Indian J Otolaryngol Head Neck Surg
(July–Sept 2018) 70(3):325–330; https://doi.org/10.1007/s12070-017-1075-8

ORIGINAL ARTICLE

Effectiveness of Type I Tympanoplasty in Wet and Dry Ear in Safe Chronic Suppurative Otitis Media

Nitin V. Deosthale[1] · Sonali P. Khadakkar[1] · Priyanka D. Kumar[1] · Vivek V. Harkare[1] · Priti Dhoke[1] · Kanchan Dhote[1] · Madhurima Banerjee[1] · Vikrant Dagar[1] · Rahul Varma[1]

Received: 18 May 2016 / Accepted: 17 January 2017 / Published online: 31 January 2017

Abstract The aims and objectives of the study were to compare the rate of graft uptake after type 1 tympanoplasty in wet and dry ears and also to compare the postoperative hearing improvement in wet and dry ears. It was a Non Randomized Experimental Study. This study was done in ENT OPD at Tertiary Health Care Institute of Central India. It was conducted from November 2012 to October 2014 on 86 patients having Safe Chronic Suppurative Otitis Media. The patients were divided into two groups as Dry ear group and Wet ear group. Dry ear group included patients whose ear was dry for at least 6 weeks prior to the surgery. Wet ear group included patients who had minimal mucoid discharge in the middle ear which on culture and sensitivity showed no microorganisms. Type 1 Tympanoplasty was done in all patients. Results were analyzed statistically. Complete graft uptake was seen in 86.95% cases of Dry ear group and 80% of Wet ear group and the difference was statistically insignificant. Hearing improvement was achieved in 80% cases in dry group and 67.5% cases in wet group. The difference in hearing improvement in both groups was also statistically insignificant. So conclusion was drawn that, presence of minimal mucoid ear discharge at the time of surgery does not affect the success rate of Type 1 Tympanoplasty.

Keywords Suppurative otitis media · Tympanic membrane perforation · Conductive hearing loss · Tympanoplasty

✉ Nitin V. Deosthale
nvdeosthale@rediffmail.com

[1] Department of ENT, NKP Salve Institute of Medical Sciences and Research Centre and Lata Mangeshkar Hospital, K-28, Bharat Nagar, Amravati Road, Nagpur, Maharashtra 440033, India

Introduction

Chronic Suppurative Otitis Media (CSOM) is the chronic inflammation of mucoperiosteal lining of the middle ear cleft characterized by ear discharge, a permanent perforation of the tympanic membrane and impairment in hearing. It is a major cause for deafness in India [1]. In the ancient age where there were no antibiotics and surgical interventions, ear infection or otitis media manifested as a life threatening condition due to its intracranial extension. In the antibiotic era, there have been many effective antibiotics available and with use of operating microscope in surgical field, it is unusual for CSOM to manifest in its lethal potential. The poor socioeconomic conditions and poor nutrition in developing countries, results in higher number of CSOM cases and chronic otitis media still remains a major health problem in India.

Perforation of tympanic membrane can be caused by many reasons and it may lead to hearing loss and recurrent ear infections in patients. Repairing the Tympanic membrane perforation in these patients by performing tympanoplasty provides many benefits like improvement in hearing, cure of recurrent ear infections and elimination of need to take water precautions. Although being the most common surgical procedure in treating CSOM, there is always a dilemma in the mind of otologist of performing Type 1 tympanoplasty on patients with active ear discharge.

Many patients attending the ENT OPD of rural based tertiary care hospital suffering with CSOM are from low socioeconomic family. Most of them have discharging ears at the time of presentation and to make their ear dry may require many weeks and extensive follow up of patients and thus put financial burden on them. Thus the current study is aimed at providing early treatment to the patient

while preventing economic loss, physical and mental stress due to this extensive follow up.

Aims and Objectives

1. To compare the rate of graft uptake in Type I tympanoplasty in dry and wet ear.
2. To compare the postoperative hearing improvement in dry and wet ear.

Materials and Methods

The study was conducted in the Department of ENT, at Tertiary Health Care Institute of Central India for the duration of 24 months from November 2012 to October 2014. Every consecutive patient of Chronic Suppurative Otitis Media (CSOM) fulfilling inclusion and exclusion criteria were included in the study The Patients were selected based on the following criteria:

1. Patients with age group of 16–60 years of either sex with Tubotympanic disease (Safe CSOM) having dry ear for minimum period of 6 weeks or wet ear with minimal mucoid discharge which on culture and sensitivity showed no microorganisms.
2. Patients with small, moderate, large or subtotal central perforation.
3. Patients with pure conductive hearing loss and good cochlear reserve.
4. Patients with normal or partially impaired Eustachian tube function.

Patients with altered ossicular status detected on Pure Tone Audiometry and intraoperatively, who required Tympanoplasty other than Type 1, were excluded from the study.

Patients selected were divided into two groups

Dry ear group—Patients of tubotympanic CSOM, whose ear was dry for at least last 6 weeks.

Wet ear group—Patients who had minimal mucoid middle ear discharge with no microorganisms on culture.

These selected patients were subjected to clinical, radiological and laboratory investigations required for Pre-anaesthetic fitness. Otomicroscopy was done in all cases. Ear Swab of discharge of patients of wet ear group was sent for culture and sensitivity.

Size of Tympanic membrane perforation is defined as follows

Small Perforation—Occupying less than the size of one quadrant of tympanic membrane. Medium perforation—Occupying more than the size of one quadrant but less than two quadrants. Large perforation—Occupying more than the size of two quadrants but less than three quadrants. Subtotal perforation—Occupying more than the size of three quadrants but less than four quadrants.

Before undergoing surgery, all patients underwent Eustachian tube function assessment by "Interacoustic AT 235 impedance audiometer" by Toynbee test [2].

Hearing assessment of all patients was carried out 1 day prior to the surgery with the help of Pure Tone Audiometry using "ELKON eda Giga 3 audiometer". The technique followed was Carhart and Jerger's of 5 up and 10 down method [3]. The test was performed in the acoustically treated room with no ambient noise. In the patients with bilateral ear disease, ear with more hearing loss was operated.

The air and bone conduction threshold averages were calculated by taking the average of 500, 1000, 2000 and 4000 Hz frequencies. The Air Bone Gap (ABG) was calculated by taking difference between air conduction and bone conduction thresholds. The air and bone conduction thresholds were recorded both pre and post operatively [4, 5]. Type 1 Tympanoplsty was done in all patients by postaural approach under Local Anaesthesia with IV sedation or General Anaesthesia using temporalis fascia graft as a graft material.

Postoperatively, all the patients were put on injectable antibiotics for 1 day followed by oral antibiotics, analgesics and antihistaminics for 7 days. Sutures were removed on 7th day. All cases were followed up on OPD basis after 1st, 2nd, 4th, 8th and 12th week. Otoscopy was done to assess the graft status and presence of any discharge at every follow-up. Postoperative hearing assessment with pure tone audiometry was done at the end of 12 weeks. The presence of any complication was noted and treated simultaneously. The post-operative Air Bone Gap (ABG) closure was calculated by taking difference between pre-operative ABG and post-operative ABG of average frequencies of 500, 1000, 2000 and 4000 Hz [4, 5]. Hearing improvement after surgery was said to be significant when Air Bone Gap Closure (ABGC) was more than 10 dB.

From the air conduction threshold level, the deafness can be graded into several categories like below [6].

≤25 dB—Normal hearing,
26–40 dB—Mild hearing impairment,
41–60 dB—Moderate hearing impairment,
61–70 dB—Severe hearing impairment,
71–90—Profound hearing impairment,
91 dB and above—Total deafness.

For the purpose of study—Successful graft uptake is stable, healed, clinically intact tympanic membrane. Graft failure includes residual perforation, reperforation, medialization of graft, and complete graft failure.

All the results were analyzed statistically. Various statistical methods used for the analysis of data are Chi square test, paired t test, unpaired t test, and Fishers Exact test. The significance level throughout the analysis was fixed at 5% and all the analysis was performed using R-3.0.0 programming tool.

Results

In our study of 86 patients, 40 patients were included in the wet ear group and 46 patients in the dry ear group. Dry ear group consisted of 22 male and 24 females and in wet ear group, there were 21 males and 19 females. The mean age of dry ear group was 27.87 ± 9.79 years and that of wet ear group was 31.25 ± 9.98 years. Right ear was more commonly operated ear, seen in 55.81% of the total patients. Bilateral perforation was found in 17.44% of total patients.

Out of 86 patients, majority of patients i.e. 43 cases had medium sized central perforation (22 in dry ear and 21 in wet ears) followed by large, small and subtotal perforation respectively in both the groups (Table 1). The difference in two groups in relation to size of perforation was statistically insignificant (p value = 0.909).

On preoperative hearing assessment, 12 patients (seven patients (15.21%)—dry group, five patients (12.5%)—wet group) had hearing threshold of less than 25 dB i.e. normal hearing. Maximum patients (65 patients) had hearing threshold between 26 and 40 dB (Mild Hearing Loss) of which 35 (76%) were in dry ear group and 30 (75%) in wet ear group. While nine patients [four patients (8.69%)—dry ear group and five patients (12.5%) of wet ear group] had hearing loss between 41 and 55 dB i.e. moderate hearing loss. None had hearing loss more than 55 dB. Postoperative hearing assessment at the end of 12 weeks revealed that, 59 patients achieved normal hearing threshold i.e. less than 25 dB (33 patients (71.74%) of dry ear group and 26 (65%) in wet ear group). 27 patients had hearing threshold between 26 and 40 dB i.e. mild Hearing loss (13 patients (28.26%) in dry ear group and 14 patients (35%) in wet ear group). None had hearing loss more than 40 dB postoperatively.

In dry ear group, preoperative average Air Bone Gap was 35.04 ± 5.72 dB and postoperative average Air Bone Gap in dry ear was 23.92 ± 4.38 dB, with Mean Air Bone Gap closure of 11.16 ± 4.06 dB. While in wet ear group, preoperative Air Bone Gap (ABG) was 34.80 ± 5.36 dB and postoperatively ABG was 24.21 ± 3.95 dB with ABG closure of 10.61 ± 2.47 dB. The difference between pre and postoperative Mean ABG individually in both groups was statistically highly significant (p value < 0.0001) as shown in Table 2. But on comparing Mean Air Bone Gap closure i.e. hearing gain between the two groups, it was statistically insignificant (t Test for Independent sample = 0.741, p value = 0.461).

On comparing, Air Bone Gap (ABG) Closure as per size of perforation in dry and wet ear, there was no statistically significant difference between the two groups as shown in Table 3.

Hearing improvement after surgery was said to be significant when Air Bone Gap Closure (ABGC) was more than 10 dB. 80% in dry ear group and 67.5% in wet ear group had hearing improvement (>10 dB) after surgery as shown in Table 4. The difference between the two groups with respect to hearing improvement was not statistically significant (p value = 0.999).

There was statistically insignificant difference between two groups in terms of success rate of graft (p value = 0.562) as shown in Table 5. In dry group, six cases had graft failure, of which four had medialization of graft and two had residual perforation. While in wet ear group, eight cases had graft failure, of which five had medialization of graft and three had residual perforation.

On comparing the postoperative status of graft uptake and size of perforation in both the groups, complete graft uptake was seen in all patients having small central

Table 1 Distribution of patients as per the size of perforation (n = 86)

Size of perforation	Dry ear (N = 46)		Wet ear (N = 40)		Total	
	No. of patients	%	No. of patients	%	No. of patients	%
Small central	9	19.57	7	17.5	16	18.6
Medium central	22	47.83	21	52.5	43	50
Large central	11	23.91	10	25	21	24.42
Subtotal perforation	4	8.69	2	5	6	6.98
Total	46	100	40	100	86	100

$\chi^2 = 0.189$; p value 0.909; Not significant

Table 2 Descriptive statistics for air bone gap closure 12 weeks after surgery in dry and wet ear (n = 86)

Group	Mean preoperative ABG[a] ± SD (dB)	Mean postoperative ABG[a] ± SD (dB)	Mean ABG[a] closure ± SD (dB)	Paired *t* test	*p* value
Dry ear (N = 46)	35.04 ± 5.72	23.92 ± 4.38	11.16 ± 4.06	18.22	<0.0001 (HS[b])
Wet ear (N = 40)	34.80 ± 5.36	24.21 ± 3.95	10.61 ± 2.47	23.591	<0.0001 (HS[b])

Independent *t* test to compare mean ABG closure between Dry and Wet ear = 0.741 and *p* value = 0.461 (Not significant)

[a] *ABG* air bone gap

[b] *HS* highly significant

Table 3 Descriptive statistics for air bone gap (ABG) closure in dB as per the size of perforation postoperatively at the end of 12 weeks (n = 86)

Size of perforation	Mean ± SD (dB) for ABG closure		*t* test[a]	*p* value (significance)
	Dry ear (N = 46)	Wet ear (N = 40)		
Small central (n = 16)	4.69 ± 1.84	5.93 ± 3.11	0.931	0.375 (NS)
Medium central (n = 43)	12.00 ± 2.19	11.40 ± 1.25	1.097	0.280 (NS)
Large central (n = 21)	13.11 ± 2.11	12.35 ± 1.14	1.044	0.312 (NS)
Subtotal perforation (n = 6)	15.75 ± 4.13	10.00 ± 1.41	2.507	0.067 (NS)

NS not significant

[a] Using *t* test for independent samples

Table 4 Distribution of patients according to hearing improvement (gain) at the end of 12 weeks postoperatively using criterion of air bone gap closure (ABGC) > 10 dB

Hearing improvement (ABGC > 10 dB)	Dry ear (N = 46)		Wet ear (N = 40)	
	No. of patients	%	No. of patients	%
Improvement	32	80	27	67.5
No improvement	14	20	13	32.5
Total	46		40	

$\chi^2 = 0.01$, *p* value = 0.999, Not Significant

Table 5 Distribution of patients as per status of graft at the end of 12 weeks postoperatively

Graft uptake	Dry ear (N = 46)		Wet ear (N = 40)		Total	
	No. of patients	%	No. of patients	%	No. of patients	%
Successful	40	86.95	32	80	72	83.72
Failure	6	13.05	8	20	14	16.27
Total	46	100	40	100	86	100

$\chi^2 = 0.355$; *p* value 0.562; Not significant

Table 6 Distribution of patients according to size of perforation and status of graft at the end of 12 weeks postoperatively

Graft uptake→	Dry ear (N = 46)		Wet ear (N = 40)	
	Intact	Failure	Intact	Failure
Size of perforation ↓				
Small central (n = 16)	9	0	7	0
Medium central (n = 43)	21	1	18	3
Large central (n = 21)	9	2	7	3
Subtotal perforation (n = 6)	1	3	0	2

Dry ear: Using Fisher exact p value 0.0105; Significant

Wet ear: Using Fisher exact p value 0.0386; Significant

perforation in both dry and wet ear group. Graft failure was seen more in patients with subtotal perforation as shown in Table 6.

Discussion

Age is an important non-mastoid factor influencing the outcome of type 1 tympanoplasty. Failures of type 1 tympanoplasty in children are attributed to adenoid, Eustachian tube function. In our study; patients below age of 16 were excluded as they would not have cooperated in the assessment of hearing and Eustachian tube function. Maximum number of patients i.e. 38 cases (44.18%) were seen in the age group of 21–30 years, out of that 21 were from dry group and 17 were from wet group. This early presentation may be due to increased awareness to health issues and difficulty in hearing affecting work efficiency; leading to early medical intervention. The perforation and the operated ear was more common on right side (42%). Whereas left side was operated only in 40% of the cases. This side predominance could be attributed to the fact that most of them are right handed person and ear picking can be the cause of side predominance. Despite the high success rate and routine nature of the procedure, the effect of many influencing factors still remains unresolved. Some studies like the study done in 1987, Ophir et al. [7], on myringoplasty in paediatric population, reported a success rate of 79%. They claim that the outcome of surgery could not be related to the presence or absence of chronic otitis media in the untreated ear, status of operated ear (whether dry or discharging) or the performance of adenoidectomy before myringoplasty.

In the present study, successful graft uptake was seen in 86.95% cases in dry ears and 80% cases in wet ears and there was no statistically significant difference. In the study done by Dhar et al. [8], graft uptake rate was seen in 96% cases of dry ear and 84% cases in wet ear, with no significant difference between the two groups. On comparing the graft uptake rate and size of perforation, we found that, more graft uptake rate was seen in small and medium size of perforation as compared to large and subtotal perforation. As seen in the studies done by Albu et al. [9], Jurovitzki and Sade [10] and Booth [11], it is suggested that in cases with perforated tympanic membrane, perforations <50% performed significantly better.

Most of the patients had hearing improvement. In our study, hearing improvement was achieved in 80% cases in dry group and 67.5% cases in wet group which is in accordance with the study done by Mathai [12]. Mathai noticed a definitive improvement of hearing in all cases that underwent myringoplasty in the range of 20–30 dB with closure or narrowing of ABG except in three cases where conductive hearing loss persisted.

On comparing the hearing improvement in relation to the size of perforation, our study shows that hearing improvement co-relates with the size of perforation. Larger the size of perforation, more is postoperative hearing gain, which is similar to the findings of Packer et al. [13].

In all of the failure cases, maximum number of cases had medialization of graft which was observed after 6 or 12 week of follow-up, and it was more frequent in larger perforation. Failure may be due to infection despite of antibiotic coverage, respiratory tract infection and some patients continued to take overhead bathing against advice etc. In a study, Vartiainen [14] analyzed 44 failure cases in 417 myringoplasties. He concluded that necrosis of the graft and anterior blunting were the main causes in early failures, whereas infection was the most common cause of reperforation in later failures. Reperforation was more frequent in larger perforations than small ones. Other preoperative factors like dry or wet ear, site of perforation or the grafting technique did not affect the graft take rate.

Conclusion

According to the statistical analysis, in current study, we found no significant differences between the success rates of wet and dry ears, either in terms of graft uptake or the

hearing improvement. Thus we conclude that the presence of minimal ear discharge at the time of surgery does not affect the success rate of type 1 tympanoplasty.

Funding This study has not been funded by any funding agency or sponsor. It was conducted without any financial interest.

Compliance with Ethical Standards

Conflict of interest All authors declare that they have no conflict of interest.

Disclosure This material has never been published and is not currently under evaluation in any other peer reviewed publication.

Ethical Approval The permission was taken from Institutional Ethics Committee prior to starting the project. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

References

1. Singh M, Rai A, Bandyopadhyay S (2006) Middle ear microsurgery in India: a retrospective audit study. Indian J Otolaryngol Head Neck Surg 58:133–136
2. Biswas A (1999) Eustachian tube function test: a new dimension in the management of CSOM. IJO-HNS 51(2):23–28
3. Livingstone G, Millar H (1961) Results of tympanoplasties. J Laryngol Otol 75:669–678
4. Maharajan M, Kafle P, Bista M, Shrestha S, Toran KC (2009) Observation of hearing loss in patients with chronic suppurativeotitis media tubotympanic type. Kathmandu Univ Med J 7(28):397–401
5. Shrestha BL, Bhusal CL, Bhattarai H (2008) Comparison of pre and post-operative hearing results in canal wall down mastoidectomy with type three tympanoplasty. J Nepal Med Assoc 47(172):224–227
6. Ministry of Social Justice and Empowerment, Govt of India (2001) Sub-guidelines for evaluation of various disabilities and procedure for certification. New Dehli No. 16-18/97-NI/I
7. Ophir D, Porat M, Marshak G (1987) Myringoplasty in paediatric population. Arch Otolaryngol Head Neck Surg 113(12):1288–1290
8. Dhar G, Basak B, Gayen GC, Ray R (2014) Outcome of myringoplasty in dry and wet ear—a comparative study. IOSR-JDMS 13(3 Ver V):01–03
9. Albu S, Babighian G (1998) Trabalzini F. prognostic factor in tympanoplasty. Am J Otol 19:136–140
10. Jurovitzki I, Sade J (1988) Myringoplasty: long term follow up. Am J Otol 9:52–53
11. Booth JB (1973) Myringoplasty: factors affecting results. J Laryngol Otol 83(11):1079–1084
12. Mathai J (1999) Myringoplasty with temporal is fascia: analysis of 200 cases. Ind J Otol Head Neck Surg 51:9–12
13. Packer P, Macendrick Solar M (1982) What's best in myringoplasty: underlay or overlay, dura or fascia. J Laryngol Otol 96(1):25–41
14. Vartiainen E, Karja J, Karjalainen S, Harma (1985) Failures in myringoplasty. Arch Otorhinolaryngol 242:27–33