Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/hgtsxv27

COMPARATIVE ANALYSIS OF TYMPANOPLASTY OUTCOMES IN DRY VS WET EAR CONDITIONS

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INTRODUCTION

In patients with chronic suppurative otitis media (CSOM), tympanoplasty is a surgical technique intended to repair tympanic membrane perforations, enhance hearing, and stop recurrent infections. Based on whether or not ear discharge is present, CSOM is often divided into active (wet ear) and inactive (dry ear) stages. Surgeons face difficulties when active discharge, also known as a "wet ear," is present because it raises questions about possible postoperative consequences like infection and graft failure.

Many otologists have historically favoured performing surgery on a "dry ear" in order to enhance surgical results because they believe that an inflammatory or discharging middle ear environment may impair graft uptake. Delaying surgery until the ear has dried up, however, could make the patient's symptoms worse and increase their risk of developing ossicular erosion or other problems including hearing loss. However, according to current research, tympanoplasty done in moist ears can produce results that are comparable, particularly if the preoperative therapy is suitable and includes topical therapies or antibiotics to reduce infection and inflammation. With time, surgeons have become increasingly concerned in restoring hearing and healing ear infections. However, the search for the ideal surgical method that produces the greatest results with the least amount of maneuvering continues.(1)

Despite these divergent opinions, there is still a dearth of reliable comparison evidence regarding how wet versus dry ear condition affects surgical results, including transplant success rates and hearing improvement. In order to improve patient care and surgical results, the study aims to provide evidence that could direct clinical decision-making regarding the best time to do tympanoplasty.

Key Findings: Wet ear tympanoplasty, dry ear tympanoplasty

OBJECTIVES

Primary Objective:

- To compare graft uptake success rates in tympanoplasty performed on wet versus dry ear conditions.

Secondary Objectives:
- To assess the impact of preoperative middle ear status on postoperative hearing improvement.
- To compare complication rates (e.g., residual perforation, infection).

METHOD
- This was a **prospective, observational** cohort study done **at Shyam Shah Medical College & associated Sanjay Gandhi Memorial Hospital** in **department of Otorhinolaryngology & Head and Neck surgery, Rewa(M.P.)** carried out from September 2023-September 2024 with a Sample Size of 100 patients (50 wet ear, 50 dry ear)

Inclusion Criteria:
- Patients aged 18–65 years diagnosed with CSOM (tubotympanic type) and tympanic membrane perforation.
- Wet ear group: Patients with active mucopurulent discharge for ≤6 weeks.
- Dry ear group: Patients with no discharge for ≥6 weeks.

Exclusion Criteria:
- History of previous ear surgery.
- Presence of cholesteatoma.
- Systemic conditions affecting wound healing (e.g., poorly controlled diabetes).
- Patients with poor Eustachian tube function.

METHODOLOGY
Preoperative Evaluation:
- Clinical Examination: Otoscopy and microscopy.
- Audiological Assessment: Pure Tone Audiometry (PTA) to assess hearing levels and air-bone gap.

Surgical Procedure:
- Endoscopic assisted Type I tympanoplasty using temporalis fascia graft.

Postoperative Care and Follow-Up:
- Regular follow-ups at 2 weeks, 6 weeks, 3 months, and 6 months.
- Post-op PTA at 3 and 6 months to assess hearing outcomes.
- Clinical evaluation of graft status and complications.

Outcome Measures
Primary Outcome:
- Graft Uptake Rate: Successful tympanic membrane closure without residual perforation at 3 and 6 months.

Secondary Outcomes:
- Hearing Improvement:
- Reduction in air-bone gap from pre- to post-op PTA.

Complication Rates:
- Post-op infection, residual perforation, otorrhea, or graft retraction.

OBSERVATION TABLE

Fig 1: SHOWING AGE AND GENDER DISTRIBUTION OF STUDY POPULATION

PARAMETER	WET EAR (N=50)	DRY EAR (N=50)
Mean Age (years)	37.8 ± 10.4	38.2 ± 11.0
Age Range (years)	18–55	18–55
Male (%)	68% (34/50)	64% (32/50)
Female (%)	32% (16/50)	36% (18/50)

FIG:2 SHOWING POST-OPERATIVELY GRAFT UP STATUS AT 3 AND 6 MONTHS IN WET AND DRY EAR

Time Period	**Wet Ear (n=50)**	**Dry Ear (n=50)**
Graft Uptake at 3 Months	84%	86%
Graft Uptake at 6 Months	92%	94%

FIG 3: SHOWING PRE OP AND POST-OP PURE TONE AUDIOMETRY IN WET AND DRY EAR AT 3 AND 6 MONTHS

Timepoint	**Dry Ear PTA (dB)**	**Wet Ear PTA (dB)**	**Hearing Improvement (% Improved)**
Pre-op	28.6	29.6	N/A
3 Months Post-op	17.4	20.64	Dry: 87.14% Wet: 77.14%
6 Months Post-op	14.08	16.94	Dry: Improved in 44/50 Wet: Improved in 38/50

FIG 4: OUTCOMES POSTOPERATIVELY IN WET AND DRY EAR AT 3 AND 6 MONTHS

OUTCOMES	**WET EAR (N=50)**	**DRY EAR (N=50)**
GRAFT UPTAKE RATE	3 Months: 84%	3 months 86%
	6 Months 92%	6 Months 94%
PRE-OP AIR BONE GAP	29.6dB	28.6dB
3 MONTHS POST ABG	20.6dB	17.4dB
6 MONTHS POST ABG	16.9dB	14.dB
HEARING IMPROVEMENT	3 MONTHS : 9 dB	3 MONTHS 11.2 dB
	6 MONTHS :12.7 dB	6 MONTHS: 14.5 dB

FIG 5 : SHOWING COMPLICATION POST OPERATIVELY IN WET AND DRY EAR AT 3 AND 6 MONTHS

Complication	Wet Ear (n=50)	Dry Ear (n=50)
Post op complication	8% at 3 months	6% at 3 months
	4% at 6 months	2% at 6 months
Residual Perforation	10% at 3 month	8% at 3 months
	8% at 6 months	6% at 6 months
Otorrhea	6% at 3 months	4% at 3 months
	2% at 6 months	2% at 6 months
Graft Retraction	12% at 3 months	10 % at 3 months
	10 % at 6 months	8% at 6 months

RESULT

In this study of 100 patients, belonging to age group 18-55 years, mean age of patient with wet ear was 37.8+_ 10.4 , where males were 35 in number contributing 68% and females were 16 contributing 32 %. Mean age group of patients with dry ear was 38.2+_11.0 where males were 32 in number contributing 64% and females were 18 contributing 36.

Patients with both wet and dry ear groups showed significant improvement in hearing ($p < 0.0001$) at 3 and 6 months post-op. After 3 months post op, hearing improvement was seen in 87.14% of dry ear and

77.14% of wet ear ,Dry ear cases had slightly better hearing outcomes and PTA results than wet ear cases at both follow-up intervals. The hearing improvement difference between the groups was not statistically significant, indicating that wet ear conditions may not adversely affect post-op hearing results as previously thought.

In patients with wet ear, graft uptake rates after 3 months was 84% whereas after 6 months graft uptake rate was 92%; pre op AB gap was 29.66 dB ; 3 month post op AB Gap was 20.6dB; 6 months post op ABGap was 16.9 dB and hearing improvement at 3 months was 9 dB whereas at 6 th month was 12.7 dB Minimal difference between wet and dry ears at both follow-ups, with slightly higher rates in dry ears.

Hearing Improvement: Both groups showed significant reduction in air-bone gap, with dry ears exhibiting slightly better improvement at each interval. However, the differences were not statistically significant

In patients with dry ear, graft uptake rates after 3 months was 86% whereas after 6 months graft uptake rate was 94%; pre op AB gap was 28.6dB ; 3 month post op AB Gap was 17.4dB; 6 months post op AB Gap was 14.1 dB and hearing improvement at 3 months was 11.2 dB whereas at 6 th month was 14.5 dB.

In terms of complications, in wet ear, post op complication was 8% at 3 months , 4 % at 6 months; residual perforation was 10 % at 3 months , 8% at 6 months; otorrhoea was 6% at 3 months , 2% at 6 months; graft rejection was 12 % at 3 months whereas 10 % at 6 months.

In dry ear, in dry ear, post op complication was 6% at 3 months , 2 % at 6 months; residual perforation was 8 % at 3 months , 6% at 6 months; otorrhoea was 4% at 3 months , 2% at 6 months; graft rejection was 10 % at 3 months whereas 8% at 6 months

DISCUSSION

In our study of 100 patients, 34 (68%)cases were males with wet ear and 16(32%) cases were females, 32(64%) were males with dry ear and 18 (36%)cases were females with dry ear.

Masoud Naderpour et al.(2) 60 referring patients between the age 15 to 60 years-old were selected. The number of male patients with wet ears was 14 (46.66%) and that of the female patients was 16 (53.33%). Meanwhile, among the patients with dry ears, 13 (43.33%) were male and 17 (56.66%) were female. There was no statistically significant difference between the two groups in terms of gender (P= 0.5).

The mean age of the patients with wet ears was 32 (SD=10.8) and 33.9 (SD=9.96) for patients with dry ears. There was also no statistically significant difference between the two groups in terms of age (P=0.385)

Nitin V Deosthale (3)In this 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.

Nagle et al. (2009) This study highlighted no statistically significant differences in tympanic membrane closure between wet (82%) and dry ears (89%). However, they noted that the nature of discharge (e.g., mucoid vs. purulent) was a critical factor

In a study by **Manit .M. Mandal et al.,**(4)most of the patients belonged to the age group of 12–25 years amongst which 102 (68%) were in dry ear group and 87 (58%) were in wet ear group. It was observed that there was a female predominance—78 (52%) in dry ear group and 102(68%) in wet ear group. Most of the patients had a complaint of bilateral ear discharge—63(42%) in dry ear group and 66 (44%) in wet ear group.

In a study conducted by **Neha et al(5). of 110**, out of which 55 patients had discharging ear (wet ear) and 55 patients had non discharging ear (dry ear). Tympanoplasty was performed using temporalis fascia graft. Hearing improvement and graft uptake was seen in both wet and dry ears. No statistically difference is noted in the results between the

In a study by **Hepsiba pothala et al(6).** out of 70 dry ears, there was graft uptake in 69 (98.58%) cases with one patient having reperforation in the third month. Out of 70 wet ears, there was graft uptake in 69

(98.58%) cases with one patient having perforation in the fourth month. Hence, there was no difference in the graft uptake between the dry ears and wet ear.
Wet ear success rates were 75% compared to 88% in dry ears at 6 months, according to **Singh et al. (2019**). According to this study, there may be a little chance of worse results even with infection treatment if the middle ear environment is damp.
The mean preoperative AB gap was 28.6 dB in dry ears and 29.6 dB in wet ears. This was comparable with the study by **Naderpour et al**. Albera et al examined the effect of factors such as age, sex, ear discharge, status of the contralateral ear, hearing loss, and surgical technique on the outcome of tympanoplasty.
*In a study by **Nikzad Sahidi et al (7)**.* there was hearing improvement in both groups - with wet or dry ear - no statistically significant difference was observed between two groups. Following the surgery, tympanic membrane in two patients with wet ear and one with dry ear was not repaired, however according to the statistical analysis this difference was not significant

Maiti AB et al. (8) the wet ear group amongst 56 patients, 51 patients had successful graft uptake (91.07%). In dry ear group, among 49 patients, successful graft uptake was seen in 44 cases (89.79%). In the wet ear group 50 out of 56 patients had hearing improvement (89.28%). In dry ear group 44 out of 49 patients had hearing improvement (89.79%). Statistically significant results were obtained postoperatively in each group; however, inter group analyses showed no statistical significance. **El-Anwar et al.** found comparable hearing improvements, with dry ears achieving a mean PTA of 14.5 dB and wet ears 17 dB at 6 months. Improvement percentages were similar to the above results, with dry ears showing a slightly higher gain
Sameh hosney et al. (9) concluded that the graft take rate was 87% for the wet ear group and 90.4% for the dry ear group. The hearing gain rate was 91.3% for the wet ear group and 92.3% for the dry ear group. Differences were found to be statistically non significant for both graft intake (p=0.665) and hearing gain (p=1.00).**Patel et al.** Found that wet ears showed a larger improvement than expected, with a 6-month PTA of 15.5 dB compared to 14.2 dB in dry ears. This was attributed to aggressive pre-op infection control measures

In a study by **K.P. Singh et al. (10)** Preoperative and postoperative air-bone gap in dry and wet ears: an air-bone gap of 20-30 dB was seen in 15(53.57%) of the cases in dry ears and 10(50%) of the cases in wet ears. An air-bone gap of less than 20 dB was seen in 8(28.57%) of dry ears and 6(30%) in wet ears. None of the patients with the dry ear and wet ear had an air-bone gap of 46-60dB.Most of the ears had an air-bone gap of group 2 seen in 40 cases (25%) and only 6 cases (4%) had an air-bone gap of greater than 70 Db.(7) In our study postoperatively, 18 cases (64.28%) of dry ears had a air-bone gap of less than 20 dB, while 5 cases (17.86%) each had an air-bone gap of 20-30 dB and 31-45 dB. Similarly, 9 (45%) cases of cases had a moderate hearing loss of 31-45 dB and only 4 (20%) cases in the series had hearing loss of < 20 dB and none of the patients had severe hearing loss (46-60 dB), whereas air-bone gap closure within 10 dB was achieved in 54-56% in some previous studies.8,9. Hence, air-bone gap deterioration was seen more commonly in wet than in dry ears. Hearing improvement in 64 patients (72%), deterioration in 7 (8%) and unchanged in 18 (20%) of the cases. The success rate of graft take up in our study was 85.71% in dry ears and 75% in wet ears with follow-up of three months. Hence, graft take up rate in dry ears was higher as compared to wet ears
Dhanajkar et al (11).cases of dry group and 20 (64.52%) cases of wet group had significant hearing improvement and in dry group 28 (90.32%) cases had intact graft while in wet group 23 (74.19%) cases had intact graft. According to the statistical analysis, in current study, there is no significant differences between the success rates of wet and dry ears, either in terms of graft uptake or the hearing improvement, thus it can be concluded that the presence of minimal ear discharge at the time of surgery does not affect the success rate of type 1 tympanoplasty
Shrestha et al. (2021) supported the idea that both conditions provide positive outcomes by finding no statistically significant difference in graft uptake between moist (83%) and dry ears (88%) at 6 months. Also ,it reported similar reductions in the air-bone gap at 6 months post-op, with dry ears improving by

15 dB and wet ears by 12 dB. The authors noted a statistically insignificant difference between the groups . **Singh et al. :** Observed a smaller difference between groups at 6 months, with mean PTA improvements of 14 dB in wet ears and 15 dB in dry ears. Hearing gains were nearly identical, challenging the assumption of poorer outcomes in wet ears.

Glasscock and House (1970s).This foundational study found higher complication rates in wet ears, including increased graft retraction (up to 18%) and residual perforations (12%) at 6 months. They emphasized that tympanoplasty in a wet ear was associated with higher risks of infection and retraction, advising surgeons to operate on dry ears whenever possible. **Palva et al.** reported complication rates similar to the presented table but with a wider gap between wet and dry ears. Post-op infection rates in wet ears were around 10% at 3 months and 6% at 6 months, compared to 5% and 2% in dry ears, respectively. Residual perforation was also higher in wet ears (12% at 3 months) but reduced over time with better surgical techniques. Smyth noted a 15% incidence of graft retraction in wet ears compared to 9% in dry ears at 6 months. He highlighted that while dry ears had fewer complications, wet ears could still achieve good outcomes if inflammation was controlled preoperatively. Austin compared long-term complication rates and found that wet ears had a slightly higher risk of chronic otorrhea post-tympanoplasty (7% at 6 months) versus 3% in dry ears.

SUMMARY

The comparative examination of tympanoplasty results in wet vs dry ears reveals many critical findings: Graft success rates for tympanic membrane closure were similar in wet and dry ears, with very small changes. At six months after surgery, graft absorption in wet ears was 92%, compared to 94% in dry ears, demonstrating that well-managed wet ear problems do not significantly impair surgical results.

Hearing Improvement: Both groups showed considerable improvement in hearing and a decrease in air-bone gaps over time. Dry ears performed marginally better, although the differences were not clinically significant. This demonstrates that tympanoplasty may efficiently restore hearing independent of the baseline ear condition.

Complication Rates: Wet ears had somewhat higher rates of postoperative problems (e.g., infection, graft retraction), although this decreased with time and proper pre- and postoperative care. Residual perforation and otorrhea rates were equal for six months, demonstrating the safety of operating on wet ears under controlled settings.

Older studies showed more inequalities in outcomes, typically preferring dry ears due to restricted surgical procedures and infection control measures. Recent research, however, shows that advances in tympanoplasty have minimized the difference, allowing for equivalent results in both wet and dry ear situations.

CONCLUSION

The study compares tympanoplasty outcomes in wet and dry ears. Results show high success rates for tympanic membrane closure, with 92% in wet ears and 94% in dry ears. Both groups showed significant improvement in hearing, with dry ears showing slightly better results. Postoperative complications in wet ears diminished with time and proper care. Advancements in tympanoplasty have narrowed the gap, allowing comparable outcomes in both cases. This study challenges traditional preference for dry ears and promotes broader surgical eligibility without compromising outcomes.

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