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Original Research Article

Minimally invasive transcanal endoscopic tympanoplasty: our experience in 120 cases of mucosal chronic suppurative otitis media

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ABSTRACT

Background: Endoscopic procedures began the era of minimally invasive surgery in otorhinolaryngology. Even in patients with a narrow external canal, the endoscopic technique facilitates easier transcanal tympanoplasty.
Methods: We conducted a retrospective study for evaluation of 120 patients who underwent endoscopic transcanal tympanoplasty between 2020 and 2023. Tragal cartilage was used as graft material. Patients were assessed for graft success rate, and hearing outcomes, duration of surgery, length of hospital stay, postoperative morbidity.
Results: The overall graft uptake rate was 96.6% (116 patients). The average duration of surgery was 45.60±17.39 minutes. Endoscopic transcanal tympanoplasty yielded excellent cosmetic results in all cases. The mean pure tone audiometry (PTA) before surgery was 32.4±7.5 dB, while the mean PTA at 24 weeks post-surgery was 25.6±6.8 dB, with a statistically significant p value of 0.001. Additionally, a significant closure of the air-bone gap (ABG) was observed postoperatively. The average hospital stay was 1.05±0.15 days.
Conclusions: Endoscopic tympanoplasty provides broad visibility and ease of application for middle ear surgery, with a short operating time, reduced risk of complications, and a minimally invasive approach but long learning curve associated with this technique.

Keywords: Chronic otitis media, Endoscopic, Pure tone audiometry, Transcanal, Tympanoplasty

INTRODUCTION

A typical consequence of COM (chronic otitis media) is chronic TM (tympanic membrane) perforation, which needs to be surgically closed by myringoplasty. In myringoplasty, a variety of graft materials and placement techniques are employed. The frequently used graft materials are perichondrium, fascia, fat, and cartilage; however, most surgeons still prefer fascia grafts. Nonetheless, cartilage grafts are preferred in challenging situations, such as patients with anterior perforations, retraction pockets, or poor Eustachian tube function, as well as in revision surgery.[1,2]

The utilization of endoscopes started in 1990 for middle ear surgery, and their use has become widespread since then.[3,4] These days, the endoscope is the main tool utilized in practically all middle ear surgeries, including cochlear implantation, stapes surgery, and chronic otitis surgery.[5,6] Angled endoscopes, in particular, offer direct access to the retrotympanum, anterior epitympanum, as well as hypotympanum-hidden regions that are impossible to properly view with traditional microscopic techniques without bone curettage.[7] Because endoscopic tympanoplasty is less painful and takes less time to complete, it is being used more and more in otologic surgery.

Furthermore, the endoscopic method offers important benefits such as excellent image quality, panoramic vision, and the simplicity of adjusting the exposure and zoom by merely moving the endoscope back and forth.[8,9] Even with these benefits, the endoscopic approach's limitations include one-handed surgery, a lengthy learning curve, and a lack of stereoscopic vision. Because endoscopic transcanal tympanoplasty is a slightly less invasive procedure, the recovery period is nearly painless, and hospital stay is brief.[9]

So, the objective of study was to evaluate the surgical outcomes of transcanal endoscopic type-1 tympanoplasty in 120 patients of inactive chronic otitis media presenting in ENT department of Rajindra Hospital, Patiala.

METHODS

The objectives of our study were to study the surgical outcomes of transcanal endoscopic tympanoplasty regarding graft uptake rate, evaluate hearing outcomes, duration of surgery, hospital stay and post-operative morbidity.

The retrospective study was done from the period 2020 to 2023 to explore the surgical outcomes of transcanal endoscopic tympanoplasty (type-1) in clinically diagnosed 120 cases of chronic otitis media (age 10-60 years) presenting in otorhinolaryngology department of GMC Patiala and Rajindra Hospital. Ethics committee approval was taken.

120 subjects with age ranges from 10- 60 years presented with safe chronic otitis media (COM) and ear dry for 4-6 weeks. There were no signs of infection or inflammation of the middle ear mucosa. Patients with the squamous type of COM and active mucosal disease were excluded from the study. Patients with comorbidities like diabetes, hypertension, presence of otitis externa, otomycosis, ossicular fixation, ossicular discontinuity, and revision cases were also not included in this study.

A detailed history, clinical examination, haematological and radiological investigations, Pure Tone Audiometry (PTA) were done in all subjects.

Surgical technique

After written and informed consent, patients were operated under general anaesthesia or local anaesthesia using oto-endoscope with 1288 Full HD endoscope camera system.

LA (2% lignocaine with adrenaline 1:200000) was injected in 4 quadrants of the External Auditory Canal (EAC) and the area from where the graft was to be taken. Supra supra-auricular incision (1.5cm) above the hairline was made, and the temporalis fascia graft was taken. Tragal cartilage was harvested, sliced (0.5mm) using a cartilage slicer. A 0-degree endoscope was introduced inside the EAC, and tympanic membrane perforation was inspected for site and its shape. After freshening of the margins of perforation with a sickle knife, and mucosal surface of TM was made raw using a circular knife. Tympanomeatal flap 4-5mm lateral to bony annulus was raised from 12-6 o'clock position. The middle ear was examined for mucosal edema, granulations, and ossicular discontinuity. Using the underlay method graft was put, the TM flap repositioned and supported by antibiotic-soaked gel foam. An antibiotic ointment-soaked wick was put in the EAC. Mastoid bandaging was done.

Post-operatively, all patients were put on antibiotics and analgesics for one week and discharged the same day or the second day. Patients were advised to keep their ears dry and to avoid straining. The sutures and EAC pack were removed on the 7th-10th day post-operatively. The patient was kept for follow-up. Post-operative PTA was done at 6, 12, and 24 weeks to assess the hearing and compare it with a pre-operative audiogram

The data regarding the duration of surgery, graft uptake, hearing outcomes, hospital stay, and post-operative morbidity were compiled and analysed statistically using appropriate statistical tests.

RESULTS

In our study, 120 patients were included with age ranges from 10-60 years presenting with chronic otitis media (COM), the maximum patients belonged to the age group of 31-40 years with 56 (46.66%). There were 53 males (44.16%) and 67 females (55.83%) (Figure 1).

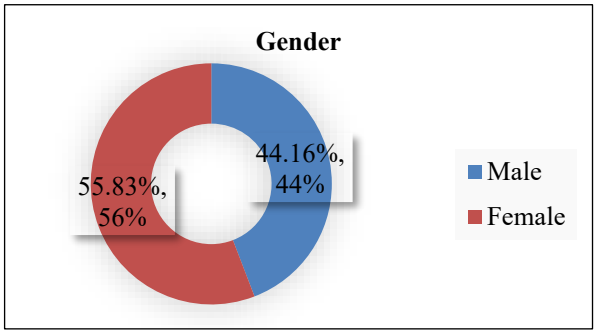

Figure 1: Gender distribution.

Out of the 120 ears operated the right ear was operated on in 68 (56.66%) cases, while 52 (43.33%) had been on the left ear. The maximum interval of symptoms in patients ranges from 5-10 years. The most common size of perforation was medium in 72 (60%) patients, large in 25 (20.83%), subtotal present in 13 (10.83%), and 10 (8.33%) patients had small sized perforation (Figure 2).

In our study graft uptake rate was assessed during the follow-up period at 6,12, and 24 weeks as well as the total graft uptake was 96.60% (116 patients) at the end of

24weeks. Out of 120 patients, 4 (3.40%) had residual perforation (Figure 3,4).

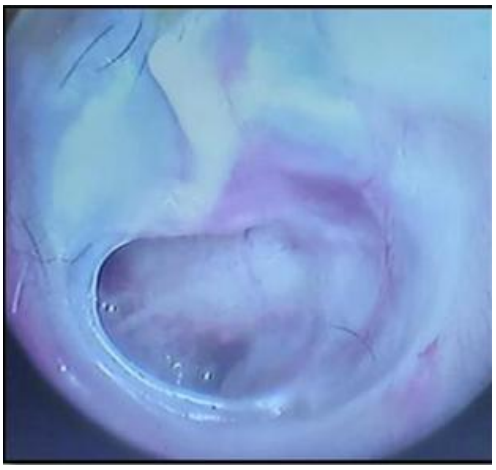

Figure 2: Pre-operative TM perforation picture at 24 weeks.

Figure 3: Post operative healed perforation (medium sized).

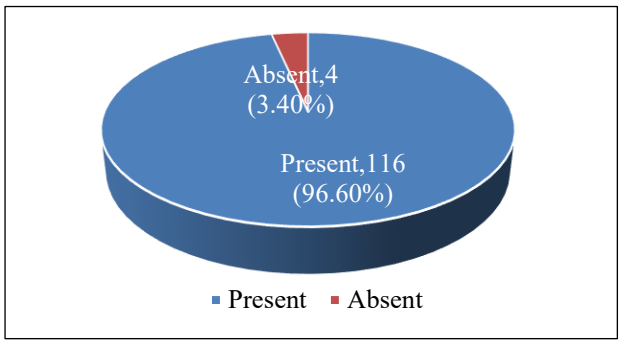

Figure 4: Showing graft uptake rate at 24 weeks post-operatively.

The mean duration of type-1 tympanoplasty surgery using endoscopic technique was 45.60±17.39 minutes. The average hospital stay was 1.05±0.15 days. All patients had excellent cosmetic outcomes because of the transcanal approach which avoid post- auricular incision and wound complications.

The pre-surgery mean PTA finding was 32.4±7.5dB, and the post-surgical mean PTA at 24 weeks was 25.6±6.8dB, with p-value=0.001, which was statistically highly significant. Pre-surgery mean ABG (Air bone gap) was 18.46dB, and post-operative mean ABG was 11.43dB, (p-value = 0.001), which was statistically highly significant (Figure 5).

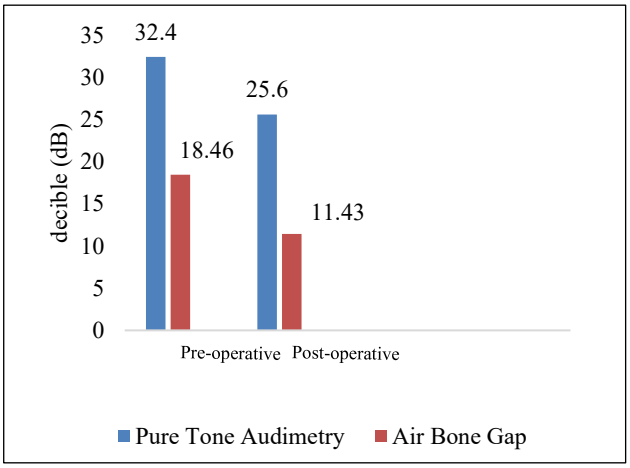

Figure 5: Pure tone audiometry and air-bone gap.

DISCUSSION

Tympanoplasty success is influenced by several parameters, including perforation size, age, eustachian tube function, otorrhea after surgery, and limited vision of the whole membrane. Endoscope gives us wider surgical exposure as compared to the microscope, specifically anterior bony overhangs of external auditory canal, as well as in subtotal/anterior perforations.[10]

With the aid of an angled rigid endoscope, obscured regions of the middle ear space that are indirectly visible using microscopes can be simply reached without the need for canaloplasty or bone work. In addition to having fewer complications, the transcanal endoscopic procedure provides several benefits, including a panoramic view, faster operating durations, minimum invasiveness, and simple access to the difficult-to-reach areas of the middle ear. However, the limitations of the endoscopic method in ear surgery are its single-handed nature, length of initial operation, and lack of stereoscopic vision.[11,12]

Hence, this research was done to assess the surgical outcome in transcanal endoscopic tympanoplasty in 120 subjects of mucosal COM (chronic otitis media).

In the present study, patients were from age groups ranging between 10-60 years. Most of individuals (56 patients) were in the age group of 31 to 40 years (46.66%). There were 53 males (44.16%) and 67 females (55.83%) (Figure 1).

A similar study conducted by Pontes-Madruga et al included patients ranging between 13 and - 69yrs, average age of 37.5 years.[13]

In our study, out of 120 patients, 53 were males (44.16%) and 67 (55.83%) were females. In another study conducted by Singh et al, 28 (40%) were males while 42 (60%) were females, which is comparable to our research.[14]

Out of the 120 cases, the right ear was operated on in 68 (56.66%) and the left ear in 52 (43.33%). The maximum interval of symptoms in subjects ranged from 5-10 years. The most common size of perforation was medium in 72 (60%) patients, large in 25 (20.83%), subtotal present in 13 (10.83%), and 10 (8.33%) patients had small size of perforations (Figure 2).

A similar result was shown in a study conducted by Özdemir et al in which the right ear operated in 55.8% (n=58) and the left ear in 44.2% (n=46). Medium-sized perforations account for 53.8% (n=56), followed by large-size (25.0%) and small perforations (21.2%).[15]

In the present research graft uptake rate was assessed at 6,12,24 weeks in terms of complete tympanic membrane perforation closure and residual perforations. 116 patients (96.6%) had complete graft uptake, and partial graft uptake was present in 4 patients (3.4%) at 24 weeks (Figure 3,4).

Özdemir et al in his research found the overall graft uptake rate to be 93.2%, which was according to the current research.[15] In another research conducted by Linares et al, at 6 months, individuals had successful grafts in 94.4 percent, while 2 individuals showed postoperative persistent perforation, which was in accordance with our study.[16]

In our research, the average length of type-1 tympanoplasty surgery using the endoscopic technique was 45.60±17.39 minutes. The shorter duration of surgery was because of the avoidance of canaloplasty, and the ossicular chain was better visualized with an endoscope in a narrow External auditory canal. Similar results were observed by Tseng et al and Huang et al had the same results with operative time in the Endoscopic Group, 50.4±13.4 minutes as contrast to 75.5±20.4 minutes in the microscopic group.[17,18] The span of surgery in endoscopic subjects was notably less than in the microscopic group ($p<0.0001$).[18]

In contrast, earlier endoscopic surgery required a longer duration because of the skill and complexity of graft placement, as well as frequent soiling of the endoscope tip with blood, stated by Gadag et al.[19]

The average hospital stay was 1.05±0.15 days in our study. Gulsen S and Baltacı's study showed similar results with the average hospitalization stay of 26.1h (range 18-36 h) in the endoscopic group. The shorter hospital stay was because of minimally invasive surgery and less post-operative pain as compared to the microscopic technique ($p<0.05$).[20]

Our study showed that all patients had excellent cosmetic outcomes because of the transcanal approach, which avoids postauricular incision and wound complications. Similar results were reported by Lakhpati et al in endoscopic myringoplasty, where minimal dissection of normal tissues, fewer complaints of post-operative pain, and less intraoperative bleeding led to better cosmetic outcomes because of avoidance of post-aural incision, which further decreases the risk of displacement as well as asymmetry of the pinna.[21]

The pre-surgery mean pure tone audiometry (PTA) finding was 32.4±7.5dB, and the post-surgical mean PTA at 24 weeks was 25.6±6.8dB, the p-value was 0.001, statistically highly significant. and pre-operative mean air bone gap (ABG) was 18.46±2.7dB and post-operative mean ABG was 11.43±3.6dB, p-value =0.001, which was statistically highly significant (Figure 5).

In similar research by Kaya et al, air conduction PTA 36.4±15.1dB (before surgery) improved to 28.8±14.3dB (post-surgery) in 93 individuals with COM and the pre-operative ABG had been 22.1±7.1dB, which was considerably reduced to 13.3±5.9dB at 6months as well as 11.9±5.5dB at 24months following surgery.[22]

The limitations of the present study were the shorter duration of follow-up; a longer period of follow-up was required to further evaluate the results of the study with respect to graft uptake and audiological outcomes.

CONCLUSION

The endoscopic surgery offers better visualization, shorter operative time, minimal tissue injury, better cosmetic outcomes, and lower postoperative morbidity. Endoscopic tympanoplasty is a slightly invasive procedure with nearly painless recovery period and brief hospital stay.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Review Board for Ethics Clearance of Government Medical College, Patiala-147001, Punjab, India. (No. Trg.9(310)2024/ 3545)

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