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Research Article

COMPARISON BETWEEN ENDOSCOPIC AND MICROSCOPIC TYPE 1 TYMPANOPLASTY USING TEMPORALIS FASCIA GRAFT

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ABSTRACT

Objective: The outcomes of endoscopic vs. microscopic type 1 tympanoplasty in patients with central perforation in the tympanic membrane and conductive hearing loss will be compared.

Methods: This study was conducted in the Department of Otorhinolaryngology at a tertiary care hospital and medical college in Odisha. This study was a hospital-based, single-centered, simple randomized control trial. A total of 100 cases of chronic suppurative otitis media were randomized into endoscopic and microscopic assisted tympanoplasty groups (50 each) after taking proper informed consent. The duration of the study was from September 2019 to August 2021.

Results: Out of 100 surgeries, there was one failure of graft uptake, and the patient belonged to the endoscopic group. Operative time was significantly shorter in the endoscopic group as compared to the microscopic group. There was no significant difference in terms of graft uptake and hearing improvement among the two groups.

Conclusion: Both microscopic and endoscopic tympanoplasty have their own advantages and disadvantages. Endoscopic tympanoplasty offers slight benefits over microscopic tympanoplasty in terms of shorter duration, less granulation, less post-operative pain and a wider angled view, but it has inherent disadvantages being a single-handed procedure. Unlike a microscope, an endoscope is easily transportable; hence, it can be ideally used in camps conducted in remote places.

Keywords: Tympanoplasty, Myringoplasty, Chronic suppurative otitis media.

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INTRODUCTION

Chronic suppurative otitis media (CSOM) is defined as chronic inflammation of the middle ear and mastoid cavity that presents with recurrent ear discharge or otorrhea through a tympanic membrane (TM) perforation [1].

Surgery of CSOM provides dry ear with the improvement of hearing in the majority of patients. Tympanoplasty is "an operation to eradicate disease in the middle ear and to reconstruct the hearing mechanism, with or without TM grafting" [2]. Tympanoplasty has been traditionally performed using a microscope.

Microscopic surgeries are two-handed techniques, but they offer a straight-line view, which limits the visual field in the deep recesses of the middle ear. This is overcome by the use of a rigid endoscope for tympanoplasty.

Endoscopes therefore offer the surgeon the capability of wide fields of view with minimal exposure, looking behind obstructions or overhanging's, with much less requirement for surgical corrections by canaloplasty than demanded by conventional techniques.

To compare the outcomes of tympanoplasty by conventional microscopic and endoscopic methods, very few studies have been conducted till date. The success rates were comparable to one another, with superior results by the endoscope group regarding cosmetic aspects [3]. There is a lack of high-volume studies in this direction regarding the efficacy and outcomes of endoscopic tympanoplasty as compared with conventional microscopic tympanoplasty. Hence, this study is undertaken.

METHODS

This study was conducted in the Department of Otorhinolaryngology at a tertiary care hospital and medical college in Odisha. This study was a hospital-based, single-centered, simple randomized control trial. A total of 100 cases of CSOM were randomized into the endoscopic and microscopic assisted tympanoplasty groups (50 each) after taking proper informed consent. The duration of the study was from September 2019 to August 2021.

Inclusion criteria

- Patients diagnosed with the CSOM tubotympanic type
- Age 8–40 years
- Patients with conductive hearing loss
- Dry ear
- Patients were willing to participate in the study.

Exclusion criteria

- Age: <8 years and above 40 years
- Discharging ear
- Mixed hearing loss and sensorineural hearing loss
- Patients with clinical or radiological evidence of atticoantral disease
- Patients with previous surgery for CSOM
- Patients with adenoid hypertrophy, active infection of the nose, throat, and paranasal sinuses
- Patients are not giving consent.

Methodology

All patients who have been diagnosed with CSOM tubotympanic variety falling under the inclusion criteria had a proper history was taken and patients underwent an ENT-specific examination, pure tone audiometry, HRCT temporal bone, and other pre-operative requisites. Pre-operative preparation of the patient was done. Out of 100 patients after randomization, 50 underwent endoscopic tympanoplasty, and the other 50 underwent microscopic tympanoplasty.

Instrumentation: For endoscopic tympanoplasty, a Storz camera with a 3 mm, 14 cm length wide-angle 0° otoendoscope was used. For microscopic tympanoplasty, a Leica microscope was used.

Surgery: Endoscopic-assisted or microscopic-assisted type 1 tympanoplasty was performed using a temporalis fascia graft. Post-op care: Patients were under observation of vitals and general conditions in the post-operative care room for 2 h (Fig. 1) .

Post-operative assessment of graft uptake was done after 21 days, and hearing evaluation was done after 3 months and 6 months after surgery.

Statistical analysis: Data was entered in Microsoft Excel and analyzed by the statistical software SPSS v.23.0 and Jamovi 1.8.4. The normal distribution of data was checked by the Shapiro–Wilk test. Normally distributed data was represented as the mean and SD. Non-parametric continuous data was represented as median and IQR. Categorical data was represented as frequency and percentage. For the analysis of two independent parametric variables, an independent t-test was used. For non-parametric variables, the Mann–Whitney U test was used. To find an association between categorical data, Pearson's Chi-square test was used. A P value < 0.05 was considered as significant.

Table 1 : Surgery time (in min.) taken between the two groups

Type 1 tympanoplasty	n	Median	IQR	25th	75th
Surgery time (in min.)					
Endoscopy assisted	50	45	63.75	40	103.75
Microscopic assisted	50	120	30	105	135

Shapiro–Wilk test; p<0.05. Mann–Whitney U test; p<0.001

OBSERVATION AND RESULTS

With consideration of eligibility criteria, 100 patients were enrolled in our study and randomized into two groups, i.e., microscopic-assisted and endoscopic-assisted tympanoplasty (50 patients each). A period of 24 months was taken for the study. The median age of patients in the endoscopy-assisted group was 30.5±12.75 years. The median age of patients in the microscopic assisted group was 32.5±10.75 years. There was no significant difference in the age of patients between both the groups (p=0.997).

In the endoscopic-assisted group, 38% male and 62% female patients were enrolled. In the microscopic-assisted group, 44% male and 56% female patients were enrolled. The majority of the patients (44%) had medium perforation size followed by large perforation size (31%). In the endoscopic-assisted group, 38% had a medium perforation size, and 34% had a large perforation size. In the endoscopic-assisted group, 50% had medium perforation size and 28% had large perforation size.

Graft uptake was done in 98% of patients in the endoscopic-assisted group and in 100% of patients in the microscopic-assisted group. There was no significant difference observed in graft uptake in both groups (p=0.315) (Fig. 2).

Median surgery time in the microscopic assisted group was found to be significantly higher in the microscopic-assisted group than in the endoscopic-assisted tympanoplasty group (120 min. vs. 45 min.; p<0.001). Hence, we can say that the surgery time for tympanoplasty was more in microscopic-assisted procedure than in an endoscopic-assisted procedure (Table 1).

Table 2: Comparison of Hearing frequency (in dB)

Hearing	Type 1 tympanoplasty	n	Median	IQR	25th	75th	p-value
Baseline hearing (in dB) Pre-op	Endoscopy Assisted	50	42	10	35	45	0.64
	Microscopic assisted	50	42.5	8	37	45	
Hearing after 3 months (in dB) Post-op	Endoscopy assisted	50	25	5	24	29	0.05
	Microscopic assisted	50	27	4.75	25	29.8	
Hearing after 6 months (in dB) Post-operative	Endoscopy assisted	50	24	3	22	25	0.06
	Microscopic assisted	50	25	6	22	28	

Shapiro-Wilk test; p <0.05. Mann Whitney U test

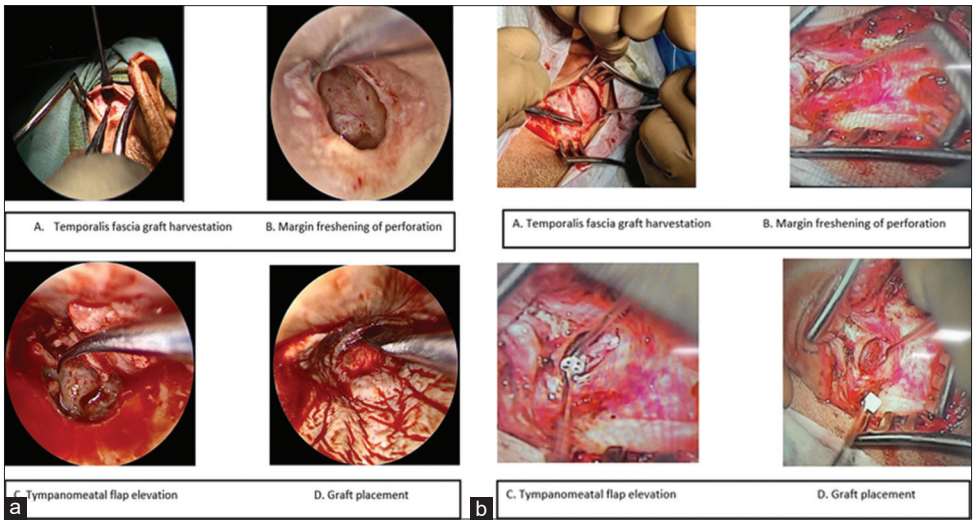

Fig. 1: Surgical illustrations of endoscopic (a) and microscopic (b) tympanoplasty

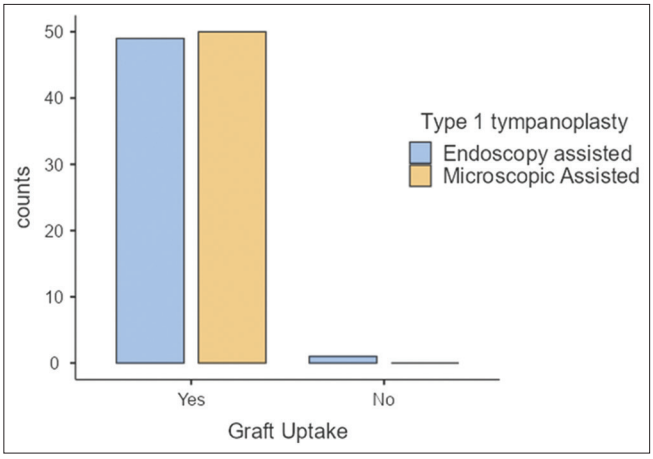

Fig. 2: Comparison of graft uptake

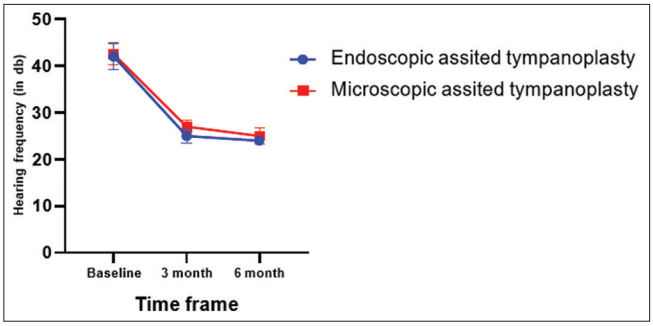

Fig. 3: Comparison of hearing frequency (in dB)

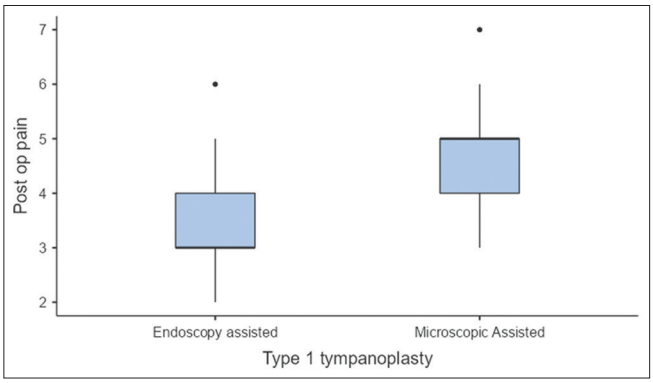

Fig. 4: Post-op pain

Granulation was present in 10% of patients in the endoscopic-assisted group and 14% in the microscopic-assisted group. There was no significant difference observed compared both groups (p=0.538).

There was no significant difference observed in the median hearing frequency (in dB) compared between the two groups at baseline (p=0.64), 3 months (p=0.05), and 6 months (p=0.06) (Table 2) (Fig. 3).

Post-operative pain was calculated using a visual analog scale. In our study, the average pain in post-operative patients who underwent endoscopic tympanoplasty was 3 and in microscopic tympanoplasty was 5. Though the pain score is less in patients who underwent endoscopic tympanoplasty, there was no statistical significant difference observed in both methods (Fig. 4).

DISCUSSION

The main goals of a tympanoplasty are to eradicate infection, repair the perforated TM, and improve hearing [4]. For decades, microscopic tympanoplasty was the main modality for ear surgery, enabling two-handed manipulation as well as binocular vision along with an excellent stereoscopic surgical view. However, the vision of a microscope may be limited when using a trans-canal approach, particularly in hidden areas such as the anterior margin of the TM and the sinus tympani or facial recesses, which forces the surgeons to use the post-auricular approach in order to obtain a wider surgical view. Endoscopic ear surgery (EES) provides an excellent surgical view, uses a smaller surgical incision, provides a panoramic view, preserves more tissue, less post-op numbness, and faster wound healing. Kozin *et al*. reported that a clear benefit existed for observational EES [5]. Also, endoscopic tympanoplasty has the added advantage of avoiding unnecessary mastoidectomies or canal widening procedures and, hence, soft tissue injuries. Unlike a microscope, an endoscope is easily transportable; hence, it can be ideally used in camps conducted in remote places. Nonetheless, EES still has a number of disadvantages, such as the need for one-handed manipulation, reduced endoscopic vision in the setting of uncontrollable hemorrhage, and the potential for thermal injury to the middle or inner ear caused by the endoscopic light source [6]. Despite the advantages offered by the endoscopic technique, microscopic tympanoplasties are widely performed since the latter has been practiced for years and the safety of the procedure is established beyond doubt. The former, though faster and offers a better view, it requires a lot of training. Hence, in this study, we aimed to compare the two techniques based on our objectives.

This study was performed in 100 patients with tubo-tympanic type of CSOM who were randomized into two groups of 50 each. One group among them underwent microscopic tympanoplasty, while the other group was operated on endoscopically. Various parameters were studied and compared. In this study, we excluded patients aged <8 years and above 40 years. As this study mainly concentrates on tympanoplasty, to exclude bias, all patients with sensorineural hearing loss or mixed hearing loss were excluded. Patients above 40 were also excluded, as they are more prone to sensorineural hearing loss and other comorbidities.

In our study, the median age in the endoscopy-assisted group was 30.5 years, and in the microscopic-assisted group, it was 32.5 years. The interquartile range is 12.75 years and 10.75 years for the endoscopic-assisted and microscopic-assisted groups, respectively. From this study, we are unable to derive data on the age prevalence of the disease; children less than 8 years and adults above 40 were excluded from the study protocol. However, in other studies, it was found that the incidence was higher in the second and third decades.

In the current study, we found the prevalence of the disease was more common in females, but the difference is not statistically significant. The gender ratio is 1:1.4 among males and females. The results of the current study are in concordance with those of Hsu *et al*. [7], Patel *et al*. [8], however, these results do not correlate with the results of Harugop *et al*. [9], Lakpathi *et al*. [10]. The differences may be attributable to the study population, as all the age groups are not included due to the above-mentioned reasons.

Of the total of 100 patients (100 ears), 55 patients left ear was affected, and 45 patients right ear was affected. Though similar results were also found in the study conducted by Hsu *et al*. [7], the data is not statistically significant.

In the current study, we identified 14 small perforations, 44 medium perforations, 31 large perforations, and 11 subtotal perforations. The incidence of medium-sized perforations is the highest among the study group. These findings are comparable with the studies by Lakpathi *et al*. [10], and Patel *et al*. [8].

In the current study, we found that endoscopic surgery was significantly quicker compared to microscopic surgery, with a median time of 45 min and 120 min, respectively. The p<0.01.

This finding is supported by the studies conducted by Lakpathi *et al*. [10], Hsu *et al*. [7], and Harugop *et al*. [9].

In the current study, temporalis fascia was used as a graft in all patients. Out of 50 patients who underwent endoscopic tympanoplasty, graft was taken up in 49 patients, i.e., 98%, when compared to microscopic tympanoplasty, where the graft uptake was 100%, but there was no significant difference noted between the two groups, which is in line with all other studies.

In our study, hearing improvement was noted in both groups. The findings of the current study were concurrent with those of Lakpathi *et al.* [10], Hsu *et al*. [7], Patel *et al*. [8], Harugop *et al*. [9], and Kim *et al.* [11].

In our study, we found that the incidence of granulation tissue is higher among the microscopic group as compared to the endoscopic group. In a study conducted by Daneshi *et al*. [12], they also found that the incidence of granulation tissue is higher among the microscopic group, similar to the current study; however, they used a cartilaginous graft, while in the current study we used temporalis fascia as the graft.

Those who underwent endoscopic tympanoplasty had a smaller scar, which was cosmetically better than those who underwent microscopic surgery.

CONCLUSION

In conclusion, both microscopic and endoscopic tympanoplasties have their own advantages and disadvantages. Endoscopic tympanoplasty offers slight benefits over Microscopic tympanoplasty in terms of shorter duration, lesser pain, and endoscopes being easily mobile, surgical camps can be conducted in rural areas, but it has inherent disadvantages, being steep learning curve and a single-handed procedure where it would become difficult if there was bleeding as even a small amount of blood could obscure the view. Also, it would be difficult to operate with a single hand and achieve hemostasis during surgery. Even though microscopic tympanoplasty is the traditional procedure, endoscopic tympanoplasty yields similar results to that of the former. We recommend further studies with large patient groups and multicenter studies to reinforce the conclusions and set new standards in line of care.

AUTHORS CONTRIBUTION

The idea was conceived and designed by Dr. Kabikanta Samantaray and Dr. Khageswar Rout. The literature search and data collection were done by Dr. Surapaneni Sai Poojyata. The contribution of data was done by Dr. Pradipt Ranjan Sahoo, Dr. Khageswar Rout, Dr. Kabikanta Samantaray, and Dr. Nishikant Pradhan. Statistical analysis was done by Dr. Nishikant Pradhan and Dr. Manas Ranjan Rout. The article was written by Dr. Surapaneni Sai Poojyata with the guidance of all the other authors.

CONFLICTS OF INTEREST

None.

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Nil.

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