Original Article

Type 1 Tympanoplasty in Wet and Dry Ears in Mucosal Chronic Otitis Media

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Abstract

Background: Objective: 1. To compare the results of type-1 tympanoplasty by transcanal underlay technique in wet and dry ears in mucosal COM, 2. To study the histopathological changes (vascular status) in tympanic membrane remnants in wet and dry ears. **Material and Methods:** The current prospective study was conducted at a tertiary care facility in Haryana, in the departments of pathology and otorhinolaryngology. The research included 40 patients with mucosal chronic otitis media (COM) of either sex aged 18 to 50. Two groups of patients were created. Twenty consecutive individuals with moist ears made up Group 1. Twenty consecutive individuals with dry ears who had not used topical or systemic antibiotics for at least 6 weeks comprised Group 2. Type 1 tympanoplasty was performed in all patients after written informed consent. Pre-operative CT scan was done in the patients who had mucoid discharge to rule out mastoiditis. The study's findings were evaluated based on graft uptake and hearing gain. **Results:** The overall graft take-up rate in group 1 was 85%, while that in group 2 was 80% and was thus statistically comparable ($p > 0.05$). The hearing gain in group 1 was 15.39 dB, and in group 2, it was 14.77 dB; therefore, comparable and showing no statistical difference. **Conclusion:** Patients with mucoid ear discharge who have not responded to adequate medical treatment can be taken up for surgery; there is no need to postpone the procedure in such cases. The condition of the treated ear is less important to the surgical outcome than careful surgical technique.

Keywords: Chronic otitis media; mucosal; tympanoplasty; histopathology; neovascularisation.

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Introduction

One of the most prevalent ear infections is chronic otitis media (COM). It is a global health issue that persists in the age of sophisticated antibiotics.[1] Cholesteatoma may be linked to chronic otitis media, which is defined by sporadic or continuous purulent discharge via a perforated tympanic membrane.[2] The phrases "myringoplasty" and "tympanoplasty" describe surgical techniques used to restore the middle ear and tympanic membrane. Repairing a tympanic membrane rupture on the assumption that the middle ear space, its mucosa, and the ossicular chain are disease-free is known as myringoplasty. Another name for it is type 1 tympanoplasty. In tympanoplasty, early graft failure is still a major issue. Numerous technical factors may impact tympanoplasty outcomes, including perforation location, intraoperative bleeding, and ear canal geometry, all of which can affect optimal graft placement. A suboptimal placement with incomplete perforation coverage can result in early graft failure in tympanoplasty. Graft failure is much more common in large perforations and anterior perforations and may be affected by variations in graft location. A few of these in-situ problems may be explained by tympanic membrane transplant movement and natural membrane changes.[3] Whatever the technique, the main indications for the repair of tympanic membrane perforation are to improve hearing and to protect the middle ear from perilymphatic insults, thereby controlling otorrhoea.[4] Many people think that to have a favourable outcome, myringoplasty should be performed on a dry ear. Deciding whether to run is challenging when discharge occurs before surgery. Although it is ideal to make active ears inactive before surgery, this is sometimes unattainable since the ear discharge persists even after getting proper medical care. Although there is not enough proof to support it, some surgeons recommend that such individuals have a cortical mastoidectomy and drum repair. The state of the ear at the time of operation has also been linked to conflicting reports of tympanoplasty outcomes. While some writers have seen no difference in the result between wet and dry ears, others have claimed that efforts to repair a hole in a damp ear fail far more often.[5] Theoretically, the vascularity of the remaining tympanic membrane also affects the success rate. According to reports, a vascularised tympanic membrane has a lower probability of transplant failure than an

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avascular one.[6]

When one of the following circumstances applies, a tympanic membrane central perforation is considered wet:

1. Congested remnant tympanic membrane.
2. The middle ear mucosa is oedematous, polypoidal, or congested.
3. Granular or oedematous perforation borders.
4. The discharge is visible via the hole.
5. In experimental animal studies, the epidermis is the first layer that closes a tympanic membrane perforation. The fibrous layer heals secondarily, and the circulatory flow in the tympanic membrane is associated with the location of response in this layer.
6. There is still uncertainty about the effect of middle-ear wetness on the outcome of tympanoplasty. Further, many patients who present with a wet ear on the day of surgery and have their surgery postponed have encouraged us to evaluate the outcomes of tympanoplasty in such patients and compare them with those in dry ears.

Materials and Methods

The present prospective study was conducted in the Departments of Otorhinolaryngology and Pathology in a tertiary care centre in Haryana. Forty patients of either sex aged 18-50 years with mucosal chronic otitis media (COM) were included in the study. Two groups of patients were created. Twenty consecutive individuals with moist ears made up Group 1. Twenty consecutive individuals with dry ears who had not used topical or systemic antibiotics for at least 6 weeks comprised Group 2. Approval was taken from the Departmental Board of Postgraduate Studies, which is equivalent to IRB.

Inclusion Criteria:

The research included patients with mild to severe conductive hearing loss and any size or location of a central pars tensa perforation.

Group 1 (Wet Ear): Patients with congestion of the drum remnant, congestion of the middle ear mucosa, presence of mucoid discharge in the middle ear, and thickened or polypoidal middle ear mucosa after adequate medical treatment were included.

Group 2 (Dry Ear): Patients with uncomplicated pars tensa perforation that has remained dry for at least 6 weeks, with normal middle ear mucosa, were included.

Exclusion Criteria

- Presence of cholesteatoma and/or granulation tissue
- Patients having marginal perforation
- Patients with sensorineural or mixed hearing loss.
- Patients with ossicular chain-related tympanosclerosis
- Individuals who have fixation or ossicular erosion
- Individuals who have a single hearing ear
- Individuals whose hearing loss is disproportionate to the dimensions of the hole
- Fundamental illnesses, including diabetes or weakened immune systems
- A markedly deviated nasal septum with an active infection in the paranasal sinuses, throat, and nose.

Every patient underwent a thorough assessment that included a history, a general physical examination, and an examination of the ears, nose, and throat. To determine the size and nature of the perforation, the state of the middle ear mucosa, the status of the malleus handle, and the state of the drum remnant—whether or not it was attached to the middle ear mucosa—all of the patients had an otoscopic examination before surgery. It was also noted how the other ear was doing. The otoscopy results were verified by microscopic examination. Pre-operative Computed tomography was performed in cases with profuse middle ear discharge. Every patient underwent tuning fork testing. These tests consist of the Absolute Bone Conduction test, Weber's test, and Rinne's test. An audiometric assessment was conducted.

The average air-bone gap for each patient was determined both before and after surgery using frequencies of 500 Hz, 1000 Hz, 2000 Hz, and 4000 Hz, respectively. Air conduction and bone conduction were also carried out. Pure-tone audiometry (PTA) was used to evaluate the opposite ear's hearing and to validate the type and extent of hearing loss. WRS (Word Recognition Score) was calculated using PB (Phonetically Balanced) words. The purpose was also to assess the patient's cochlear reserve and to determine improvement in speech recognition in all patients. Patients were admitted one day before surgery, and a detailed history was recorded. Written informed consent was obtained from the patients, explaining the advantages, disadvantages, and complications of the treatment being offered, as well as their inclusion in the present study. Patients were taken up for surgery after the routine investigations. Although general anaesthesia was provided to patients, local anaesthesia was preferred for patients who were hesitant to undergo local anaesthetic surgery. All the patients had type 1 tympanoplasty. Every patient who had surgery was routinely checked in the outpatient department at one week, six weeks, and three months after the procedure. Analysis of statistics Using SPSS version 17, the parameters of the two groups were compared, statistical significance was decided, and statistical analysis was conducted. The Chi-square/Fisher's exact test was used to compare categorical data between two groups. In contrast, the student t-test (independent or paired) was used to compare quantitative data. The significance threshold was set at $p < 0.05$.

Results

Size of Perforation in Relation to Graft Uptake

A total of 17 (85%) patients had graft uptake in group 1 and 16 (80%) patients in group 2. In group 1, 7 had perforations up to 3 mm; all had successful graft uptake (100%). In the 3-5 mm size, 9 out of 11 (81.8%) had successful graft uptake, and 1 out of 2 (50%) had graft uptake in perforations> 5 mm. In group 2, we found that eight patients out of 9 (88.8%) with perforation size up to 3 mm had successful graft uptake, and 8 out of 9 (88.8%) with >3-5 mm had successful uptake of graft. None of the patients with a perforation size >5mm in group 2 had graft uptake. Statistical comparison between the two groups showed no significant difference ($p > 0.05$). [Table 1] (size of perforation (in mm) amongst two groups in relation to graft uptake)

Success of Graft Uptake

The overall graft take-up rate in group 1 was 85%, while that in group 2 was 80% and was thus statistically comparable (p >

0.05). Only 3 (15%) patients in group 1 and 4 (20%) patients in group 2 had residual perforation. [Table 2] (graft uptake amongst two groups)

Comparison of Histopathological Examination (Fibroblasts / Neovascularisation) Among Two Groups with Graft Uptake

Further histopathological analysis was performed to assess graft uptake rate. In Group 1, 85% of neovascularisation cases had graft uptake; in Group 2, 84.2% of patients with fibroblasts had graft uptake. The patient whose histopathology showed fungal infection had graft failure in Group 2. [Table 3] (histopathological examination amongst two groups)

Improvement in Abg in Two Groups:

Improvement in ABG was observed in both groups, with preoperative ABG values of 29.78±8.58 in group 1 and 33.57±8.09 in group 2. Postoperatively, it was 14.08±6.14 in group 1 and 18.77±10.81 in group 2. Hearing gain (AC gain) saw was 15.39±8.40 in group 1 and 14.77±8.93 in group 2. Mean improvement of 15.69±8.27 was found in group 1 and 14.8±8.94 in group 2. In the statistical analysis, both groups were found to be comparable and thus statistically insignificant ($p > 0.05$). [Table 4] (improvement in ABG amongst the two groups).

Table 1: Size of Perforation (In Mm) Amongst Two Groups in Relation to Graft Uptake

Size of perforation	Group I (Wet Ear) n (%)	Group 2 (Dry Ear) n (%)	Statistical significance
Upto 3	7/7(100%)	8/9(88.8%)	$\chi2 = 0.578$ (>0.05 NS)
>3-5	9/11(81.8%)	8/9(88.8%)	
>5	1/2(50%)	0/2(0%)	
Total	17 (85%)	16(80%)	

Table 2: Graft Uptake Amongst Two Groups

	Group I (Wet Ear) Mean±SD	Group 2 (Dry Ear) Mean±SD	Statistical significance
Yes	17(85%)	16(80%)	$\chi2 =0.173$ (>0.05 NS)
No	3(15%)	4(20%)	

Table 3: Histopathological Examination Amongst Two Groups

	Group I (Wet Ear) n (%)	Group 2 (Dry Ear) n (%)
Fibroblasts	0	16/19(84.2%)
Neovascularisation (n=20)	17/20(85%)	0
Fungus	0	0/1(0%)

Table 4: Improvement in Abg in Two Groups:

	Group I (Wet Ear) Mean±SD	Group 2 (Dry Ear) Mean±SD	Statistical significance
Preoperative ABG	29.78±8.58	33.57±8.09	p=0.159 (>0.05NS)
Postoperative ABG	14.08±6.14	18.77±10.81	p=0.100 (>0.05NS)
Hearing gain (AC gain)	15.39±8.40	14.77±8.93	p=0.822 (>0.05NS)
Improvement in ABG	15.69±8.27	14.8±8.94	p=0.743 (>0.05NS)
Statistical analysis	<0.001	<0.001	

Table 5: Comparison of Graft Uptake with Literature:

Study	Success Dry ears	Success Wet ears	P value
Nagle[9]	88%	74%	0.07
Webb[10]	10%	7%	0.06
Hosny[7]	90.4%	87%	0.6
Pinar[11]	79%	64%	0.003
Dhar[12]	96%	84%	0.
Shankar[8]	88%	80%	0.5
Naderpur[13]	97%	94%	0.89
Gamra[14]	87.5%	88%	0.9
Fadl[15]	84.6%	83.3%	0.933
Sarker[16]	89.36%	53.85%	0.0016
Caylan[17]	100%	75%	<0.05
Sharma et al[18]	85.71%	75%	0.267
Present study	80%	85%	0.677

Table 6: Audiological Success Comparison with Literature:

Study	Audiological success Dry ears	Audiological success Wet ears	P value
Nagle[9]	72%	60%	0.85
Gamra[14]	56%	62%	0.29
Sharma[18]	85.71%	55%	0.267
Hosny[7]	92.3%	91.3%	1.00
Present study	80%	95%	0.151

Discussion

Chronic inflammation of the mucoperiosteal lining of the middle ear cleft is a typical symptom of chronic otitis media. In Hosny et al.'s study, patients with grade IV perforations had a higher residual perforation rate than those with grade I perforations.[7] The success rate for small perforations was 100%, 81% for medium-sized perforations, and 86% for large perforations.[7] The hole size did not affect the general success rate in either the wet or dry groups, according to research by Shankar et al.[8]

In the present study, it was also seen that size 5mm perforations healed as well as 3mm perforations. There was no relationship between the size of the puncture and its healing(p=0.578).

Comparison of Graft Uptake with Literature:

Many authors have reported that dry and wet ear conditions did not have a significant effect on anatomic and functional success. According to Nagle et al., the closure percentage was 74% for wet ears and 88% for dry ears, with no discernible difference between the two. 72% of those with dry ears and 60% of people with wet ears had hearing gain rates of over 10 dB.[9] According to Shankar et al., the favourable outcome rate of surgery was unaffected by the kind or existence of middle ear discharge.10 According to a meta-analysis by Vrabec et al., tympanoplasty on a discharging ear is just as effective as it is on a dry ear.[19] Nagle et al. concluded that discharge during the procedure did not affect the outcome of tympanoplasty, but only in cases where the discharge was sparse and mucoid.[9] According to studies by Mills et al and Dhar et al also, there was no significant difference in the success rate of wet and dry myringoplasty.[20,21] Raj and Tripathi, in their study, also concluded that primary closure of 84% of wet perforations was observed, similar to that in dry ears, and the incidence of complications was also low and similar to that in dry ears.[22] According to a retrospective study done by Fadl et al, middle ear status, whether wet (6.2%) or dry (93.8%), showed nearly similar results of success (83.3% and 84.6% respectively).[15] However, several studies have shown that myringoplasty outcomes are negatively affected when the middle ear is discharged during surgery. Patients with dry ears for three months before surgery had a considerably greater rate of graft absorption, according to Uyar et al.[23] When performing on a dry ear, Gersdorff et al. and Pignataro et al. discovered a better result.[24,25] According to Onal et al., myringoplasty is more effective if the ear has remained dry for at least 1 month.89 Pinar et al. also found that myringoplasty success rates are higher for dry ears (79% vs. 64% for wet ears).[26] Takahashi et al. discovered that granulation tissue or oedematous mucosa in the middle ear increases the distance between capillaries and the middle ear cavity and hinders transmucosal gas exchange. Tympanoplasty in moist ears may be surgically unsuccessful as a consequence.[27] According to Saeed et al. and Noh et al., neither patient with a discharging ear had succeeded in the procedure, and patients with a wet middle ear mucosa before surgery experienced more post-operative otorrhea than those with a dry one.[28,29] In a study by Sarker et al., graft take-up rate was higher in dry ears than in wet ears (89.36% versus 53.85%).[16]

Few studies in the literature have reported better outcomes of myringoplasty in discharging ears, possibly due to increased vascularity of the middle ear, which could favour better healing in wet ears. After myringoplasty, Caylan et al. found that the tympanic membrane healed 100% of the time in discharging ears and 75% of the time in dry ears.[17] In 2006, Vijayendra et al. discovered that the failure rate of completely dry tympanoplasty was higher than that of wet tympanoplasty. In wet perforations, all the layers of the tympanic membrane were present along with abundant blood vessels and an increased number of inflammatory cells. Due to these findings, the graft failure rate was higher in dry perforation.[11]

We found that the presence of inflammatory cells and neovascularization positively influences graft uptake. A histological analysis of the remaining tympanic membrane from 20 dry and 20 wet central perforations was conducted by Vijayendra et al. They found that all the epithelial layers were present in the moist central perforations, along with an increased number of blood vessels and inflammatory cells. Additionally, they said that the graft uptake is eased by these anatomical parameters 5 [Table 5] (graft uptake compared with literature)

Audiological Success Comparison in Literature

We further analysed the improvement in ABG and hearing gain. The hearing gain in group 1 was 15.39 dB, and in group 2, it was 14.77 dB. Both groups were comparable in terms of hearing gain and showed no statistical difference (p-value=0.822). Regarding ABG improvement, group 1 showed a 15.69 dB improvement, while group 2 showed a 14.8 dB improvement. Both groups showed highly significant improvement in ABG compared with preoperative levels, but they were comparable to each other (statistically insignificant; p value = 0.743). In a study by Sharma et al., 85.71% of cases in the dry ear group showed improvement in ABG, while 55% in the wet ear group did.[18] In Sarker et al.'s study, ABG improvement was 18.23 dB in dry ears and 7.8 dB in wet ears, respectively, and hearing improvement was also better in dry perforations.[16] One patient had steady hearing loss, three (10.72%) cases experienced worsening, and 24 (85.71%) cases of dry ear saw improvement in the air bone gap in the research conducted by Sharma et al. One instance had a steady hearing loss; eight (40%) had deterioration; and eleven (55%) had improvement in the air-bone gap in wet ears.[18] Hosny et al. reported that improvement in hearing (more than 10 dB) was observed in 92.3% of cases with dry ears and 91.3% of cases with wet ears, and the difference was not statistically significant.[7] In Nagle et al.'s study, a hearing gain of more than 10 dB was seen in 72% dry ears and 60% of wet ears.9 In Gamra et al.'s study, audiological success of 72 % was seen in dry ears and 62% in wet ears.[14] [Table 6] (audiological success comparison with literature) (Supplemental Data Scattergram showing pre-op and post-op PTA and WRS).

Conclusion

The current study's findings show that graft uptake rate and hearing gain after myringoplasty in wet and dry ears do not differ in a clinically meaningful way. Medical treatment should be given to all patients to control their discharge before surgery. But

patients with mucoid ear discharge, even after adequate medical treatment, can be taken up for surgery, and there is no need to postpone the procedure in such cases. The condition of the treated ear is less important to the surgical outcome than careful surgical technique.

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Conflicts of interest
There are no conflicts of interest.

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