



Comparative Study of Hearing Results in Various Types of Tympanoplasties

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Abstract

Background This study mainly focus on hearing loss pattern in CSOM patients undergoing tympanoplasty surgery or tympanomastoidectomy pre-operatively and analysis of the outcome of the surgery in terms of improvement in hearing (air-bone gap) after 3 months of the surgery.

Methodology All patients of age 15–65 years reporting to ENT OPD with ear discharge and decreased hearing were screened with detailed history, clinical examination and microscopic examination. 110 cases of tympanic membrane perforation who were fit for surgery were advised tympanoplasty or tympanoplasty with mastoidectomy.

Results Our study shows that postoperative air-bone gap closure is maximum for cortical mastoidectomy type I tympanoplasty (14.03 dB), followed with cortical mastoidectomy with type II (12.2 dB), Type I tympanoplasty (11 dB), cortical mastoidectomy with type III (7.72 dB). Procedures combined with modified radical mastoidectomy showed a very poor mean improvement in our study.

Conclusion It is very difficult to predict the results pre-operatively because outcome will depend on extent of involvement of middle ear cleft by the disease process which can only be assessed intraoperatively.

Keywords Pure tone average (PTA) · Air-bone gap (ABG) · Chronic suppurative otitis media (CSOM) · Acute suppurative otitis media (ASOM) · Sensorineural hearing loss (SNHL)

Introduction

Chronic suppurative otitis media is a disease characterized by chronic inflammation of mucoperiosteal lining of the middle ear cleft resulting in recurrent otorrhea and impairment of hearing [1]. Chronic suppurative otitis media (CSOM) usually causes a wide range of middle ear pathologies including permanent mucosal damages, formation of granulation tissue, cholesteatoma, ossicular erosion, tympanosclerosis and is differentiated into inactive mucosal, inactive squamous, active mucosal and active squamous type of chronic otitis media (COM) [2]. The Tympanic Membrane play a significant role in physiology of normal hearing as well as have valuable role in the pathophysiology of chronic inflammatory middle ear disease (Table 1).

The goal of tympanoplasty is to remove the underlying disease, restore hearing and produce a safe dry ear [3]. This study attempts at assessing the hearing gain by the patients, who underwent different types of tympanoplasties according to their disease status. It is often difficult to predict the hearing gain of various tympanoplasties post-surgery (Table 2).

Tympanoplasty irrespective of combination of mastoidectomy is an indication for chronic ear disease process such as perforation of ear drum due to prior middle ear infections, atelactasis of tympanic membrane, retraction pocket, cholesteatoma and chronic otitis media with effusion or mastoid granuloma. Conductive hearing loss from ossicular chain deformities may occur from either discontinuity or fixation of ossicular chain [4]. Ossiculoplasty is done to reconstruct the ossicular chain. This study has been undertaken to establish definite predictor of hearing results according to type of tympanoplasties done. This study mainly focus on hearing loss pattern in CSOM patients

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Table 1 Types of surgery

S. no	Surgery	Number of patients	Percentage (%)
1	Type I tympanoplasty	41	38
2	Cortical mastoidectomy with Type I tympanoplasty	26	24
3	Cortical mastoidectomy with Type II tympanoplasty	6	6
4	Cortical mastoidectomy with Type III tympanoplasty	19	17
5	Modified radical mastoidectomy with Type III tympanoplasty	11	10
6	Modified radical mastoidectomy with Type IV Tympanoplasty	7	6
		110	100

Table 2 Pre-operative and post-operative air-bone gap distribution according to various procedures

S. no	Procedure	Number	Percentage (%)	Mean pre-operative air-bone gap (dB)	Mean post-operative air-bone gap (dB)
1	Type I tympanoplasty	41	38	21	10
2	Cortical mastoidectomy with Type I tympanoplasty	26	24	28	14
3	Cortical mastoidectomy with Type II tympanoplasty	6	5	26.3	14.1
4	Cortical mastoidectomy with Type III tympanoplasty	19	17	29.6	21.9
5	Modified radical mastoidectomy with Type III tympanoplasty	11	10	34.6	30.9
6	Modified radical mastoidectomy with Type IV tympanoplasty	7	6	33.3	30.34
		110	100		

undergoing Tympanoplasty surgery or tympanomastoidectomy pre-operatively, and analyze the outcome of the surgery in terms of improvement in hearing (air-bone gap) after 3 months of the surgery (Table 3).

Materials and Methods

Selection of Cases

All consecutive patients between age group of 15 to 65 years reporting to ENT OPD with Tympanic Membrane perforation who are fit for surgery and are advised tympanoplasty or tympanoplasty with mastoidectomy were

Table 3 Mean hearing improvement with procedure

S. no	Procedure	Number	Percentage (%)	Mean PTA improvement (dB)	Mean air-bone gap improvement (dB)
1	Type I tympanoplasty	41	38	11	11
2	Cortical mastoidectomy with Type I tympanoplasty	26	24	14.2	14.03
3	Cortical mastoidectomy with Type II tympanoplasty	6	5	13.4	12.2
4	Cortical mastoidectomy with Type III tympanoplasty	19	17	9.4	7.72
5	Modified radical mastoidectomy with Type III tympanoplasty	11	10	5	3.7
6	Modified radical mastoidectomy with Type IV tympanoplasty	7	6	3.4	2.96
		110	100		

included in the study. Patients presenting with chief complaints of discharge from ear and decreased hearing for duration of more than 3 months and diagnosed as chronic suppurative otitis media were taken into study. A written consent was taken before participation of the patients into the study. They were given detailed information about the procedure. A detailed history was taken and complete general, systemic examination and

local examination was carried out.

Inclusion Criteria for this Study

Patient with

1. Chronic suppurative otitis media (CSOM) with small, medium, large, subtotal, total, and attic perforation.
2. Tympanosclerotic patches
3. Pure conductive and mixed type of hearing loss
4. Between the age of 15–65 year
5. Sex: Both male and female

Exclusion Criteria for this Study

Patient with

1. Patients not included in the above age group.
2. All ASOM
3. CSOM with sensory neural hearing loss (SNHL)
4. CSOM with complications
5. Pregnant female
6. Immuno-compromised patient
7. Patient having systemic illness like—Diabetes mellitus, hypertension, tuberculosis, hepatitis.

Operation

Cases were operated under local anesthesia with sedation (2% xylocaine with adrenaline) and general anesthesia as per requirement. Surgeries were performed by senior surgeons of our hospital. Grafts material used are Temporalis fascia, Cartilage and Fascia lata. Type of surgery is decided intraoperatively depending upon extent of disease. Intra venous antibiotics were given during the hospital stay and patient discharged on oral antibiotics. Mastoid dressing kept for 7 days. Aural pack was removed on seventh day. Stitches removed on 7th post operative day. Patient were followed up for 3 months after surgery at the interval of every 15 days. Follow up Audiometry was done after 3 months of surgery.

Observation and Results

In our study, total 110 patients, out of which 41 (38%) of patients underwent Type I tympanoplasty followed by 26 (24%) cortical mastoidectomy with Type I tympanoplasty, 19 (17%) cortical mastoidectomy with Type III tympanoplasty, 11 (10%) Modified radical mastoidectomy with Type III tympanoplasty, 7 (6%) Modified radical mastoidectomy with Type IV tympanoplasty and 6 (5%) cortical mastoidectomy with type II tympanoplasty.

In our study of 110 patients, mean postoperative Air Bone Gap was 10 dB in Type I tympanoplasty, 14 dB in cortical mastoidectomy with Type I tympanoplasty, 14.1 dB in cortical mastoidectomy with Type II tympanoplasty, 21.9 dB in cortical mastoidectomy with type III tympanoplasty, 30.9 dB in Modified radical mastoidectomy with Type III tympanoplasty and 30.34 dB in Modified radical mastoidectomy with Type IV tympanoplasty.

In our study of 110 patients hearing assessment was done 3 months after the surgery. Mean PTA improvement in Type I Tympanoplasty was 11 dB, in cortical mastoidectomy with Type I tympanoplasty was 14.2 dB, in cortical mastoidectomy with Type II tympanoplasty was 13.4 dB, in cortical mastoidectomy with Type III tympanoplasty was 9.4 dB, in Modified Radical Mastoidectomy with Type III tympanoplasty was 5 dB, in Modified Radical Mastoidectomy with Type IV tympanoplasty was 3.4 dB.

Mean ABG improvement in Type I Tympanoplasty was 11 dB, in cortical mastoidectomy with Type I tympanoplasty was 14.03 dB, in cortical mastoidectomy with Type II tympanoplasty was 12.2 dB, in cortical mastoidectomy with Type III tympanoplasty was 7.72 dB, in Modified Radical Mastoidectomy with Type III tympanoplasty was 3.7 dB, in Modified Radical Mastoidectomy with Type IV tympanoplasty was 2.96 dB.

The *p* value for PTA improvement and that of air-bone gap comes out to be 0.0078 and 0.05 hence we can easily validate our hypothesis that different types of tympanoplasties have different level of improvement and are correlated.

Discussion

Chronic suppurative otitis media is a very common ENT problem worldwide, especially in developing countries. Around 7.8% of the Indians suffer from this infection according to WHO report [1]. It is more prominent in rural areas and is related with poor hygiene, illiteracy and is common among the middle- and low-income groups.

CSOM typically produces a mild-to-moderate conductive hearing loss. Of all the complications, hearing loss associated with chronic ear discharge is nearly always significant and tending to be more severe than those reported in other types of otitis media.

This prospective study was undertaken to study and compare hearing results in various types of tympanoplasties. Total 110 patients were included in the study.

In our study, patients from 15 to 65 years were taken into consideration. Majority of the patients 29 (26.3%) belonged to the age group ranging from 15 to 20 years compared to Indorewala et al. [7] where majority of the patients 33.3% belonged to the age group ranging from 31 to 45 years. In the study done by Balasubramaniam et al. [6] patient's age ranging from 10 to 50 years were taken into consideration.

In our study, females 68 (62%) were slightly predominated over males 42 (38%) among 110 cases studied compared to Indorewala et al. [7] where also females were 335 (51.3%) predominated as compared to males 302 (48.72%).

In our study, 37% patients underwent type I tympanoplasty, followed by 24% patients had cortical mastoidectomy with type 1, followed by 17% patients who had cortical mastoidectomy with type III, 10% had Modified radical mastoidectomy with Type 3. 6% patients underwent Modified radical mastoidectomy with Type 4. 5% patients underwent cortical mastoidectomy with type II. Compared with the study of Muqtadir et al. [5] in which 48% patients underwent cortical mastoidectomy with type I tympanoplasty, followed by 18% patients underwent cortical mastoidectomy with type III, 16% patients had type I tympanoplasty, 6% each had Modified radical mastoidectomy with Type 3, Modified radical mastoidectomy with Type 4 and cortical mastoidectomy with type II tympanoplasty.

In our study, cortical mastoidectomy with Type I tympanoplasty showed the best mean air bone gap improvement of 14.03 dB, followed by cortical mastoidectomy with type II which had a mean improvement of 12.2 dB. Procedures combined with modified radical mastoidectomy showed a very poor mean improvement in our study; only 2.96 dB for MRM with type IV and 3.7 dB MRM with type III tympanoplasty. Type I tympanoplasty showed mean hearing improvement of 11 dB and cortical mastoidectomy with type III showed mean improvement of 7.72 dB compared with the study of Muqtadir et al. [5], where Type I with cortical mastoidectomy showed the best mean improvement of 16.7 dB, followed by type II with cortical mastoidectomy which had a mean improvement of 12.66 dB. Procedures combined with modified radical mastoidectomy also showed a very poor mean improvement in Muqtadir et al. [5]; only 1 dB for type IV with

MRM and 4.33 dB with type III with MRM. Type I tympanoplasty showed mean improvement of 8.875 dB and cortical mastoidectomy with type III showed equal mean improvement of 8.5 dB.

Conclusion

Tympanoplasty is a valuable procedure that can lead to improvement in hearing function of patients and prevention of recurrent ear discharge. Ideal results can be achieved by the use of the appropriate surgical technique. Apart from the surgical procedure success of the surgery also depends on the post-operative care. Proper follow-up of patients is necessary to ensure effective outcome.

The success of surgery is determined in terms of air-bone gap improvement. Our study shows that postoperative air-bone gap improvement was maximum for cortical mastoidectomy with type I tympanoplasty (14.03 dB), followed with cortical mastoidectomy with type II (12.2 dB), Type I tympanoplasty (11 dB) and cortical mastoidectomy with type III tympanoplasty (7.72 dB). Procedures combined with modified radical mastoidectomy showed a very poor mean improvement in our study. It is very difficult to predict the results preoperatively because outcome will depend on extent of involvement of middle ear cleft by the disease process which can only be assessed intraoperatively.

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Compliance with Ethical Standards

Conflict of interest The authors declared that they have no conflict of interest.

Ethical Approval The study was approved by the Institutional Ethics Committee.

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