

Comparative Study of Endoscopic and Microscopic Tympanoplasty

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Abstract:

Background: This study compares endoscopic and microscopic tympanoplasty for the treatment of chronic otitis media (COM) without cholesteatoma. Conventional Microscopic Ear Surgery (MES) using a post-auricular approach remains the most common tympanoplasty technique. However, the evolution of endoscopes and other instruments has made Endoscopic Ear Surgery (EES) far more powerful, particularly in the management of ear disease. Trans canal Endoscopic Ear Surgery (TEES) permits wide-angle vision at a high resolution while enabling magnification of the structures of the middle ear as well as the direct visualization of hidden areas, such as the hypotympanum, sinus tympani, epitympanum, and posterior part of the mesotympanum. The present study evaluates the tympanoplasties to treat COM without cholesteatoma and compares the surgical outcome of hearing restoration rates and advantages and disadvantages of endoscopic versus microscopic approach totympanoplasty ..

Materials and Methods: Source of sample and the study conducted in the Dept of ENT Viswabharathi Medical College and Hospital, Penchikalapadu. All patients seeking services came to Dept of ENT with a diagnosis of tubotympanic type of CSOM pathology were recruited. Sample size of 30 Ears of 30 patients were divided into two groups TESS and MES.

Results: TESS resulted in the successful healing of 96.2% of ear drums whereas MES led to successful healing in 92% of cases. The average hearing gain was 10.3 ± 6.4 dB in the TESS group and 12.4 ± 7.5 dB in the MES group. In both groups, preoperative air bone gap (ABG) is significantly lower than preoperative Bagher is no statistically significant differences between the two groups with respect to the average pre- and post-operative ABG values (in dB)

Conclusion: The endoscopic approach has introduced a new perspective to ear surgery. Smaller incisions performed under the guidance of endoscopes are preferred over conventional large incisions. TESS resulted in the successful healing of 96.2% of eardrums. TESS appears to be associated with less consumption of medical resources in terms of shorter surgical and anesthesia time. However, further prospective studies should be conducted in the future to reinforce these conclusions.

Key Word: Chronic Otitis Media, Endoscopic tympanoplasty, Microscopic tympanoplasty.

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I. Introduction:

Chronic Suppurative otitis Media (CSOM) is a chronic infection of the middle ear cleft. There are 2 types of CSOM, the safe type and unsafe type (1). The safe type has a central perforation and the complications are less and not dangerous. The unsafe type is because of the attico antral disease with attic or posterior marginal perforation. The intracranial complications in this type are due to the bone eroding properties of the granulations and cholesteatoma

The main treatment of CSOM without cholesteatoma is medical. But perforation not healing and deafness is persisting then need to go for tympanoplasty by using a temporofacial graft (2). The unsafe type requires mastoidectomy of different types.

CSOM can be treated by Conventional Microscopic Ear Surgery (MES) or by Trans canal Endoscopic Ear Surgery (TEES). Although Endoscopic Ear Surgery (EES) was introduced in 1960, it did not attract much attention initially. Most prior studies have focused on the outcomes of EES in the management of cholesteatomas. TESS found to have advantages and disadvantages over MES.

Advantages TEES:

Trans canal Endoscopic Ear Surgery (TEES) permits wide-angle vision at a high resolution while enabling magnification of the structures of the middle ear. The direct visualization of hidden areas, such as the hypotympanum, sinus tympani, epitympanum, and posterior part of the mesotympanum. Operation time is shorter.

Provide less postoperative pain and sooner recovery. Do not require large incisions (postauricular, endaural incisions).

Disadvantages: TEES:

Surgical manipulations must be performed using a single hand. Mist may frequently accumulate over the endoscope and require frequent dip in savlon. Another disadvantage of the endoscope is that even a small amount of blood can totally obscure the view of the operating field by soiling the scope. Potential harm to surrounding structures caused by heat produced from the endoscope's light source is also a matter of concern. Require training for beginners and use of endoscope and not for experts

II. Material and Methods:

This study included 30 ears of 30 patients treated surgically (endoscopic or microscopic tympanoplasty) for COM in the absence of cholesteatoma In our hospital at the Dept of ENT, between January 2021 and March 2022

Comparisons between the two groups focused on the following:

- (I) surgical outcome and restoration of hearing
- (II) successful healing of tympanic membrane perforation
- (III) post-operative complications;
- (iv) consumption of medical resources, including the duration of surgery and anesthesia.

Study Design: Prospective open label observational study

Study Location: Study is done in a tertiary care teaching hospital in the Department of ENT, at Viswabharathi Medical college and Hospital, Penchikalapadu, Kurnool, Andhra Pradesh.

Study Duration: January 2021 to March 2022.

Sample size: 30 ears of 30 patients

Procedure Methodology: All patients who presented with signs and symptoms suggesting tubotympanic type of CSOM were submitted to assessment protocol, based on a guided history taking, physical exam(otoscopy)and subjected to audiogram. During history taking the patients were questioned about disease onset and if they had undergone previous otologic surgeries.

Pure tone audiometry has become the standard procedure for describing audiometry sensitivity, therefore pure tone audiometry has been used for assessment of hearing level. In this study the mean hearing level and air bone gap of each patient were measured by averaging their hearing thresholds at 500,1000,2000 Hz. These frequencies were selected because they represent speech frequency range and elevation of threshold in these frequencies will be clinically significant.

The operation is performed under LA using a microscope with lens of 250mm. In all cases post auricular approach was used. In all cases temporalis fascia graft was harvested and underlay grafting done ..

In contrast, TEES follows a trans canal approach using a rigid endoscope of length 14 cms, outer diameter 3 mm at angle of 0 degree or 30 degrees used (HOPKINS II telescopes Karl storz, Germany)

In all cases temporalis fascia graft was harvested.

All patients are followed after surgery on 1st , 2nd, 4 th and 8 th week.

Pure tone audiometry was done 3 months after surgery to assess the outcome i.e improvement of hearing.

Anesthesia: All tympanoplasty surgeries were performed under local anesthesia (LA).

Inclusion criteria:

1. Including patients in the age 20-60 years having good general physical condition.
2. No evidence of active infection in nose, throat or PNS.
3. Central perforation of pars tensa of tympanic membrane with dry ear for minimum period of 3 weeks before day of operation.
4. Patient having good eustachian tube function with good cochlear reserve.
5. Patients who are willing to participate and give informed written consent.

Exclusion criteria:

1. Patients with pre-operative or intra-operative diagnosis of cholesteatoma,
2. Cholesterol granuloma
3. Tympanic membrane retraction pocket
4. Patients presented with facial nerve paralysis
5. History of prior ear surgery mastoidectomy or atticotomy were excluded.

Statistical analysis:

Data was entered into Microsoft Excel (Windows 7;Version 2007) and analyses were done using Statistical Package for Social Sciences 9 SPSS) for windows Software (Version 22.0;SPSS Inc., Chicago).Descriptive statistics such as frequencies and percentages were calculated for categoriacalVariables were determined .Association between variables was analyzed by using Chi square Test and Fishers exact test 9 when appropriate) for categorical variables .Br charts and pie charts were used for visual representation of the analyzed date .Level of significance was set at 0.05.

III.Observations and Results:

In the present study, the patients were taken who fits in the inclusion criteria and presented to Department of ENT, Viswabharathi General hospital. Among 30 patients taken, 15 patients of Group A underwent tympanoplasty by MES and 15 patients of group B underwent endoscopic tympanoplasty (TESS). All patients with discharge were treated by giving medications and only dry ears were taken into consideration. In our study males and females are in equal ratio. (1:1). Hearing loss was the most common symptom (100%).

In our study, the age group ranged from 21-60 years. Majority (46%) of patients are in the age group of 21-30 years of age. Incidence is more in the age group of 2nd and 3rd decade.

Age Distribution:

Table 1: Showing Age distribution among two groups.

Age Groups	Group A	Group B	Total
21-30	6	8	14(46.66%)
31-40	6	4	10(33.33%)
41-50	2	2	4(13.33%)
51-60	1	1	2(6.66%)
Total	15	15	30

Sex Distribution:

In the present study, 50% of our patients were male and 50% were female with 15 numbers each in both the groups **Table 2:** Showing the sex Incidence :

Sex	Group A	Group B	Total
Male	7	8	15(50%)
Female	8	7	15(50%)
Total	15	15	30(100%)

Size of perforation:

All patients had TM perforations due to CSOM (100%). Medium sized perforations were present in 36.67% of patients, 30% had large size perforations and 33.33% had subtotal perforations,

Table 3: Size of perforation:

Size	Group A	Group B	Total
Medium	6	5	11 36.67%)
Large	5	4	9 (30%)
Subtotal	4	6	10 (33.33%)
Total	15	15	30(100%)

Laterality:

In our study, 13 patients (43.33%) had right ear disease,11 patients (36.67%) had left ear disease and 6 patients (20%) had bilateral disease.

Table 4: Laterality

Laterality	Group A	Group B	Total
Right	6	7	13(43.33%)
Left	5	6	11 (36.67%)
Bilateral	4	2	6 (20%)
Total	15	15	30 (100%)

Pre-Operative audiometry:

In our study, the average conductive hearing loss in the study was 31.5dB (25-40dB). Average conductive hearing loss in group A was 32.33 (range 25-40dB) and in group B was 30.6 dB (range 25-40dB).

Table 5: Pre-Operative audiometry:

Average CHL(dB)	Group A	Group B	Total
21-30	6(40%)	8(53%)	14(46.67%)
31-40	7(46%)	6(40%)	13(43.33%)
41-50	2(14%)	1 (6%)	3(10%)
Total	15 (100%)	15 (100%)	30(100%)

Post Operative Audiometry:

In the present study 10 patients (33.4%) had closure of A-B gap to less than 10 dB,16 patients (53.33%) had closure between 11-20 dB and 4 patients (13.33%) had closure between 21-30dB.The difference between the two groups was statistically not significant.

Table 6: Post Operative Audiometry:

A-B Gap	GroupA	Group B	Total
0-10 dB	4(27%)	6(40%)	10(33.4%)
11-20 dB	9(60%)	7 (46%)	16(53.33%)
21-30 dB	2(14%)	2(14%)	4(13.33%)
Total	15 (100%)	15 (100%)	30(100%)

Comparison of Pre and post operative Average CHL (dB) in Both groups:

In both the groups improvement is seen in postoperative hearing loss compared to preoperative conductive hearing loss .Preoperative hearing loss in group A was ranging from 21-50 which improved to 0-30 dB.In group B also Hearing loss was from 21-50 dB which improved to 0-30 dB Statistically not much difference is seen in both the groups.

Table 7: Comparison of Pre and post operative Average CHL (dB) in Both groups:

AVERAGE CHL(dB)	MES		TESS	
	Pre OP	Post OP	Pre OP	Post OP
0-10	0 (0%)	4 (27%)	0 (0%)	6 (40%)
11-20	0 (0%)	9 (16%)	0 (0%)	7 (46 %)
21-30	6 (40%)	2 (14%)	8(53%)	2 (14%)
31-40	7 (46%)	0 (0%)	6 (40%)	0 (0%)
41-50	2 (14%)	0 (0%)	1 (6%)	0 (0%)

Complications:

In the present study 4 patients (13.33%) had skin infections, 3 patients (10%) had graft infections, 1 patient (3.33%) had perichondritis and 1 patient (3.33%) had canal stenosis.

Complications	Group A	Group B	Total
Skin infections	2	2	4(13.33%)
Graft Infections	2	1	3 (10%)
Perichondritis	1	0	1(3.33%)
Canal Stenosis	1	0	1 (3.33%)

Healing and Hearing:

TEES resulted in the successful healing of 96.2% of ear drums whereas MES lead to successful healing in 92% of cases .The average hearing gain was 10.3 ± 6.4 dB in the TEES group and 12.4 ± 7.5 dB in the MES group. We did not detect any statistically significant differences between the two groups with respect to the average pre- and post-operative ABG

IV. Discussion:

This study was taken with the objective to compare the advantages and disadvantages of endoscopic over conventional microscopic ear surgery/tympanoplasty. Endoscopic assisted surgery is always advantageous.

Conventional microscopic ear surgery is done under the guidance of a microscope. But it's very difficult for visualization of deep recesses of the middle ear because of the linear view. If the external canal is small, surgical enlargement is needed to view the structures inside. The main advantage of the microscopic approach is that it provides a stereo-view and allows bimanual operation. But by Endoscopes magnified view of surgical field is possible. Rotational movement of angled endoscopes can provide panoramic images of the deep and hidden regions of the middle ear. An endoscopic approach to the middle ear can improve visualization of structures, such as the tuba orifice, incudostapedial joint and oval/round window niches. Advantages of the endoscopic approach include shorter operation time, reduced exposure to anesthetic agents and associated side effects, and improved surgeon concentration. (4) as stated by Huang et al., 2016. With angled endoscopes it is possible to visualize other structures like round window niche, eustachian tube orifice, and incudostapedial joint easily. (5). Same thing was observed in our study too.

By avoiding post aural incision in endoscopic ear surgery there is less dissection of normal tissues, less intraoperative bleeding, less incidence of postoperative pain and bleeding.

In present study it is observed that there is minimal dissection and has better cosmetic results.

Unlike microscope, endoscope is easily transportable and hence use is ideal to use in ear surgery. The disadvantage of endoscopic ear surgery is one handed technique. It is difficult to operate in excessive bleeding, which can be managed easily in microscope assisted ear surgery where one hand used for suction and other hand used for surgery. We confirmed this observation which were reported in other studies by tarabichi (6) and karhuketoet et al (7).

Endoscope provides monocular vision which leads to loss of depth perception compared to binocular vision. Extra care has to be taken to ascertain that the graft had been lifted enough to make contact with edges of perforation.

In our study in both the MES and TESS group of patients, there is no difference in the post operative results and the conductive hearing loss has been corrected well. As stated by Gulsen S et al 2021 (8) the endoscopic tympanoplasty decreased the time of surgery and hospital stay, with no much difference in postoperative ABG.

V. Conclusion:

The endoscopic approach has introduced a new perspective to ear surgery. Smaller incisions performed under the guidance of endoscopes are preferred over conventional large incisions.

TEES resulted in the successful healing of 96.2% of eardrums. TEES appears to be associated with less consumption of medical resources in terms of shorter surgical and anesthesia time. However, further prospective studies should be conducted in the future to reinforce these conclusions.

Compliance with Ethical standards:

Conflict of interest: The authors of this article declare that he/she has no conflict of interest.

Human and animal Rights: Animals were not involved in the study.

Ethical Approval: All procedures performed in the studies involving human participants were in accordance with the ethical standards of the institution and with the 1964 Helsinki declaration and its later amendments ethical standards.

Informed consent: Informed consent was obtained from all individual participants included in the study.

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