively, as postoperatively bandage was required for a lesser period. Complications are minor and treatable. It is suggested to opt for the method surgeons are familiar with as both these approaches have similar results.

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