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ANATOMICAL AND FUNCTIONAL OUTCOME OF MICROSCOPIC VERSUS ENDOSCOPIC TYMPANOPLASTY IN PATIENTS OF CHRONIC OTITIS MEDIA INACTIVE MUCOSAL TYPE

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ABSTRACT

AIM

This study aims to compare microscopic and endoscopic tympanoplasty, examining each technique's outcomes, advantages, and limitations in patients of COM, inactive mucosal type.

METHODS AND MATERIAL

This prospective study was performed on 150 patients with COM with the patients being randomly assigned either microscopic or endoscopic tympanoplasty.

STATISTICAL ANALYSIS USED

Statistical comparisons were made on the mean values of the pre-operative and post-operative airborne gaps and the pre-and post-operative hearing thresholds using the chi-square test and t-test for these independent samples within 95% reliance and at a significance level of $P < 0.05$.

RESULTS

There was also no discernible change in the air-bone gap (ABG) (dB) and bone conduction threshold (dB) post-operatively between both the techniques.

CONCLUSIONS

In comparison, the operating time was noticeably shorter, and post operative pain was less in cases of endoscopic tympanoplasty. There was no appreciable difference in the two groups' graft uptake.

KEYWORDS

Tympanoplasty; Endoscopic; Microscopic; Graft uptake; Air-bone gap

INTRODUCTION

Chronic suppurative otitis media (CSOM) is one of the most common chronic infectious diseases in the world, especially in children. One of the most prevalent outcomes of CSOM is hearing impairment, which can negatively impact a child's behaviour, education, and speech development

The traditional microscopic approach provides highly magnified, 3D views of the ear structures with an operating microscope. Endoscopic tympanoplasty employs an endoscope, a slender, rigid instrument equipped with a camera, to visualize the surgical site.

The endoscopic approach has several benefits, particularly for paediatric patients and cases

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with complex anatomy including improved visualization of the middle ear's hidden recesses, reduced surgical trauma, and shorter recovery times. Moreover, the wide-angled, high-definition view of the operative field without requiring a postauricular incision makes the endoscopic approach an attractive option.

The microscopic approach has been the gold standard for many years, due to its precise manipulation of the delicate ossicular chain and Tympanic Membrane. The extensive experience and established outcomes of microscopic tympanoplasty underscore its continued relevance in otologic surgery.

Each approach has its advantages and limitations, and the choice between them depends on various factors, including the patient's condition, the surgeon's expertise and equipment availability. A comparative analysis of endoscopic and microscopic tympanoplasty is essential to reflect the evolving nature of surgical techniques, the need for optimized patient-centred outcomes in otologic surgery and cost-effectiveness.

SUBJECTS AND METHODS

The study is a hospital-based prospective comparative study which has been conducted in the Department of ENT & Head Neck Surgery of a medical college in Uttar Pradesh. The study was carried out from September 2022 to June 2024 (18 Months). The sample size was 75 patients who were presented with Chronic Otitis Media inactive mucosal type. Out of 150 ears operated, 131 were compared based on the graft uptake. Patients aged 18 to 50 were included in the study. A random allocation of the test patients was performed into the microscopic tympanoplasty (n=67) and endoscopic tympanoplasty(n=64).

INCLUSION CRITERIA:

- Patients of the age group between 18 – 50 years.
- Patients diagnosed with Chronic Otitis Media, mucosal type
- Patients with inactive disease for > 3 weeks
- Patients with only Conductive Hearing Loss
- Exclusion criteria:
- Individuals with active ear discharge
- Patients suffering from squamosal-type Chronic Otitis Media
- Patients suffering from SHL
- Any uncontrolled medical disease (DM, HTN, Immuno-compromised states).
- Patients with intra-operative adverse findings (ossicular discontinuity / ossicular fixation/cholesteatoma) were be excluded from the study.

The state of the tympanic membrane, external auditory canal, and external ear, along with otoscopic findings such as perforation, discharge, and oedematous middle ear mucosa, was documented during general examination. Routine investigations, specialized tests like pure tone audiometry, and radiological examinations, including X-ray mastoid (Schuller's view), were conducted, and the nose and throat were examined for a complete evaluation. Patients were selected alternatively (simple random selection) to undergo either endoscopic or microscopic tympanoplasty. Based on perforation size, large, very large and subtotal perforation, a suitable sized superficial temporalis fascia graft was used.

Patients were discharged after surgery on the 3rd post-op day on co-amoxyclav, antihistaminic and anti-inflammatory drugs. They were followed up on the 10th, 21st, and 28th post-op days and the 12th week from the day of surgery.

The status of uptake of the graft and audiometry was done at 3 months.

The graft uptake at 3rd month postoperatively was recorded and was analysed for statistical significance. The Postoperative hearing gain (Group A with <20dB and Group B with >20dB) and hearing levels (average of 500, 1k, 2k, and 4k Hz frequency, at third-month post-surgery), were also observed. A comparison of postoperative complications, duration of surgery, ease of surgery and cosmetic outcome was also performed.

STATISTICAL ANALYSIS PLAN

The data was entered into Microsoft Excel and the mean values of the pre-operative and post-operative airborne gaps and the pre- and post-operative hearing levels at frequencies 0.5, 1, 2, and 4k Hz respectively was calculated. Statistical comparisons were made on the corresponding data series of such obtained mean values using the chi-square test and t-test for these independent samples using the built-in tools offered by MS Excel. The results were be assessed within a 95% reliance and at a significance level of $P < 0.05$. The ease of surgery and cosmetic outcome were measured using a 5-point Likert scale.

ETHICAL CONSIDERATION:

With institutional ethical committee permission, patients were sorted. Written & informed consents from the patients were taken for the surgical procedure.

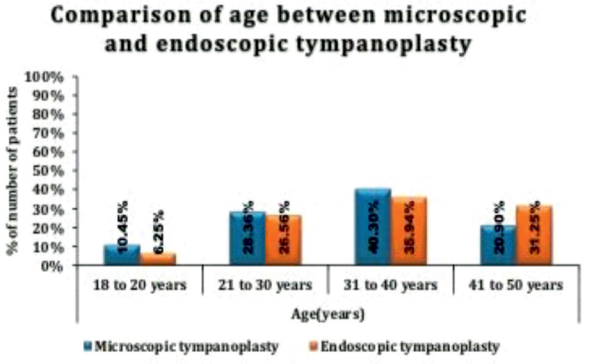
RESULTS:

The age distribution between microscopic and endoscopic tympanoplasty was comparable: 18 to 20 years (10.45% vs 6.25%), 21 to 30 years (28.36% vs 26.56%), 31 to 40 years (40.30% vs 35.94%), and 41 to 50 years (20.90% vs 31.25%). There was no discernible change, as indicated by the p-value of 0.524. The mean ± standard deviation (SD) age for microscopic tympanoplasty was 33.45 ± 9.55 years, and for endoscopic tympanoplasty, it was 34.88 ± 9.55 years, with no significant difference between the groups (p-value = 0.394).

Figure 1: Comparison of age between microscopic and endoscopic tympanoplasty.

The gender distribution between microscopic and endoscopic tympanoplasty was comparable, with females comprising 52.24% and 50% of the patients, respectively, and males comprising 47.76% and 50%, respectively. The p-value was 0.798, indicating no significant difference.

Comparing microscopic and endoscopic tympanoplasty, there was no discernible change in hearing level (dB) between pre-operative ($p = 0.495$) and post-operative ($p = 0.408$) circumstances. No statistically significant difference between the two techniques were observed.



Hearing level (dB)	Microscopic tympanoplasty (n=67)	Endoscopic tympanoplasty (n=64)	Total	P value
Preoperative				
Mean ± SD	31.52 ± 5.07	30.94 ± 4.69	31.24 ± 4.88	0.495†
Median (25th-75th percentile)	32(28-35)	31.5(28-34)	32(28-35)	
Range	20-40	20-40	20-40	
Post operative				
Mean ± SD	24.22 ± 4.91	23.53 ± 4.63	23.89 ± 4.77	0.408†
Median (25th - 75th percentile)	24(20-28)	24(20-28)	24(20-28)	
Range	16-35	15-33	15-35	
Intra group p value	<0.0001‡	<0.0001‡	-	-

† **Independent t test,** ‡ **Paired t test**

Table 1 - Comparison of hearing level (dB) between microscopic and endoscopic tympanoplasty.

When comparing microscopic and endoscopic tympanoplasty, there was no discernible change in the air-bone gap (ABG) (dB) between pre-operative (p= 0.78) and post-operative (p = 0.551) circumstances. No statistically significant difference between the two surgical techniques was observed. In both groups, a significant decrease was seen in ABG post-operatively when compared to pre-operative values (p<.0001).

Figure 2: Comparison of the operated ear between microscopic and endoscopic tympanoplasty

ABG (dB)	Microscopic tympanoplasty (n=67)	Endoscopic tympanoplasty(n =64)	Total	P value
Preoperative				
Mean ± SD	23.34 ± 5.49	23.08 ± 5.36	23.21 ± 5.41	0.78†
Median (25th - 75th percentile)	24(20-28)	22(19-27.25)	23(19-28)	
Range	11-34	12-34	11-34	
Post operative				
Mean ± SD	14.12 ± 5.61	13.52 ± 5.94	13.82 ± 5.76	0.551†
Median (25th - 75th percentile)	14(10-17)	13(9-18)	13(9-17)	
Range	5-31	4-26	4-31	
Intra group p value	<0.0001‡	<0.0001‡	-	-

† **Independent t test,** ‡ **Paired t test**

Table 2 - Comparison of ABG (dB) between microscopic and endoscopic tympanoplasty

Between microscopic and endoscopic tympanoplasty, there was no discernible difference in the bone conduction threshold (dB) either preoperatively (p-value=0.232) or postoperatively (p-value = 0.753). In both groups, a significant increase was seen in bone conduction threshold post operatively when compared to pre-operative values. (p<.0001).

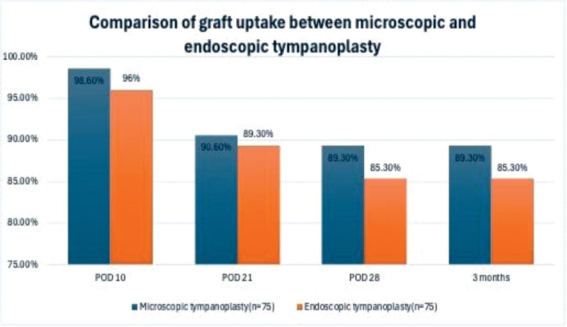
Bone conduction threshold (dB)	Microscopic tympanoplasty (n=67)	Endoscopic tympanoplasty (n=64)	Total	P value
Preoperative				
Mean ± SD	8.28 ± 2.17	7.83 ± 2.17	8.06 ± 2.17	0.232†
Median (25th -75th percentile)	8(7-10)	8(6.75-9.25)	8(7-10)	
Range	5-14	3-13	3-14	
Post operative				
Mean ± SD	10.09 ± 2.48	10.23 ± 2.77	10.16 ± 2.62	0.753†
Median (25th -75th percentile)	10(8-12)	10(8-12)	10(8-12)	
Range	5-15	5-15	5-15	
Intra group p value	<0.0001‡	<0.0001‡	-	-

Table 3 - Comparison of bone conduction threshold (dB) between microscopic and endoscopic tympanoplasty

When comparing the graft uptake rates of microscopic and endoscopic tympanoplasty—which were 89.3% (67 out of 75)

and 85.3% (64 out of 75), respectively—between the two groups, there was no discernible difference.

Figure 3: Graft uptake comparison between microscopic and endoscopic tympanoplasty



Post allocation (Graft uptake)	Microscopic tympanoplasty (n=75)	Endoscopic tympanoplasty (n=75)
POD 10		
Intact	74 (98.6%)	72 (96%)
POD 21		
Intact	68 (90.6%)	67 (89.3%)
POD 28		
Intact	67 (89.3%)	64 (85.3%)
3 months		
Intact	67 (89.3%)	64 (85.3%)

Table 4 - Comparison of post allocation (Graft uptake) between microscopic and endoscopic tympanoplasty

For microscopic tympanoplasty, the mean postoperative absolute hearing gain (in dB) was 7.3 ± 3.63, while for endoscopic tympanoplasty, it was 7.41 ± 3.16. Limited variation was identified among the two methods (p = 0.857). There was no significant difference (p = 0.615) between the two procedures for the mean ± standard deviation of air-bone gap (ABG) closure: 9.22 ± 4.38 for microscopic tympanoplasty and 9.56 ± 3.25 for endoscopic tympanoplasty.

DISCUSSION

In our study, the mean age calculated of patients who underwent endoscopic tympanoplasty was 34.88 ± 9.55 years, and the mean age for microscopic tympanoplasty was 33.45 ± 9.55 years. We were unable to obtain information regarding the age prevalence of the disease in those who were over 50 and under the age of 18, as these groups were excluded according to the study design. In other studies, however, incidences were discovered to be higher in the second and third decades.

In the study conducted, the gender distribution between microscopic and endoscopic tympanoplasty was comparable, with females comprising 52.24% and 50% of the patients, respectively, and males comprising 47.76% and 50%, respectively. The study found that women had a greater illness rate, however, this difference is not statistically significant. The ratio of genders is 1:1.04.

The distribution of the operated ear was comparable between microscopic and endoscopic tympanoplasty, with 50.75% versus 48.44% for the left ear and 49.25% versus 51.56% for the right ear, respectively, which was not statistically significant. According to the study, endoscopic surgery and microscopic surgery took an average of 54 minutes (54.28 ± 6.07) and 112 minutes (112.02 ± 10.37 minutes) respectively. With P < 0.0001, the mean operative time difference was statistically significant (t = 41.60). The results in other studies were coherent as Kawale et al. stated mean ± standard deviation (SD) of the operative time for the endoscopic procedure was 49.22 ± 8.24 minutes (range 30-70 minutes), and for MES, it was 83.20 ± 14.73 minutes (range 80-110 minutes)[1] along with the study conducted by Huang et al that concluded that there was a substantial difference in the mean operation time between the 50 ears who

had the endoscopic method (50.4 minutes) and the microscopic approach (75.5 minutes)[2].

A visual analogue scale (VAS) measured post-operative pain. Endoscopic tympanoplasty patients averaged 3, while microscopic patients averaged 5. Despite lower pain scores for endoscopic cases, no significant procedural differences were found. Mean VAS scores were 2 (1-2) and 4 (3-5), with endoscopic patients reporting significantly less pain (P<0.001) in concordance with the study conducted by Daneshi et al[3].

The graft employed in all patients in the current study was superficial temporalis fascia. When comparing the graft uptake rates of microscopic and endoscopic tympanoplasty—which were 89.3% (67 out of 75) and 85.3% (64 out of 75), respectively—between the two groups, there was no discernible difference.

Study	Graft uptake in endoscopic group	Graft uptake in microscopic group	Significance
Zakir et al[4]	91.6%	90.0%	No significance
Kawale et al[1]	80%	78%	No significance
Huang et al[2]	98%	98%	No significance
Choi et al[5]	95.8%	100%	No significance
Hsu et al[6]	96.2%	92%	No significance
Current study	85.3%	89.3%	No significance

Table 4 - Comparison of Graft uptake

Both groups in our study showed improvement in their hearing. The mean postoperative absolute hearing gain (in dB) was 7.3 ± 3.63 for microscopic tympanoplasty and 7.41 ± 3.16 for endoscopic tympanoplasty at 12 weeks. Between the two methods, there was no discernible difference (p = 0.857).

The mean ± SD of air-bone gap (ABG) closure for the two treatments was found to be similar (p = 0.615): 9.22 ± 4.38 for microscopic tympanoplasty and 9.56 ± 3.25 for endoscopic tympanoplasty. Dundar et al. discovered that the post-operative ABG (8.12 versus 8.13 dB, p ≥ 0.05) did not differ statistically significantly[7].

From a cosmetic perspective, endoscopic tympanoplasty patients had a smaller scar than those who underwent microscopic surgery.

CONCLUSION

Endoscopic tympanoplasty is a great substitute for the conventional microscopic method since it requires fewer medical resources, has a faster recovery period after surgery, and requires shorter hospital stay. Endoscopic technique offers shorter operating time and less tissue damage to get appropriate exposure for the operation since their field of vision is greater than that of microscopic techniques.

There was no appreciable difference between the graft uptake. It was also observed that the scar of endoscopic tympanoplasty is cosmetically superior.

Limitations of the study:

- The exclusion of patients with comorbidities and those older than 50 years old is one of the study's shortcomings.
- We made the decision not to record the Tympanic Membrane perforation's location.
- Since the postauricular method was used for all microscopic tympanoplasties at our facility, the endaural and per meatal approach was not discussed at all during the study.
- Patients with narrow external auditory canal could not be operated although this can be overcome by using 2.7mm wide angle paediatric 0-degree endoscope.

AUTHORS DECLARATIONS

Ethical Approval: Obtained

Consent to Participate: Obtained

Competing Interests: None

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Authors' Contributions: Equal

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Conflict of Interest: None

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