

Research Article

Endoscopic Tympanoplasty in Chronic Otitis Media with Inactive Mucosal Disease

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Abstract

Background: Chronic otitis media (COM) is a condition usually seen in patients attending the ENT department. Chronic inactive mucosal disease (CIMD) is characterized by tympanic membrane (TM) perforation with hearing loss. Endoscopic tympanoplasty (ET) is a surgical method to repair TM perforation with minimal invasion. **Objective:** The present analysis was done to find out the outcome of ET surgeries in CIMD. **Methods:** Retrospective data analysis was done in 30 patients underwent ET with endoscopic under-lay technique at Al-Ameen medical college, Vijapur, India. **Results:** Average age of patients was 34.17 ± 9.52 years. Majority (40%) patients were from 18-30 years of age group. There were 12 (40%) males and 18 (60%) females. Right-side and left-side CIMD was equally distributed in 30 patients. Sixteen (53.3%) and 14 (46.7%) patients were having right and left TM perforation, respectively. TM perforation size was small, medium and large in 43.3%, 30% and 26.7% of patients, respectively. Twenty-eight (93.3%) patients had temporalis fascia and 2 (6.7%) patients had tragal cartilage as graft material. Two (6.7%) patients had graft rejection without improvement in hearing. No patient had complication or any miscellaneous issues. Eighteen (60.0%), 11 (36.7%) and 1 (3.3%) pre-operative patient with pure-tone average (PTA) had mild, moderate, and severe conductive hearing loss (CHL), respectively. All patients with PTA were improved after surgery. **Conclusion:** ET is an effective, minimally invasive, and less painful surgical technique for repair of central TM perforations in CIMD.

Keywords

Chronic Otitis Media, Chronic Inactive Mucosal Disease, Endoscopic Tympanoplasty, Tympanic Membrane Perforation

1. Introduction

Chronic otitis media (COM) is a condition usually seen in patients attending the ENT department. COM may be present with active or inactive type of mucosal diseases. Chronic inactive mucosal disease (CIMD) is characterized by permanent tympanic membrane (TM) perforation without mucosal disease or ear discharge. CIMD causes hearing loss [1-2]. Majority of the TM perforations which are small in sizes heal spontaneously. However, persistent perforations need surgical repair.

Tympanoplasty and myringoplasty are commonly used procedures for the treatment of chronic otitis media [1-4].

Tympanoplasty is a surgical procedure for repairing perforated tympanic membrane (TM) in middle ear to restore the hearing. Since last few decades, there is much advancement in tympanoplasty surgeries including endoscopic tympanoplasty (ET). The use of endoscopes in ear surgery began in the 1990s [3-7]. Development in endoscopic

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technologies emphasize surgeons to perform endoscopic surgeries with high magnification, clear visualization, and ease of surgical access. ET has been considered as much safer surgical procedure than conventional tympanoplasty. ET allows a more comprehensive, directed surgical clearance in the middle ear in a less invasive manner. Advancement in endoscopic and surgical training procedures allows less invasive repair of TM perforations. The unique advantage of the endoscope is in placement of the objective lens into middle ear space, giving a broad width and depth of field to the visualization of middle ear structures. Thus, endoscopic technique can be demonstrated itself as ideal for teaching, with a simultaneous view of the operative field in middle ear by surgeons [3-9].

However, reliable data on ET for repair of central TM perforations without mucosal disease is limited [3-9]. This retrospective study was performed to determine the clinical benefits of ET in the management of TM perforations by evaluating the surgical outcomes. The results of this study might be helpful in better understanding and provision of precise backup on ET surgery in CIMD management.

2. Materials and Methods

2.1. Study Approval

Access to the medical data was done after approval from the institutional ethics committee (IEC) of Al-Ameen medical college and hospital, Vijapur, Karnataka, India. The study was performed as per good clinical practices (GCP) guidelines. The written informed consent was taken wherever required. Patient identity and medical details were kept confidential, undisclosed, and to limited access.

2.2. Study Site

This retrospective cohort study was included 30 patients, who underwent ET at ENT department, Al-Ameen medical college and hospital, India from December 2022 to October 2023.

2.3. Study Objectives

The primary objective of the study was to evaluate and document the evidences for endoscopic tympanoplasty in patient with chronic otitis media with inactive mucosal disease. Also, the objective was to evaluate an expediency of endoscopic tympanoplasty (ET) in improvement of visibility of middle ear during the surgical repair of tympanic membrane perforations.

2.4. Study Design

The study was retrospective, single centre, and observational study.

2.5. Inclusion and Exclusion Criteria

As per eligibility criteria, patients from 18-50 years of age suffering from COM with inactive mucosal disease were included in the study. Patients suffering from CIMD with dry and stable TM perforations or traumatic TM perforations were included in the study. Patients who had regular follow-up of at least six months after surgery were included. Patient suffering from COM with active mucosal disease and sensorineural hearing loss were excluded from the study. Patients with active COM or cholesteatoma or those requiring simultaneous mastoidectomy, and with sensorineural or mixed hearing loss were excluded from the study.

2.6. Study Procedure and Data Collection

Patient demographics, complaints, disease history, previous history of trauma or surgeries to the ear, any associated symptoms like tinnitus and vertigo, graft success rate, pre and post operative hearing abilities, surgery time, postoperative care and complications were noted.

Data regarding the preoperative analysis including patient's demographic and clinical examination details, speech audiometry (SA), pure-tone audiometry (PTA), temporal bone computed tomography (CT) scans, and endoscopic examination details were noted. Other factors such nasal allergy, deviated nasal septum, sinusitis, rhinitis, absence of any focus of infection, conductive hearing loss less than 40dB, and adequate cochlear reserve were noted.

As per patient's data, tympanoplasty surgeries were performed with endoscopic approach and double door technique via transcanal route. During surgeries the margins were refreshed. The anterior door was made by making anterior incision almost 4 mm away from annulus. Tympanomeatal flap was elevated from sulcus and entered in middle ear. Eustachian tube opening was visualized and washed with normal saline. The posterior door was made by making posterior incision almost 7 mm away from annulus from 12'o clock position to 6'o clock position. Tympanomeatal flap was elevated till annulus. After entrance in middle ear, malleus bone was divided and ossicular chain was inspected. Previously harvested, shaped, and dried temporalis graft was placed under the annulus and malleus handle. The graft was placed over the anterior bone through the anterior door. Graft was also placed over the posterior part of the bone. Tympanomeatal flap was then placed back.

Parameters related to surgery such as disease diagnosis, membrane perforation side (left and right), size of perforation, graft success and rejection rate, and surgical complications or any miscellaneous issues of all patients were noted and analyzed. Changes in number of pre and post operative cases of conductive hearing loss (CHL) was assessed on mild, moderate, and severe intensity scale. TM perforation size was assessed on small, medium and large perforation scale. Large TM perforation was defined as perforation >50% of total TM (more than three quadrants), and small perforation was <25% of total TM.

Clean ear canal without tympanic membrane perforation was considered graft success.

2.7. Statistical Analysis

Data distribution was done according to skewness, kurtosis, and Shapiro-Wilk tests. Z values for skewness and kurtosis were evaluated to analyze normality of the data (data were considered normally distributed if $-1.96 < z < 1.96$). The surgical success rate based on perforation size and graft material was analyzed using linear-by-linear association. The chi-square test was used to compare graft take rates, rejection rates and hearing improvement. All data are presented as mean \pm standard deviation. Statistical significance was considered at 95% confidence interval i.e. $p < 0.05$. All statistical analyses were performed using SPSS software.

3. Results

In present study, data of 30 patients suffering from CIMD was analyzed. All 30 participants underwent ET under lay technique as a primary surgery. The skewness of the data was 0.15. It suggested that the data was not skewed, thus suggesting it was normally distributed. The kurtosis of the data was -1.2, and it suggested that the data was normally distributed. Shapiro-Wilk test for the data was not significant ($p = 0.131$), suggesting that the data was normally distributed. There appeared to be only one mode/peak in the data, thus making it unimodal. Since all three criteria (skewness, kurtosis, Shapiro-Wilk test) were suggestive of normality, it appeared that the data was normally distributed (approximately followed a bell-shaped curve) (Figure 1).

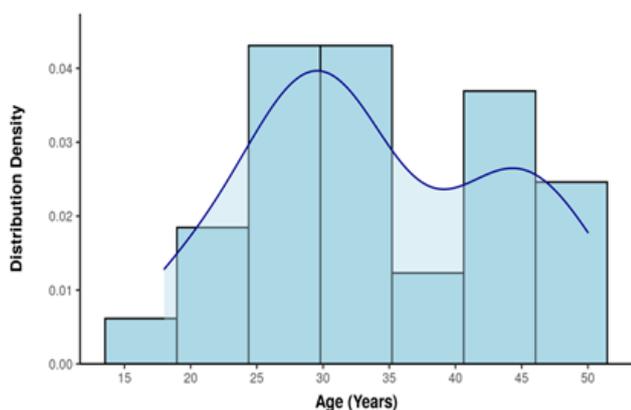


Figure 1. Distribution of age.

The mean of age of patients suffering from CIMD was 34.17 (9.52) years. The median (IQR) of age was 32.00 (27.25-43) years.

Forty percent of the patients were from age group of 18-30 years, 26.7% of the patients were from age group of 31-40

years, and 33.3% of the patients were from age group of 41-50 years (Figure 2). There were 40% of male patients and 60% of female patients (Figure 3).

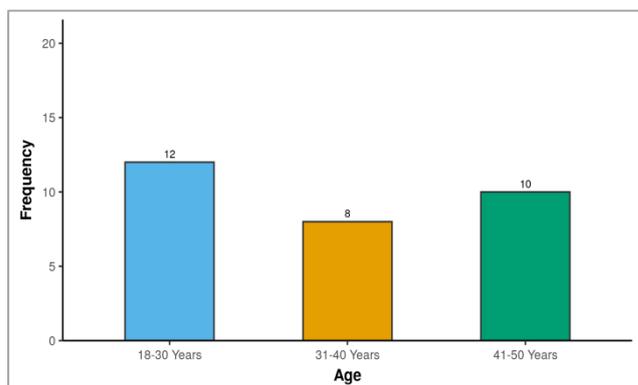


Figure 2. Distribution of participants in terms of age.

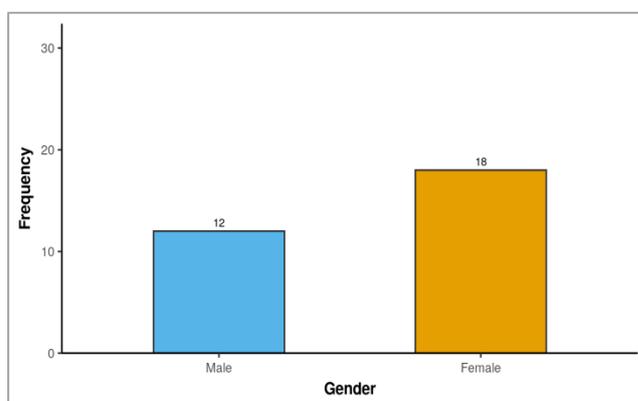


Figure 3. Distribution of participants in terms of gender.

Half (50%) of patients had right-side CIMD and 50% patients had left-side CIMD (Figure 4).

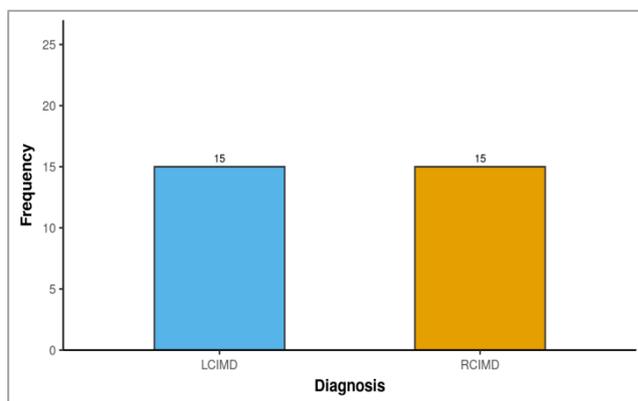


Figure 4. Distribution of participants as per diagnosis.

Sixteen (53.3%) and 14 (46.7%) patients were having right

and left TM perforation, respectively (Figure 5).

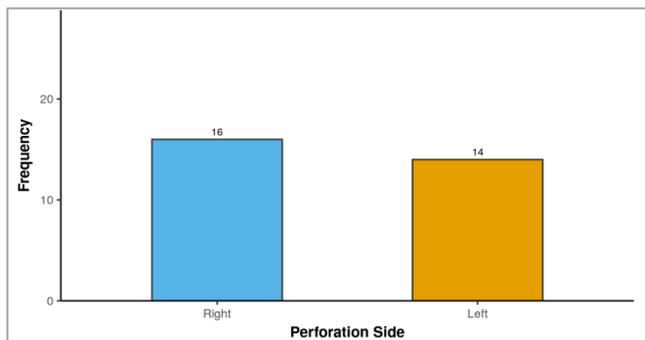


Figure 5. Distribution of participants as per perforation side.

(93.3%) patients had successful grafting with ET surgery.

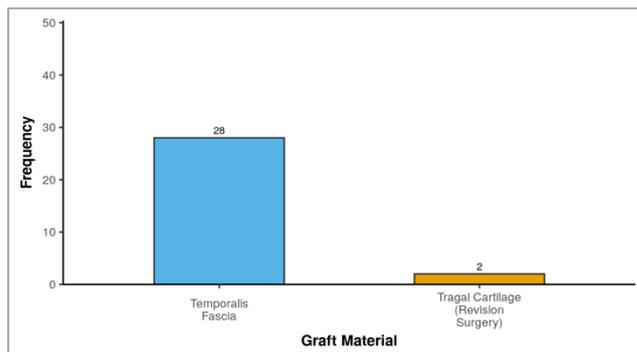


Figure 7. Distribution of participants in terms of graft material.

TM perforation size was small, medium and large in 43.3%, 30% and 26.7% of patients, respectively (Figure 6).

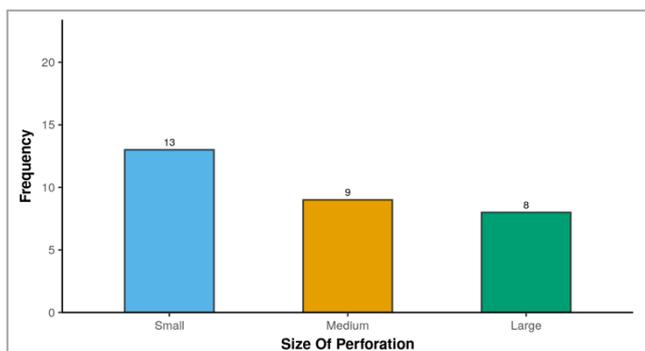


Figure 6. Distribution of participants as per the size of perforation.

No patient had complication or miscellaneous issues. Eighteen (60.0%), 11 (36.7%) and 1 (3.3%) pre-operative patient had mild, moderate, and severe conductive hearing loss (CHL), respectively. All 30 patients with PTA were improved after surgery (Figure 8).

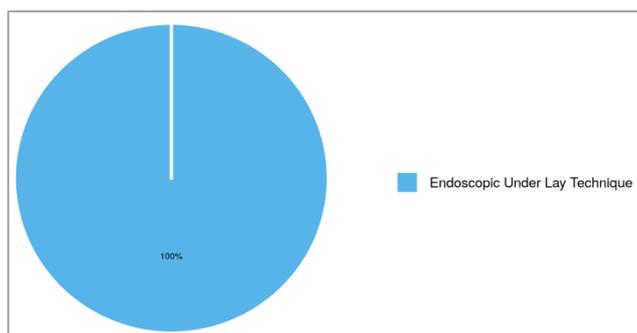


Figure 8. Distribution of participants as per surgical technique.

Twenty-eight (93.3%) patients had temporalis fascia as graft material and 2 (6.7%) patients had tragal cartilage (revision surgery) as graft material (Figure 7). Two (6.7%) patients had graft rejection without improvement in hearing, whereas 28

Also, the details of above all parameters are given in Table 1.

Table 1. Summary of clinical and demographic parameters.

Parameters	Values
Age (mean ±SD) Years	34.17 ±9.52
Age (median, IQR) Years	32.00 (27.25 - 43.00)
Age (Min-Max OR N%) Years	18.00 - 50.00
Age Groups	
18-30 Years	12 (40.0%)
31-40 Years	8 (26.7%)
41-50 Years	10 (33.3%)
Gender: Male; & Female	12 (40.0%); 18 (60.0%)

Parameters	Values
Diagnosis: LCIMD; & RCIMD	15 (50.0%); 15 (50.0%)
Perforation Side: Right & Left	16 (53.3%) & 14 (46.7%)
Size of Perforation	
Small	13 (43.3%)
Medium	9 (30.0%)
Large	8 (26.7%)
Graft Material	
Temporalis Fascia	28 (93.3%)
Tragal Cartilage (Revision Surgery)	2 (6.7%)
Surgical Technique (Endoscopic Under Lay Technique)	30 (100.0%)
Graft Rejection	
Not Rejected	28 (93.3%)
Rejected	2 (6.7%)
Complication (None)	30 (100.0%)
Miscellaneous (None)	30 (100.0%)
PTA (Pre-Operative)	
Mild CHL	18 (60.0%)
Moderate CHL	11 (36.7%)
Moderate Severe CHL	1 (3.3%)
PTA (Post-Operative) (Improved)	30 (100.0%)

4. Discussion

COM is an infection of the middle ear cleft. In inactive mucosal COM, there is perforation of tympanic membrane without ear discharge. Tympanoplasty is an effective surgical procedure to repair tympanic membrane defects. Tympanoplasty has been done for restoration of hearing [3-8, 10, 11]. Many comparative studies have been conducted to assess surgical outcomes in tympanoplasty, when using a conventional microscope [12]. The two common techniques of tympanoplasty are underlay and overlay. According to few scientific studies, the drum healing was more in underlay tympanoplasty than overlay approach [13].

Since last few decades, there is much advancement in tympanoplasty surgeries including endoscopic tympanoplasty (ET) [3, 6-8, 12]. ET appears to be associated with shorter surgical and anesthesia time, safer technique, and better postoperative pain outcomes, which makes it an ideal alternative for the management of chronic otitis media. In addition, positive factors related to the endoscopic approach to the tympanic membrane include its cost-effectiveness or lower

cost, and shorter hospital stay [3, 6-10]. In this study, underlay technique in ET was adopted as per the requirement of individual cases. Hence, a definite opinion on approach and outcome parameters was not possible.

Skewness, kurtosis, and Shapiro-Wilk test are common statistical criteria for data distribution analysis [14]. In present study, all three data distribution criteria viz. skewness, kurtosis, and Shapiro-Wilk test were suggestive of normality. From the results of the study, it appeared that demographically the data was normally distributed, and almost followed a bell-shaped curve.

Several studies supported ET surgery with better surgical outcomes and hearing restoration comparable to the conventional microscopic surgeries. According to research studies, endoscopic ear surgery has a shorter operative time without external incisions and can avoid mastoidectomy. The observations of this study were in line with the results obtained in previous research studies. In this study, the surgical outcomes obtained from patient's data were noticeable from cosmetic point of view [3, 6-8, 12].

In previous studies, tragal perichondrium was commonly used as graft material. Many research studies supported the use of temporalis fascia and tragal cartilage with successful

closure of tympanic membrane perforations [15]. In present study, both graft materials showed successful closure of central TM perforations as well. The graft uptake rate in present study was 97.3% in terms of the absence of residual perforation, and only two cases had graft failures and postsurgical residual perforation. The overall graft success rate of ET for central TM perforations showed favorable outcomes compared to the conventional microscopic approach in patients suffering from CIMD.

In present study, underlay ET procedure not only showed positive surgical outcomes in mild TM perforations but also showed remarkable surgical outcome in 56.7% cases of moderate to large TM perforations with CIMD. Post surgery, 100% improvement in PTA was noted in all conductive hearing loss cases. This was suggestive of effectiveness of underlay ET in CIMD patients. In addition, no patients developed graft blunting, intraoperative and postoperative complications, or any miscellaneous issues during this study.

However, this study has some limitations. As the study was a retrospective analysis, missing data were unavoidable, which may have affected the results. The type of surgical technique (underlay) was decided according to the preference of each surgeon, which might cause bias. The limitations of the present study were a small sample size. However, multi-center data with large sample size, and statistical power should be analyzed for more definitive conclusions.

5. Conclusions

Based on the data analysis, it was concluded that underlay ET is effective in treating the central TM perforation, without the need for an external incision. Regardless of the site and size of the perforation, ET is effective in treating large TM perforations. ET also provides lower surgical morbidity and better cosmetic results, which supports backup data for the philosophy of minimally invasive surgery. These results may help surgeons to achieve optimal results in selection of appropriate surgical method for tympanoplasty.

Abbreviations

CHL	Conductive Hearing Loss
CIMD	Chronic Inactive Mucosal Disease
COM	Chronic Otitis Media
ET	Endoscopic Tympanoplasty
IEC	Institutional Ethics Committee
IQR	Interquartile Range
PTA	Pure-tone Average
TM	Tympanic Membrane

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Author Contributions

Aasiya Tai: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Resources, Software, Validation, Visualization, Writing – original draft, and Writing – review & editing.

Basavaraj Walikar: Conceptualization, Formal Analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, and Writing – review & editing.

Satish Rashinkar: Conceptualization, Formal Analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, and Writing – review & editing.

Ashfak Kakeri: Formal Analysis, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualization, and Writing – review & editing.

Anees Patel: Formal Analysis, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualization, and Writing – review & editing.

Data Availability Statement

The data is available from the corresponding author upon reasonable request.

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Conflicts of Interest

The authors declare no conflicts of interest.

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Biography



Basavaraj Walikar, an esteemed ENT surgeon and professor at AI Ameen Hospital in Vijapur, Karnataka, India, specializes in diagnosing and treating ear, nose, and throat conditions. His academic contributions include lectures, research, and patient care. Dr. Walikar's compassion and commitment to improving lives make him a respected figure in the field.



Satish Rashinkar, an experienced ENT surgeon, serves as the Head of the ENT Department at AI Ameen Hospital in Vijapur, Karnataka, India. With 40 years of expertise, he specializes in diagnosing and treating ear, nose, and throat conditions. Dr. Rashinkar's commitment to patient care and his proficiency make him a respected figure in the field.



Ashfak Kakeri, an esteemed ENT specialist, holds the position of Professor in the Department of ENT at AI Ameen Hospital in Vijapur, Karnataka, India. With a wealth of experience, Dr. Kakeri focuses on diagnosing and treating ear, nose, and throat conditions. His compassionate patient care and dedication to excellence make him a respected figure in the field.



Anees Patel, an accomplished ENT specialist, completed her MS in Otorhinolaryngology (ENT) at Mahadevappa Rampure Medical College (MRMC) in Gulbarga, Karnataka, India. With a passion for patient care and a keen eye for detail, Dr. Anees Fatima has emerged as a respected figure in the field of otolaryngology. Her journey began at MRMC, where she honed her surgical skills and gained a deep understanding of ENT disorders. As a Professor in the Department of ENT at AI Ameen Medical College, Dr. Anees Fatima imparts her knowledge to the next generation of medical professionals.

Research Field

Aasiya Tai: ENT surgery.

Basavaraj Walikar: ENT surgery.

Satish Rashinkar: ENT surgery.

Ashfak Kakeri: ENT surgery.

Anees Patel: ENT surgery.