

A comparative study of canal wall up tympanomastoidectomy in dry and wet ear

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Abstract

Background: Chronic suppurative otitis media is a common condition seen in patients attending otorhinolaryngology clinic. The discharging ear presents the otologist with the dilemma of operating on it or not. This is due to the widespread belief that the success rate while doing tympanoplasty on wet ear is decidedly inferior. Here with a study is under taken to compare surgical outcome of canal wall up tympanomastoidectomy in dry and wet ear. **Objectives:** To compare the success of graft uptake in dry and wet ears. To compare the post-operative hearing improvement in dry and wet ear following canal wall up tympanomastoidectomy. **Methods:** The comparative study was carried out on total 60 patients with chronic otitis media with central perforation. Of these 30 patients belong to dry ear group and 30 patients with mild, mucoid discharge as wet ear group. All patients underwent canal wall up tympanomastoidectomy under general anesthesia. Post-operatively all patients were evaluated for graft uptake and hearing improvement by pure tone audiometry at 3rd month follow-up. **Results:** In our study, the successful graft uptake was seen in 76.7% in dry ear and 80% in wet ear, statistically p-value is 0.75 (p>0.05) which is insignificant. Postoperatively hearing gain was (0-5 dB) in 2 patients with dry ear and 1 patient with wet ear; (6-10 dB) in 5 patients with dry ear and 10 patients with wet ear; more than 10 dB in 12 patients with dry ear and 8 patients with wet ear, statistically p-value is 0.55 (p>0.05) which is insignificant. **Conclusion:** The very fact that the p-value is insignificant in both, the graft uptake and hearing improvement, shows that the presence of discharge in the ear at the time of operation does not interfere with the result of canal wall up tympanomastoidectomy.

Keywords: canal wall up tympanomastoidectomy, dry ear, wet ear.

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Introduction

Chronic suppurative otitis media is a long standing infection of a part or whole of middle ear cleft. It is a common condition seen in patients attending the Otorhinolaryngology clinic and is characterized by ear discharge, a permanent perforation and impairment in hearing. It is a single most important cause for hearing impairment in rural population.

Repairing of the tympanic membrane by performing tympanoplasty may lead to considerable benefit on patients with tympanic membrane perforation.

These benefits include prevention of ear infections and aural discharge, improvement in hearing, ease of hearing aid usage and elimination of the need to take water precautions when showering, washing hair and swimming. Despite the high success rate and the routine nature of the procedure, the effect of many influencing factors remains unresolved. These include the age of the patient, site and size of perforation, length of time the ear has been dry prior to surgery, the presence of infection at the time of surgery and the status of the opposite ear. The discharging ear presents the otologist with the dilemma of operating on it or not. This is due to the widespread belief that the success rate while doing

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tympanoplasty on wet ear is decidedly inferior. There are also significant variations in the reported success rates for achieving graft uptake and hearing improvement after tympanoplasty in dry and wet ear. Here with a study is undertaken to compare surgical outcome and factors influencing success of canal wall up tympanomastoidectomy in dry and wet ear.

Objectives of the present study

To compare the success of graft uptake and post-operative hearing improvement in dry and wet ear following canal wall up tympanomastoidectomy.

Materials and methods

Data for the study was collected from the patients who underwent canal wall up tympanomastoidectomy in the Department of Otorhinolaryngology, Saraswati Medical College, Unnao, Uttar Pradesh from November 2017 to November 2019.

Method of collection of data

A pre-designed proforma was used to record the relevant information (patients data, clinical findings, investigation reports) from the individual patient selected with inclusion and exclusion criteria.

The study was carried out on 60 patients who underwent canal wall up tympanomastoidectomy. Of these 30 patients belong to dry ear group and 30 patients belong to wet ear group.

Inclusion criteria

- Age between 15-45 years in both sexes.
- Patients with small, medium, large and subtotal central perforation.
- Patient with mild, mucoid or mucopurulent discharge as wet ear.

Exclusion criteria

- Total and attic perforation.
- Patients with copious, purulent, foul smelling, blood stained discharge.
- Patients having evidence of active disease in nose, paranasal sinuses and throat.
- Patient with CSOM with complications.

Method

These selected patients were subjected to clinical, audiological, radiological and laboratory investigations.

The patterns of examination followed was

- Detailed history of patient.
- General physical and systemic examination.
- Examination of nose, throat and paranasal sinuses, especially for any source of chronic infection or allergy.
- Otosopic 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. Written informed consent was taken in all cases.
- Shaving of hair of the post-auricular region 3 cms 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 and 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 patient 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. The results were tabulated and statistical analysis was done.

Statistical analysis

Results are expressed as number and percentages. Chi-square test was used to analyse categorical data. p-value of 0.05 or less was considered for statistical significance.

Results

Table 1: Percentage of Dry and wet ear

Age group in years	Dry ear	%	Wet ear	%
15-25	20	66.7	18	60
26-35	8	26.7	4	13.3
36-45	2	6.7	8	26.7

In our study, most of the patients were in the age group of 15-25 yrs, 20(66.7%) patients in dry ear group, 18(60%) patients in the wet ear were in this age group. 2

patients were present in dry ear group between 36-45 yr age group.

Table 2: Sex distribution

Sex	Dry ear	%	Wet ear	%
Male	17	56.7	15	50
female	13	43.3	15	50

In dry ear group, male to female distribution was 1.3: 1. In wet ear group male to female distribution was 1:1

Table 3: Side affected

Side affected	Dry ear	%	Wet ear	%
Right	7	23.3	7	23.3
Left	8	26.7	6	20
Bilateral	15	50	17	56.7

Bilateral ear discharge was found in 17(56%) patients in wet ear group compared to 15 (50%) patients in dry ear group. In dry group, unilateral discharge seen in

7(23.3%) on right and 8(26.6%) on left side. In wet group, unilateral discharge seen in 7(23.3%) on right and 6(20%) on left side.

Table 4 : Presenting complaints

Presenting complaint- duration of ear discharge (yrs)	Dry ear	%	Wet ear	%
0-5	12	40	13	43.3
6-10	10	33.3	10	33.3
11-15	5	16.7	4	13.3
>15	3	10	3	10
Type of discharge				
Mucoid	12	40	14	46.7
Mucopurulent	18	60	16	53.3
Duration of hearing impairment (yrs)				
0-5	27	90	21	70
6-10	3	10	8	26.7
>10	0	0	1	3.3

In both the groups majority of the patients had history of ear discharge for less than 10 years duration. History of mucopurulent type of discharge was found in majority

of patients of both group, 60% in dry ear. 53.3% in wet ear. 90% of patients had impaired hearing of less than 5 year duration in dry group and 70% in wet ear group.

Table 5: Examination findings

Examination findings	Size of perforation	Dry ear	%	Wet ear	%
Small		9	30	5	16.7
Medium		14	46.7	9	30
Large		6	20	9	30
Subtotal		1	3.3	7	23.3
Margin of perforation					
Congested		0	0	25	83.3
Congested and edematous		0	0	5	16.7
Dry		23	76.7	0	0
Thinned out		7	23.3	0	0
Status of middle ear mucosa					
Congested		0	0	20	66.7
Congested and edematous		0	0	5	16.7

Not applicable in small perforations	5	16.7	5	16.7
Normal	17	56.7	0	0
Pale	8	26.7	0	0

In dry ear group, small central perforation was found in 9 (30%) patients, Medium sized perforation was found in 14 (46%) patients, large perforation was found in 6 (20%) of patient, and subtotal perforation was found in 1(3%) patient. In wet ear group, small central perforation was found in 5 (16%) patients, Medium and larger sized perforations were found in 9 patients (30%) each, and subtotal perforation was found in 7(23%) patients. In dry group, margins of the perforation was dry in 23 (76.7%)

patients and thinned out in 7 (23%) patients. In wet group, margin of perforation were congested in 25(83.3%) and congested and edematous in 5 (16.7%) of patients. Middle ear mucosa was congested in 20 (66.7%) patients, congested and edematous in 5 (16%) patients in wet group. Status of the Middle ear mucosa was not considered in small central perforations. In dry group, middle ear mucosa was normal in 17(56.7%) and pale in 8(26.6%).

Table 6: X- ray Mastoids

X- ray mastoid	Dry ear	%	Wet ear	%
Sclerosed	17	56.7	25	83.3
Pneumatized	13	43.3	5	16.7

25 Patients (83.7%) had sclerotic pattern of temporal bone in affected side in wet group compared to 17 patients (56.7%) in dry ear group.

Table 7: Graft uptake

Graft uptake	Dry ear	%	Wet ear	%
Taken	23	76.7	24	80
Not taken	7	23.3	6	20

In our study, graft was taken in 23(76.7%) patients in dry group, and 24(80%) in wet group. Graft was not taken in 7 patients (23.3%) in dry group, and 6(20%) in wet group. However there was no statistical significance (p=0.75) was found on comparing both groups with respect to graft uptake.

Table 8: Hearing gain following surgery

Hearing gain	Dry ear	%	Wet ear	%
No gain	9	30	8	26.7
<5 dB gain	2	6.7	1	3.3
6-10dB gain	5	16.7	10	33.3
>10 dB gain	12	40	8	26.7
Worsened	2	6.7	3	10

Hearing improvement is noted in 19 (63.3%) patients in dry ear group, and 19 (63.3%) in wet ear also.

Worsening of hearing impairment was noticed in 2(6%) in dry group compared to 3(9%) patients in

wetgroup.10(33%) patients had hearing improvement in the range of 6-10dB in wet ear patients, and 12(40%) patients had hearing improvement of more than 10 dB in

dry group. However there was no statistical significance (p=0.55) was found on comparing both groups with respect to hearing improvement.

Table 9: Status of ear following surgery

Status of ear	Dry ear	%	Wet ear	%
Dry ear	27	90	24	80
Persistent wet ear	3	10	6	20

In our study, complete dry ear was obtained in 27 patients (90%) in dry ear group, and 24 (80%) of wet ear group. However there was no statistical significance (p=0.28) was found on comparing both groups with respect to status of ear following surgery.

Table 10: History of ear discharge

Presenting complaint- duration of ear discharge (in yrs)	Dry ear						Wet ear					
	Total no of dry ears	Improvement in hearing			Graft uptake		Total no of wet ear	Improvement in hearing			Graft uptake	
		Improved n(%)	Not improved	Worsened	Graft taken	Not taken		Improved n(%)	Not improved	Worsened	Graft taken	Graft not taken
0-5 years	12	11 (91.7)	1 (8.3)	0 (00)	12 (100)	0 (00)	13	9 (69.3)	3 (23)	1 (7.7)	12 (92.3)	1 (7.7)
6-10	10	4 (40)	5 (50)	1 (10)	6 (60)	4 (40)	10	5 (50)	3 (30)	2 (20)	7 (70)	3 (30)
11-15	5	2 (40)	2 (40)	1 (20)	2 (40)	3 (60)	4	2 (50)	2 (50)	0 (00)	2 (50)	2 (50)
>15	3	2 (66.7)	1 (33.3)	0 (00)	3 (100)	0 (00)	3	3 (75)	1 (25)	0 (00)	3 (100)	0 (00)
Type of discharge												
Mucoid	12	8 (66.7)	4 (33.3)	0 (00)	11 (91.7)	1 (8.3)	14	9 (64.3)	4 (28.6)	1 (10.1)	12 (85.7)	2 (14.3)
Mucopurulent	18	11 (61.1)	5 (27.8)	2 (12.1)	12 (66.7)	6 (33.3)	16	10 (62.5)	4 (25)	2 (12.5)	12 (75)	4 (25)
Duration of hearing impairment (in yrs)												
0-5 years	27	17 (70)	9 (33.3)	1 (6.7)	21 (77.8)	6 (22.2)	21	14 (66.7)	6 (28.6)	1 (4.8)	19 (90.5)	2 (9.5)
6-10	3	2 (75)	0 (00)	1 (25)	2 (75)	1 (25)	8	5 (62.5)	1 (12.5)	2 (25)	5 (62.5)	3 (37.5)
>10	0	0 (00)	0 (00)	0 (00)	0 (00)	0 (00)	1	0 (00)	1 (100)	0 (00)	0 (00)	1 (100)

In our study, patients with history of ear discharge for (0-5yrs), (6-10yrs), (11-15yrs), and (>15yrs) showed

hearing improvement in 11(91.7%), 4(40%), 2(40%), and 2(66.7%) patients respectively and graft

uptake was seen in 12(100%), 6(60%), 2(40%), and 3(100%) patients in dry ear group. In wet group, hearing improvement was noted in 9(69.3%), 5(50%), 2(50%), and 3(75%) patients and graft uptake in 12(92.3%), 7(70%), 2(50%), and 3(100%) patients respectively. In our study, in patients with history of mucoid discharge showed hearing improvement in 8(66.7%) and graft uptake in 11(91.7%) patients in dry ear and in wet ear 9(64%) and 12(85.7%) respectively. In patients with history of mucopurulent discharge hearing improvement

in 11(61.1%) and graft uptake in 12(66.7%) patients in dry ear and in wet ear 10(6.5%) and 12(75%) of patients respectively. In our study, patients with history of duration of hearing impairment (0-5yrs), (6-10yrs) showed improvement in hearing in 17(70%) , 2(75%) and graft uptake in 21(77.8%), 2(75%) of patients respectively in dry ear. In wet ear hearing improvement in 14(66.7%), 5(62.5%) and graft uptake in 19(90.5%), 5(62.5%) of patients respectively.

Table 11: Surgical outcome in relation to margin of perforation

Margin of perforation	Dry ears						Wet ears					
	No of patients	Hearing improvement			Graft uptake		No of patients	Hearing improvement			Graft uptake	
		Improved n(%)	Not improved n(%)	Worsened n(%)	Graft taken n(%)	Graft not taken n(%)		Improved n(%)	Not improved n(%)	Worsened n(%)	Graft taken n(%)	Graft not taken n(%)
Congested	0	-	-	-	-	-	25	16 (64)	7 (28)	2 (8)	20 (80)	5(20)
Congested and edematous	0	-	-	-	-	-	5	3(60)	1 (20)	1 (20)	4(80)	1(20)
Dry	23	16(69.6)	6 (26.0)	1 (4.3)	19 (82.6)	4 (17.4)	0	-	-	-	-	-
Thinned out	7	3 (42.8)	3 (42.8)	1 (14.3)	4 (57.1)	3 (42.8)	0	-	-	-	-	-
	X ² =1.65,p=0.20,NS			X ² =1.95,p=0.16,NS			X ² =0.03,p=0.87,NS			No difference		

In dry group, hearing improvement was observed in 16(69.6%) patients with dry margin when compared to 3(42.8%) of patients with thinned out margin. Graft uptake was successful in 19(82.6%) patients with dry margin and 4(57.1%) of patients with thinned out margin. In wet group, hearing improvement was observed in 16(64%) patients with congested margin of perforation and 3(60%) patients with congested and edematous margin of perforation. Graft uptake was successful in 20(80%) patients with congested margin of perforation and 4(80%) patients with congested and edematous margin of perforation.

In our study, maximum patients with chronic otitis media attending outpatient department for surgical treatment are in the middle age and predominantly in 15-25 year age group. The early presentation may be due to increased awareness to health issues and difficulty in hearing affecting the work efficiency, leading patients and parents to seek early medical intervention. Saurabh Varshney observed similar finding that the number of cases in the 16- 25 year age group was (51.3%), and this formed the largest group in their study[1]. Similar observation were also found in various other studies also[2].

Discussion

Age distribution

Sex distribution

There is no sex predilection for disease in our study. In dry ear group, male to female distribution was 1.3: 1. In

wet ear group male to female distribution was 1:1. Saurabh Varshney observed that distribution of chronic otitis media in male to female was 1.00:1.08 [36].

Side affected

In our study, incidence of bilateral ear discharge was found in 56% cases in wet ear group compared to 50% cases in dry ear group. But for unilateral ear discharge, there is no difference noted between side of predilection in both groups.

Presenting complaints

In both groups, duration of the discharge showed no significant difference. Majority of the cases presented had ear discharge lasting for less than 10 yrs. Only 10% of cases were seen with ear discharge lasting for more than 15 years. Poor socio-economic status of the patient, difficulty in accessing the medical care in their near hood are some of the risk factors for leaving the disease at natural course. AO Lasini observed that majority of patients who presented had ear discharge as major complaint and duration was more than 10 years [3]. Majority of the patients in both the group had intermittent mucopurulent discharge.

Surgical outcome in relation to

Duration of ear discharge

In our study we found that, as the duration of the discharge increases, chances of hearing improvement and graft uptake were less. This association was found when the duration of discharge was more than 5 years in dry ears. This is because of persistent inflammation within middle ear cleft, long standing disease, destruction of ossicles, fibrosis and adhesions in the middle ear. In wet ear group, increased chance of graft uptake and improvement in hearing was noticed when the duration of the discharge was less than 5 years. As duration increased, graft failure and no improvement of hearing was observed.

Duration of hearing impairment

In our study, pre operative long standing hearing impairment more than 5 years adversely affected the post operative hearing gain, both in dry ear and wet ear groups. In patients with long standing hearing impairment, probable irreversible damage to the conductive apparatus would contribute to the poor post operative outcome.

Graft uptake in relation to dry and wet ear

In our study, the successful graft uptake following canal wall up tympanomastoidectomy was seen in 76.7% in dry ear and 80% in wet ear with no statistical significance ($p=0.75$) between the two groups in relation to graft uptake. In a study by Yasuo Mishiro et al., graft

success rates for dry ear was 90.7% and 90.0% for discharging ear following tympanoplasty with mastoidectomy [4]. Anita Krishnan et al., observed that chances of tympanic membrane graft giving way was more in quiescent ears though the percentage is not statistically accurate because smaller number analyzed this group but hearing improvement in ears where the graft and ossicular reconstruction has survived is same, irrespective of whether ear is dry or quiescent at surgery [5]. In our study, we did canal wall up mastoidectomy in both dry and wet ear to check for presence of diseased mucosa, aditus block and also restoring the connection between the middle ear and mastoid, a more normal physiological relationship can be established. In accordance with Boyle's Law, the additional volume created by the surgically opened mastoid would restore the pressure-buffering effect of the mastoid air cell system and thereby reducing the chance for surgical failure.

Hearing improvement in relation to dry and wet ear

In our study, hearing improvement is noted in 19 (63%) patients in dry ear group, and 19 (63%) in wet ear also. And also 10 (33%) patients had hearing improvement in the range of 6-10 dB in wet ear patients, and 12 (40%) patients had hearing improvement of more than 10 dB in dry group. However there was no statistical significance ($p=0.55$) was found on comparing both groups with respect to hearing improvement. Hatice Emir et al found that post operative hearing gain was 47.3% in dry ears and 40.7% in wet ears [6].

Surgical outcome in relation to

Size of perforation

In dry group, size of the perforation adversely affects the post operative hearing improvement and graft uptake. This can be attributed to thin nature of the remnant tympanic membrane and reduced vascularity to the margins of perforation. In wet group, size of the perforation was found to be adversely affecting the post operative hearing improvement but not with respect to graft uptake. This can be attributed to thick residual tympanic membrane and increased vascularity of the inflamed tympanic membrane.

Margin of perforation

In our study, in dry ear group hearing improvement 42.8% and graft uptake rate 57.1% cases with thinned out margin when compared to 69.6% and 82.6% in cases with dry margin of perforation. Our finding correlates with Vijayendra H et al observation that graft failure rate is more in totally dry thinned out perforations than in wet perforation mainly because of

avascularity of remnant tympanic membrane in totally dry central perforation[7].But in wet group, hearing improvement and graft uptake rate were found similar in cases with congested margin and in cases with congested and edematous margin of perforation.

Status of middle ear mucosa

In our study, hearing improvement was observed in 58.8% of normal, 50% of pale, 70% of congested and 60% of congested and edematous middle ear mucosa.Graft uptake was found in 82.3% of normal, 50%of pale, 75% of congested and 80% of congested and edematous middle ear mucosa.Chopra H et al, observed graft uptake in 100% of normal, 85.7% of congested and 58.8%of congested and edematous middle ear mucosa.[1]

Conclusion

In dry ear successful graft uptake of 76.7% was obtained while in wet ear successful graft uptake of 80% was obtained, statistically p-value is 0.75 ($p>0.05$) which is insignificant. Postoperatively hearing gain was (0-5 dB) in 2 patients with dry ear and 1 patient with wet ear; (6-10 dB) in 5 patients with dry ear and 10 patients with wet ear; more than 10 dB in 12 patients with dry ear and 8 patients with wet ear, statistically p-value is 0.55 ($p>0.05$) which is insignificant.The very fact that the p-value is insignificant in both, the graft uptake rate and hearing improvement, shows that the presence of discharge in the ear at the time of operation does not

interfere with the result of tympanomastoidectomy, but it should be mild and mucoid.

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