



A Comparative Study of Canal Wall Up Tympanomastoidectomy in Dry Ear and Wet Ear

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ABSTRACT

Introduction: Chronic otitis media is a common condition seen in patients attending otorhinolaryngology clinic. The otologist must decide whether to operate on the discharge-producing ear. This is due to the widespread belief that the success rate while doing tympanoplasty on wet ear is decidedly inferior. In our country patients coming from remote and far-flung areas, find it difficult to maintain a regular follow-up with additional financial burden of catering multiple antibiotic courses. Only a few research have found that ear discharge increases transplant uptake.

Aims/ objective: To compare surgical outcome of canal wall up tympanomastoidectomy in dry and wet ear.

Materials and Method: The study was carried out on 90 patients who underwent canal wall up tympanomastoidectomy. Of these 45 patients belong to dry ear group and 45 patients belong to wet ear group. Tympanomastoidectomy was done through post-auricular approach was used in all patients. The sutures were removed after 1 week of surgery and regular follow-up took place at 3rd week, 6th week and 12th week postoperatively. Graft uptake and complications were evaluated in each visit. Hearing improvement evaluated with the help of pure tone audiometry at 3rd month and compared with preoperative pure tone audiometry. In speech frequency of 0.5, 1 and 2 KHz the hearing gain was evaluated.

Results: Hearing improvement is noted in 29 (63.3%) patients in dry ear group and 29 (63.3%) patients in wet ear. 15 (33%) patients had hearing improvement in the range of 6-10 dB in wet ear patients and 18 (40%) patients had hearing improvement of more than 10 dB in dry group. Successful graft uptake was noted in 91.11% of dry ears and 86.66% of wet ears. Graft failure was noted in 4 patients in dry ears and 6 patients in wet ears. Persistent ear discharge was seen in 4.44% in the dry ear and in 13.33% of wet ear cases.

Conclusion: Presence of mucoid discharge which is culture negative at the time of surgery does not affect the success rate of surgery as it does not interfere much with the results of tympanoplasty.

Keywords: Tympanomastoidectomy, Chronic Otitis Media, Dry Ear, Wet Ear, Ear Discharge, Graft Uptake, Hearing Gain.

INTRODUCTION

Chronic otitis media (COM) is a common condition seen in patients attending otorhinolaryngology clinic. The diagnosis of chronic otitis media (COM) implies a permanent abnormality of the pars tensa or flaccida most likely a result of earlier otitis media with effusion (OME), negative middle ear pressure or otitis media with effusion. The distinction remains between active COM where there is inflammation and the production of pus and inactive COM where this is not the case.¹ Otitis Media refers to a group of complex infectious and inflammatory diseases affecting the middle ear.²

It is widely believed that COM often starts with episodes of acute otitis media or otitis media with effusion (OME) in childhood. OME may lead to thinning of the tympanic membrane, hearing loss and delayed speech development. Active COM is chronic inflammation of the middle ear and mastoid mucosae, with recurrent discharge (at least 2 weeks).³

Otitis media is generally very common as studies show that around 80% of children should have experienced at least one episode by their 3rd birthday.⁴ COM is further

classified into healed COM, inactive (mucosal) COM, inactive (squamous) COM, active (mucosal) COM, active (mucosal) COM and active(squamous) COM.⁵

The otologist must decide whether to operate on the discharge-producing ear. This is due to the widespread belief that the success rate while doing tympanoplasty on wet ear is decidedly inferior.⁶

The patient appears to be visiting the hospital more frequently as a result of the time needed to make an actively discharged ear dry being highly variable and unexpected. In our country patients coming from remote and far-flung areas, find it difficult to maintain a regular follow-up with additional financial burden of catering multiple antibiotic courses. Extensive counselling and high grade of motivation is required to keep these groups of patients motivated for prolonged treatment duration.⁶

Despite proper antibiotic therapy, acute otitis media may progress to chronic suppurative otitis media characterized by a persistent drainage from the middle ear associated with a perforated ear drum. The majority of adults (~80%) presenting with COM report a hearing impairment and approximately 70% an ear discharge.⁷



The primary role of canal wall up tympanomastoidectomy (CWU) is in the control of chronic otitis media. It is also used as a standard approach for cochlear implantation, excision of tumours and surgery for vertigo. Cortical mastoidectomy is a transcortical opening of the mastoid cells and the antrum. It is the initial stage of any transmastoid surgery of the middle ear, inner ear, facial nerve, endolymphatic sac, labyrinth, internal auditory canal & for procedures on skull base.^{7,8}

Combined approach tympanoplasty consists of a large mastoidectomy with an intact but thin bony ear canal and a posterior atticotomy. Two phases make up the intact canal wall approach. First stage is removal of cholesteatoma and repair the tympanic membrane. Second stage aims to improve hearing by ossicular chain reconstruction.^{7,8}

Only a few research have found that ear discharge increases transplant uptake. There are various studies which have reported better healing of the tympanic membrane after myringoplasty in a discharging ear with nearly 100% of success rate, and up to 75% in dry ear.⁹⁻¹¹ They associated these superior outcomes to the likely rise in middle ear blood supply. They have commented that contrary to popular articles in the literature, discharging ear in children favours good outcome and should be operated on, regardless of age and site of perforation.^{7,8}

The successful closure rate for trainees was 78% compared to expert surgeons which was 95%. Successful outcome seems to be significantly influenced by the expertise of the surgeon. Certain other studies have found no influence of the condition of the condition of the ear at the time of surgery on the subsequent graft take up rate.^{12,13}

Herewith this study is undertaken to compare surgical outcome of canal wall up tympanomastoidectomy in dry and wet ear. The objectives were to compare the success of graft uptake in dry and wet ears and to compare post op hearing improvement in dry ear and wet ear following canal wall up tympanomastoidectomy.

MATERIALS AND METHODS

This was a prospective observational study and hospital-based study. This study was undertaken after assent from the Institute Ethical Committee. After taking written informed consent, data for the study was collected from the patients who presented with complains of ear discharge both active and inactive and underwent canal wall up tympanomastoidectomy in the Department of Otorhinolaryngology at tertiary care hospital of eastern India from September 2019 to August 2021.

Consecutive sampling method was used and every patient planned for canal wall up tympanomastoidectomy fulfilling inclusion and exclusion criteria and giving written informed consent were enrolled in the study. The study was carried out on 90 patients who underwent canal wall up tympanomastoidectomy. Of these 45 patients belong to dry ear group and 45 patients belong to wet ear group.

Inclusion Criteria: Patients of either gender of age less than 60 years with small, medium, large, and subtotal central perforation were enrolled in the study. Patients with mild, mucoid, or mucopurulent discharge were defined as wet ear and patients with dry ear for at least six months were kept in dry ear group.

Exclusion Criteria: Patients with more than 60 years of age or patients having total and attic perforation or with copious, purulent, foul smelling and blood-stained discharge or having evidence of active disease in nose, paranasal sinuses, and throat or with COM with complications.

A predesigned proforma was used to record the relevant information (patients' data, clinical findings, investigation reports) from the individual patient selected with inclusion and exclusion criteria. Detailed history of patient was taken. General physical and systemic examination, examination of nose, throat, and paranasal sinuses, was especially for any source of chronic infection or allergy. Otoloscopic and otomicroscopic examination done thoroughly. Hearing evaluation was done with tuning forks. Pure tone audiometry was done with proper masking in sound treated room. X-ray mastoid was taken in all cases. X-ray paranasal sinuses and chest was done as and when required. Relevant laboratory investigations including – haemogram and urine routine was done. One day before operation, patients were admitted to the hospital.

Shaving of hair of the post-auricular region 3 cm inside the hair line done. Injection Tetanus toxoid 0.5 ml given intramuscularly and injection lignocaine 2% 0.2 ml test dose given intradermally and observed for any hypersensitivity reactions in all cases. All cases were done under general anaesthesia. 2% lignocaine with adrenaline infiltration given to skin of external auditory canal at 12'O clock, 3'O clock, 6'O clock and 9'O clock and also over skin of post-auricular region. Post-auricular William Wilde's incision given and temporalis fascia as a graft was taken in all cases. Post-auricular approach was used in all patients. Tympanic membrane was visualized and margin of perforation was freshened by curved pick. The under surface of remnant tympanic membrane was curetted. The post-auricular incision was deepened and 'V' shaped incision was taken over the periosteum and posterior canal skin was elevated upto bony cartilaginous junction. Post-auricular skin flap was incised from 6'O clock to 12'O clock at bony cartilaginous junction to enter into external auditory canal. The incision was extended from 6'O clock to 4'O clock and 12'O clock to 2'O clock anteriorly.

The tympanomeatal flap was elevated & middle ear was inspected and status of ossicles was noted. The canal wall up mastoidectomy was done by exenterating all the accessible mastoid air cells. Boundaries of McEwen's triangle are marked by three cuts. The first cut is marked along the linea temporalis. Second cut lies posterior and parallel to posterior meatal wall towards the mastoid tip. Third cut is drawn perpendicular to first cut and tangential



to the second cut. Cortical bone is removed with continuous irrigation. Wide saucerization is done, delineating tegmen plate superiorly, meatal wall anteriorly and sigmoid sinus posteriorly. Presence of any diseased mucosa or aditus block was checked. Patency of aditus was established and confirmed by seeing the flow of saline into middle ear from antrum. The temporalis fascia graft was placed by underlay technique in all cases. The graft was placed under the skeletonized handle of malleus and tucked anteriorly under the rim of the perforation. The graft was supported by a few pieces of dry gel foam. Before placement of graft, the administration of nitrous oxide was stopped in order to prevent accumulation of gas in the middle ear there by interference with the laying of the graft. The tympanomeatal flap was repositioned. Gel foam soaked with antibiotic drops is placed in EAC. Periosteum, subcutaneous tissue and skin are sutured in layers and mastoid dressing was done.

Post-operatively, patients were put on antibiotics, analgesics, antihistamines for 3 weeks and topical nasal decongestants were used if necessary. The mastoid dressing was removed after 24 hours of surgery and patient were discharged with small post aural dressing. The sutures were removed after 1 week of surgery and regular follow-up took place at 3rd week, 6th week and 12th week postoperatively. Graft uptake and

complications were evaluated in each visit. Hearing improvement evaluated with the help of pure tone audiometry at 3rd month and compared with preoperative pure tone audiometry. In speech frequency of 0.5, 1 and 2 KHz the hearing gain was evaluated.

Statistical Analysis

Data collected were presented in tabular form using Microsoft Excel 365 and transferred to SPSS version 24. The baseline characteristics such as age, gender, side effected, duration of disease, status of opposite ear, perforation size, middle ear status, cellularity of mastoid, and status of antrum and outcome measures after surgery such as hearing gain, graft uptake, and control of ear discharge were expressed as categorical data in the form of frequency and percentage. Chi-square test was done to evaluate statistical significance of difference of these parameters between wet and dry group with a p-value of 0.05 as measure of statistical significance.

RESULTS

The study involved analysis of cases registered in the department of ENT of tertiary care centre of eastern, India during observation period September 2019 to August 2021. Baseline demographic and clinical characteristics of study participants is given in table 1.

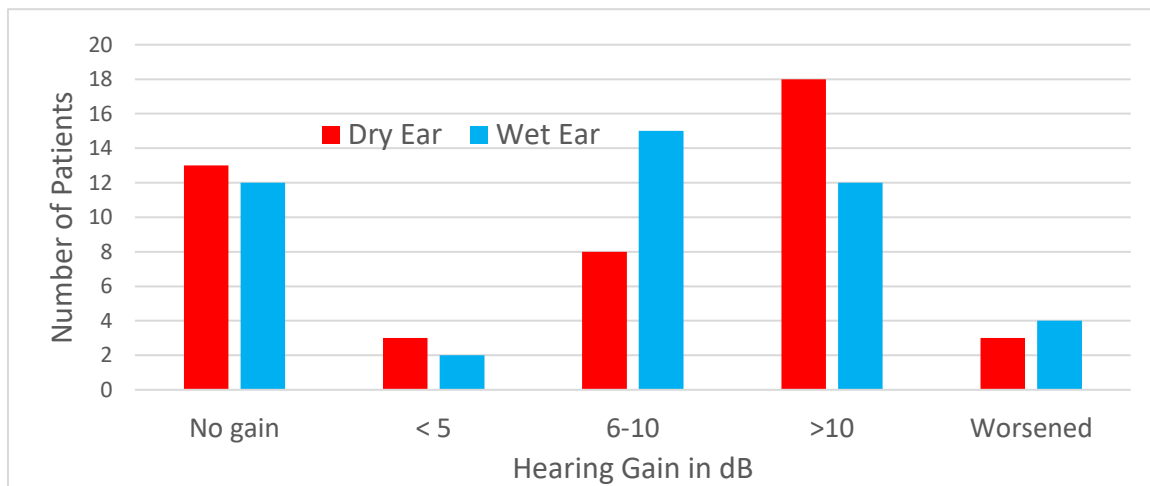


Figure 1: Comparison of Hearing Gain following Surgery between Dry and Wet Group

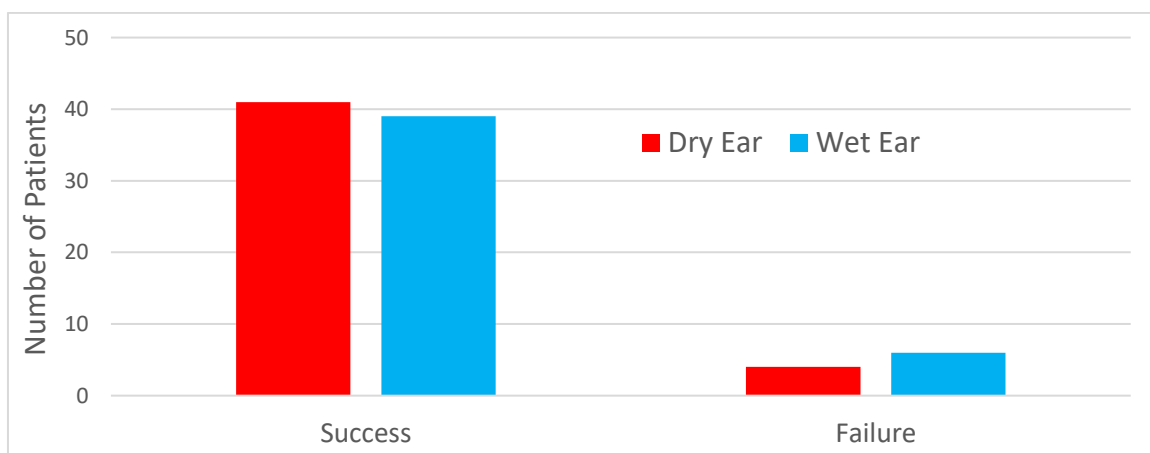


Figure 2: Comparison of Graft Uptake following Surgery between Dry and Wet Group



Table 1: Comparison of Baseline Demographic and Clinical Characteristics between Dry and Wet Group

Variables	Number of Cases (%)		P-Value (Chi-Square Test)
	Dry Ear (n = 45)	Wet Ear (n = 45)	
Age			
<20 Years	5 (11.11%)	6 (13.67%)	0.48
21-30	21 (46.67%)	20 (44.44%)	
31-40 Years	12 (26.67%)	14 (31.11%)	
41-50 Years	4 (8.89%)	2(4.44%)	
51-60 Years	3 (6.67%)	3 (6.34%)	
Gender			
Male	26 (57.77%)	30 (66.67%)	0.38
Female	19 (42.22%)	15 (33.33%)	
Side Effected			
Left	16 (35.56%)	23 (51.11%)	0.14
Right	29 (64.44%)	22 (48.89%)	
Duration of Disease			
< 5 Years	28 (62.22%)	30 (66.67%)	0.57
5-10 Years	11 (24.44%)	12 (26.67%)	
> 10 Years	6 (13.33%)	3 (6.67%)	
Status of Opposite Ear			
Bilateral	19 (42.22%)	12 (26.67%)	0.12
Unilateral	26 (57.78%)	33 (73.33%)	
Size of Perforation			
Small	11 (24.44%)	7 (15.55%)	0.74
Medium	12 (26.67%)	12 (26.67%)	
Large	12 (26.67%)	15 (33.33%)	
Sub-total	10 (22.22%)	11 (24.44%)	
Status of Middle Ear Mucosa			
Erythema	5 (11.11%)	25 (55.56%)	<0.0001
Hyperaemic	12 (26.67%)	13 (28.89%)	
Normal	28 (62.22%)	7 (15.56%)	
Cellularity of Mastoid			
Cellular	15 (33.33%)	8 (17.78%)	0.23
Partially Sclerotic	3 (6.67%)	3 (6.67%)	
Sclerotic	27 (60.00%)	34 (75.56%)	
Status of Antrum			
Granulation Tissue	4 (8.89%)	2 (4.44%)	0.70
Normal	38 (84.44%)	40 (88.89%)	
Polypoidal Mucosa	3 (6.67%)	3 (6.67%)	

Table 2: Comparison of Hearing Gain following Surgery between Dry and Wet Group

Hearing gain in dB	Number of Cases (%)		P-Value (Chi-Square Test)
	Dry Ear (n = 45)	Wet Ear (n = 45)	
No gain	13 (28.88%)	12 (26.67%)	0.44
< 5	3 (6.67%)	2 (4.44%)	
6-10	8 (17.77%)	15 (33.33%)	
>10	18 (40.00%)	12 (26.67)	
Worsened	3 (6.67%)	4 (8.89%)	

Table 3: Comparison of Graft Uptake following Surgery between Dry and Wet Group

Graft Uptake	Number of Cases (%)		P-Value (Fisher's Exact Test)
	Dry Ear (n = 45)	Wet Ear (n = 45)	
Success	41 (91.11%)	39 (86.66%)	0.74
Failure	4 (8.89%)	6 (13.33%)	

Successful graft uptake was noted in 91.11% of dry ears and 86.66% of wet ears. Graft failure was noted in 4 patients in dry ears and 6 patients in wet ears.

Table 4: Comparison of Control of Ear Discharge Post Operatively between Dry and Wet Group

Graft Uptake	Number of Cases (%)		P-Value (Fisher's Exact Test)
	Dry Ear (n = 45)	Wet Ear (n = 45)	
Success	43 (95.56%)	39 (86.66%)	0.27
Failure	2 (4.44%)	6 (13.33%)	

Hearing improvement is noted in 29 (63.3%) patients in dry ear group and 29 (63.3%) patients in wet ear also worsening of hearing impairment was noticed in 3 (6%) dry ear group and 4 (9%) patients of wet ear group. 15 (33%) patients had hearing improvement in the range of 6-10 dB in wet ear patients and 18 (40%) patients had hearing improvement of more than 10 dB in dry group. However, no statistical significance ($p>0.05$) was found on comparing both groups with respect to hearing improvement.

Persistent ear discharge was seen in 4.44% in the dry ear and in 13.33% of wet ear cases.

DISCUSSION

A surgical procedure known as a tympanomastoidectomy cleans out the infection and returns the middle ear's function to ears that have had chronic otitis media. The materials the surgeon selects for the tympanic membrane graft are used in this procedure, which is carried out using surgical methods. Numerous studies have looked into the effects of a variety of variables, including gender, age, the extent of the perforation, the condition of the other ear, the ear's discharge condition at the time of operation, surgical procedures and methods, and the materials used for the graft. According to these studies, the majority of hospitals mainly employ the strategies and methods that their own surgeons find most effective.¹⁴

Robert and associates looked at the causes of re-perforation after myringoplasty surgery. They examined the effects of gender, age, ear discharge, the condition of the other ear, loss of hearing, surgical strategy, and surgical method on the outcomes of myringoplasty. They finally identified the method of surgery as the more important element in the success of myringoplasty based on their statistical analysis.¹⁵

Similar to this, in our study, variables including gender, age, and ear discharge had no influence on how the outcome of tympanomastoidectomy.

Ashfaque and associates looked at the outcomes of 100 COM patients with dry ear who underwent type 1 tympanoplasty with internal graft approach (underlay).

They came to the conclusion that the majority of patients (81%), who had tympanic perforations, had them initially closed after the operation, and their hearing had improved noticeably. However, gender, age, and the extent of the perforation had no appreciable impact on the outcomes of tympanoplasty.¹⁶

In our investigation, COM patients with dry ear had a greater graft uptake rate (95.56%) than in the previously mentioned study, and gender and age also had no significant impact on the surgical outcomes.

Vijendra and colleagues (2007) conducted histological studies on the patients' residual tympanic membranes with the assumption that tympanoplasty in totally dry and atrophic ears with centralized perforations is more inclined to fail than in wet ears with centralized perforations. They noticed that blood vessels are distinctly marginalized in fully dry and atrophic membranes, whilst the membranes are either missing or as tiny as feasible. On the contrary, the rest of the membranes of the wet ears were packed with inflammatory cells and blood vessels.

Researchers therefore came to the conclusion that the main reasons for failure in fully dry and atrophic membranes with centralized perforations are these kinds of alterations in blood vessels. Therefore, they advised raising wide tympanomeatal flaps, placing temporal fascia grafts between the bony wall of the canal and the large bloody flap, and resecting the perforation margins and turning central perforations into subtotal while performing on these kinds of ears and membranes. They suggest that by taking these parameters, the likelihood of a successful procedure is increased. Contrary to Vijendra's findings, COM patients with dry ear had a higher rate of graft integration than patients with dry ear (95.56% vs. 86.66%). This distinction, nevertheless, was not statistically significant.¹⁷

Nagle and associates looked studied the outcomes of type 1 tympanoplasty in a group of 100 individuals who had ruptured tympanic membranes and either wet ears or dry ears. Additionally, they contrasted the two groups' membrane perforations' closure rates and auditory health.



Results revealed that after the operation, the ruptured membrane had been healed in 88% of patients with dry ear and 74% of patients with wet ear. However, there was no statistically significant difference between dry and wet ear group. Patients in both groups experienced a significant improvement in their hearing status as well, although there was no discernible difference between them.¹⁸

The findings of our research were consistent with Nagle's study, and the rate of graft uptake were almost similar in both groups. Compared to Nagle's study, our study had higher frequencies of both group of patients with wet and dry ear.

There was not a statistically significant distinction between patients with wet and dry ear in terms of graft uptake and auditory improvement, according to Hosney and colleagues' study of the outcomes of myringoplasty in patients with wet and dry ear.¹⁹

Limited number of patients and inability for long term follow-up of patients were limitation of our study. However, the results definitely add to existing evidence and suggest need for multi-centered study with long term follow-up.

CONCLUSION

We had a success rate of 91.11% in dry ears and 86.66% in wet ears. Presence of mucoid discharge which is culture negative at the time of surgery does not affect the success rate of surgery as it does not interfere much with the results of tympanoplasty. There is no significant difference in the success rate in both the dry and culture negative wet ears in our study. Hearing improvement, graft uptake and clinical improvement were found to be statistically insignificant between both groups. Hence, in culture negative wet ears, the patients can be taken up for surgery without waiting for the ear to become dry. In most of the cases of wet ear the patients do not come on subsequent follow ups, leading to loss in the number of cases and complications on the patients' part. The aim of conducting the study was to be able to operate on dry as well as wet ear which will be more helpful.

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