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Original article:

Audiometric evaluation of type1 tympanoplasty for hearing results

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Abstract:

Background: A perforation on the tympanic membrane reduces the surface area of the membrane available for sound pressure transmission and allows sound to pass directly into the middle ear. This study deals with functional outcome in a series of patients who underwent type-1 tympanoplasty with underlay technique using temporalis fascia graft.

Material & methods: This is a prospective study were carried out to assess the hearing loss in relation to site and size of tympanic membrane perforation and to assess improvement in hearing loss post type 1 tympanoplasty in Department of Otorhinolaryngology, National Institute of Medical Sciences & Research and Hospital, Jaipur from January 2017 to June 2018. Hearing is assessed with pure tone audiometry preoperatively, written consent is taken and considered for Type1 Tympanoplasty through post aural approach using autologous temporalis fascia graft by underlay technique under general or local anaesthesia. Pure tone audiometry is done to assess hearing during post operative follow up at 1 and 3 months. The operation is considered to be successful if patient has intact tympanic membrane at 1 and 3 months follow up period. Improvement of post operative air conduction by 10dB is accepted as hearing improvement.

Results: We have observed that there is a relationship between size and site of perforation with hearing impairment in tubotympanic type of CSOM. The larger the perforation greater is the hearing loss. Average hearing improvement was also found to be greater in larger perforations. Posterior quadrant perforations were having more hearing loss and greater hearing improvement after surgery as compared to those with anterior quadrant perforation. Rate of graft uptake is directly proportional to size of perforation.

Conclusion: Patients who undergo type 1 tympanoplasty should be advised whilst been consented that there is a good chance of hearing improvement. Type 1 tympanoplasty is a safe and effective technique to achieve intact tympanic membrane and improve hearing in patients of chronic otitis media tubotympanic type.

KeyWords : type 1 tympanoplasty, Perforation, tympanic membrane, Hearing loss

Introduction

Tympanic membrane is a membranous partition separating the external auditory meatus from the tympanic cavity, measuring 9-10 mm vertically and 8-9 mm horizontally. It plays a major role in middle ear transformer mechanism. Tympanic membrane perforation is caused by variety of causes, the most common being trauma and infections.[1] Trauma (Barotrauma, temporal bone fracture), infections (Acute otitis media, chronic otitis media, TB), Iatrogenic (ventilation tubes).Tympanic membrane perforation leads to varying degree of conductive hearing loss. Loss of hearing is a national health problem with significant physical and psychosocial problem. So it is important to diagnose and treat tympanic membrane perforation as early as possible as untreated tympanic membrane perforation leads to ongoing destructive changes in the middle ear, thus adding to further hearing loss.

In all developing countries the incidence of chronic suppurative otitis media (CSOM) is very high because of poor socioeconomic standard, overcrowding, poor nutrition and lack of health education.[2] Among the two types of chronic suppurative otitis media, tubotympanic disease is characterized by a central perforation of the pars tensa of varying size and shape.

Discharging ear and deafness are the major otolaryngological problem faced in India. Chronic suppurative otitis media (CSOM) is probably the commonest disease seen in an ENT clinic. 30% of the patients attending in ENT outpatient department suffer from chronic suppurative otitis media . Middle ear infections are almost universally associated with hearing loss, mostly conductive in nature. Chronic suppurative otitis media (CSOM) was found to be a single major cause responsible for 60.27% cases of conductive deafness.[2]

Hearing loss in tubotympanic disease is usually conductive in nature but a few case of sensorineural hearing loss is also found.[3] Hearing loss with intact ossicular chain is approximately 10-30 dB.[4,5] But more when ossicular chain is disrupted.

A perforation on the tympanic membrane reduces the surface area of the membrane available for sound pressure transmission and allows sound to pass directly into the middle ear. The location of the perforation is believed by some schools of thought to have a significant effect on the magnitude of hearing loss.[6]

For instance, posterior quadrant perforations are believed to be worse than the anterior ones because of the direct exposure of the round window to sound waves and perforations at or near the site of tympanic membrane attachment to manubrium have more severe effects than those of comparable size at different sites.[6]

In the studies by Kumar *et al*.,[7] and Pannu *et al*.,[8] it was observed that the degree of hearing loss increases with the size of perforation and has no relation with the site of perforation. However, Malik *et al*.,[9] in his study observed that the degree of hearing loss did not vary with the size of the perforation but was dependent on the site of perforation. Frequency dependence of hearing loss was also not correlated well with the site and size of hearing loss.

To sum up, because of the high incidence of conductive hearing loss caused by central perforations of tympanic membrane, the conflicting reports regarding the effect of perforations on hearing loss, this project has been under taken to study the clinical profile of CSOM & effects of tympanic membrane perforations on the degree of hearing loss and to assess hearing pre and post type 1 tympanopplasty.

Myringoplasty and tympanoplasty are descriptive terms defining surgical procedures that address pathology of the tympanic membrane (TM) and middle ear. Myringoplasty is an operative procedure used in the reconstruction of a perforation of the tympanic membrane. This assumes that the middle ear space, its mucosa, and the ossicular chain are healthy. Tympanoplasty implies reconstruction of the tympanic membrane but also deals with pathology within the middle ear cleft, such as chronic infection, cholesteatoma or an ossicular chain problem.

Type 1 tympanoplasty is the operation which involves eradication of disease from middle ear and visualisation of ossicular cleft and repair or reconstruction of the tympanic membrane without repair of ossicles. Evaluation of treatment results in reconstructive middle ear surgery with special regard to quality of life aspects is, therefore, of increasing importance. This study deals with functional outcome in a series of patients who underwent type-1 tympanoplasty with underlay technique using temporalis fascia graft.

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Material & methods:

This is a prospective study were carried out to assess the hearing loss in relation to site and size of tympanic membrane perforation and to assess improvement in hearing loss post type 1 tympanoplasty in Department of Otorhinolaryngology, National Institute of Medical Sciences & Research and Hospital, Jaipur from January 2017 to June 2018.

SELECTION OF PATIENTS

INCLUSION CRITERIA:

- Patients of tubotympanic type of Chronic suppurative otitis media who are willing to participate in study and surgery.
- Patients between 15 to 50 years of age.
- CSOM- Tubotympanic type with dry central perforation for atleast 3 months
- Patients with conductive hearing loss.
- Both males and females
- Graft taken up after tympanoplasty

EXCLUSION CRITERIA:

- Patients below 15yrs of age
- Patients above 55yrs of age
- Pateints with active disease, tympanosclerosis, revision myringoplasty, mixed SNHL, CSOM attico antral type (marginal perforation), ossicular chain fixation or disruption and patients in whom ossicular chain status could not be assessed.
- Graft rejection after tympanoplasty
- Patients who didn't gave the consent to be participated in the study.

METHODS

Patients were selected by the convenience sampling method. After informed consent, a detailed history was taken, physical examination was performed, Otoscopy and pure tone audiometry was done.

All patients was undergo following investigations:-

1. Tuning Fork Tests.
2. Pure Tone Audiometery.
3. Paper patch test.
4. Otomicroscopy.
5. X-ray both mastoids lateral/oblique view was done to know the involvement of mastoid air cell system.
6. To measure the size of perforation, thin and transparent plastic paper were used and over it graphs of 1 mm^2 were drawn, oval pieces of about 9 mm x 8 mm size is cut and sterilized by keeping in cidex, under operating microscope with magnification x15 sterile plastic with graph imprinted on it is kept over the TM perforation number of square occupying the perforation will

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be directly counted, if half or more of any square is within the perforation it is taken to be one square and if less than half of a square is within the perforation, it is not counted.

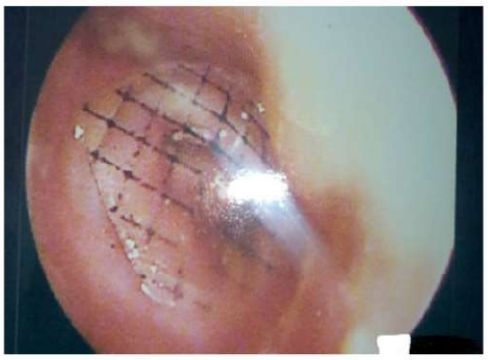


Fig. 1 Measurement of size of perforation of tympanic membrane, thin and transparent plastic paper were used and over it graphs of 1 mm^2 were drawn

7. To assess the site of tympanic membrane perforation-The tympanic membrane was divided into four quadrants by imaginary lines-one passing through the umbo & lateral process of malleus and another perpendicular to the first line and passing through umbo. The perforations were grouped according to the quadrant or quadrants in which they were located, i.e. antero-superior, antero-inferior, postero-superior, postero-inferior and combined (involving 2, 3 or all 4 quadrants). The perforations were also divided into malleolar i.e. those touching handle of malleus & non-malleolar, i.e. perforations not touching handle of malleus.

Hearing is assessed with pure tone audiometry preoperatively, written consent is taken and considered for Type1 Tympanoplasty through post aural approach using autologous temporalis fascia graft by underlay technique under general or local anaesthesia. Pure tone audiometry is done to assess hearing during post operative follow up at 1 and 3 months. The operation is considered to be successful if patient has intact tympanic membrane at 1 and 3 months follow up period. Improvement of post operative air conduction by 10dB is accepted as hearing improvement.

Results:

Our study showed that the mean age of patients was 30.67 years, majority of patients were seen in 15 years to 35 years (70%) of age group (table 1).

Site perforation:

Our study showed that the most of the site perforation in single quadrant was AI (24.54%) followed by PI (18.63%), AS & PS (1.36% each)

In two quadrant AI+PI was most common (19.09%) followed by PS+PI (15.90%) and AS+AI (8.63%).

In three quadrant AS+AI+PI were 1.36% cases and PS+PI+AI only 0.90% cases in our study.

In four quadrant AS+AI+PS+PI were involved 8.18% cases in our study.

Size of perforation:

The majority of ear involved in small size perforation (1-14 mm^2) was (45.90%) followed by medium size perforation (15-27 mm^2) (43.63%), large size perforation (42-55mm^2) (8.18%) and large size perforation (28-41mm2) (2.27%) in our study.

Hearing loss and improvement with relation to size of perforation:

Our study showed that the hearing loss in 1-14mm^2 size of perforation was 31.63 db followed by 36.33 db in 15-27 mm^2 size, 40.00 db in 28-41 mm^2 and 46.67 db in 42-55 mm^2 size of perforation.

The hearing improvement in 1-14mm^2 size of perforation was 9.775 db followed by 13.83 db in 15-27 mm^2 size, 16.00 db in 28-41 mm^2 and 17.00 db in 42-55 mm^2 size of perforation. Which was statistical significant when compare in between pre-operative and post operative (P<0.0001).

Hearing loss and improvement with relation to site of perforation:

Our study showed that the hearing loss in site of perforation (single quadrant) postero-inferior (PI) was 35.68 db followed by 32.50 db in postero-superior (PS), 28.83 db in antero-inferior (AI) and 25.00 db in antero-superior (AS) site of perforation.

Hearing improvement in site of perforation was 13.51 db in postero-inferior (PI) followed by 10 db in postero-superior (PS), 7.234 db in anteroinferior (AI) and 3.33 db in anterosuperior (AS) site of perforation. In AI & PI site of perforation was statistical significant (P<0.0001).

The hearing loss in site of perforation (double quadrant) postero-superior & postero-inferior (PS+PI) was 38.48 db followed by anteroinferior & postero-inferior (AI+PI) was 36.54 db and 34.44 db in anterosuperior & antero-inferior (AS+AI) site of perforation.

Hearing improvement in site of perforation, 16.06 db in postero-superior & postero-inferior (PS+PI) followed by anteroinferior & postero-inferior (AI+PI) was 13.08 db and 12.78 db in anterosuperior & antero-inferior (AS+AI) site of perforation. Which was statistical significant (P<0.0001***).

The hearing loss in site of perforation (triple quadrant) PS+PI+AI was 45.50±3.536 db and hearing loss in AS+AI+PI was 41.67±2.887 db and the average hearing improvement in site of perforation (triple quadrant) PS+PI+AI was 19.00 db and in AS+AI+PI was 17.60 db (graph 3).

Our study showed that the hearing loss in site of perforation (four quadrant) AS+AI+PS+PI was 46.18±3.762db and hearing improvement in site of perforation (four quadrant) AS+AI+PS+PI was 19.41 db, which was statistical significant (P<0.0001) (table 6,7).

Malleolar & Non-malleolar relation hearing loss & improvement:

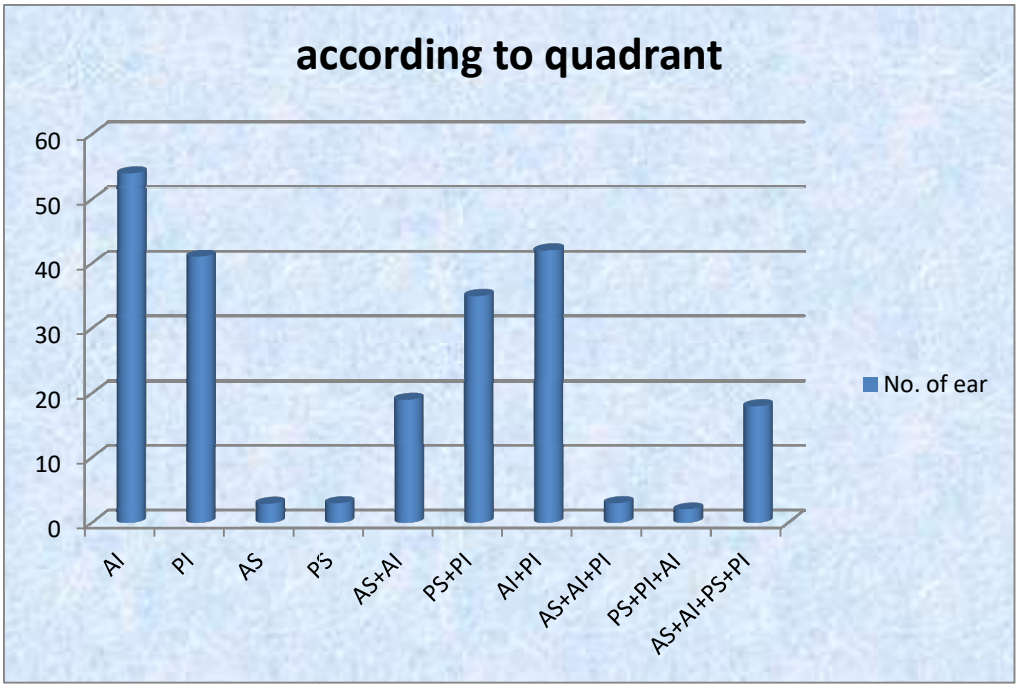
Our study showed that the hearing loss in malleolar was 41.94±7.266 db and in non-malleolar was 34.17±6.467 db and hearing improvement in malleolar was 16.29 db and in non-malleolar was 12.02 db, which was statistical significant (P<0.0001).

Correlation of graft rejected with site of perforation

Our study showed that the maximum no. of graft rejected in four quadrant (38.09%) followed by three quadrant (AS+AI+PI) was 19.04% and in two quadrant (33.33%). Out of which in two quadrant, maximum graft rejected seen in AS+AI (19.04%).

Table 1: Age wise distribution of cases

Age (yrs)	No. of patients	Percentage
15-25 yrs	84	38.18%
26-35 yrs	70	31.81%
36-45 yrs	45	20.45%
46-55 yrs	21	9.54%
Total	220	100%
Mean±SD	30.67±9.869	



Graph 1: Number of ears respect to the site of perforation

Table 2: Number of ears respect to the size of perforation

Size of perforation (mm^2)	Average of TM involved by perforation (mm^2)	No. of ears	Percentage
1-14	8.693	101	45.90%
15-27	20.29	96	43.63%
28-41	36.80	5	2.27%
42-55	50.11	18	8.18%
Total		220	100%

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Table 3: Hearing loss respect to the size of perforation

Size of perforation (mm2)	Pre-operative	Post-operative
1-14	31.63±6.067	21.85±4.420
15-27	36.33±5.599	25.50±4.575
28-41	40.00±3.536	24.00±2.236
42-55	46.67±3.619	29.67±5.499

Table 4: Hearing improvement respect to the size of perforation

Size of perforation (mm2)	Difference of mean	SD	t-value	p-value
1-14	9.775	0.7956	12.29	<0.0001***
15-27	13.83	0.7621	18.15	<0.0001***
28-41	16.00	1.871	8.552	<0.0001***
42-55	17.00	1.700	10.00	<0.0001***

Graph 2: Hearing loss respect to the site of perforation

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Table 5: Hearing improvement respect to the site of perforation

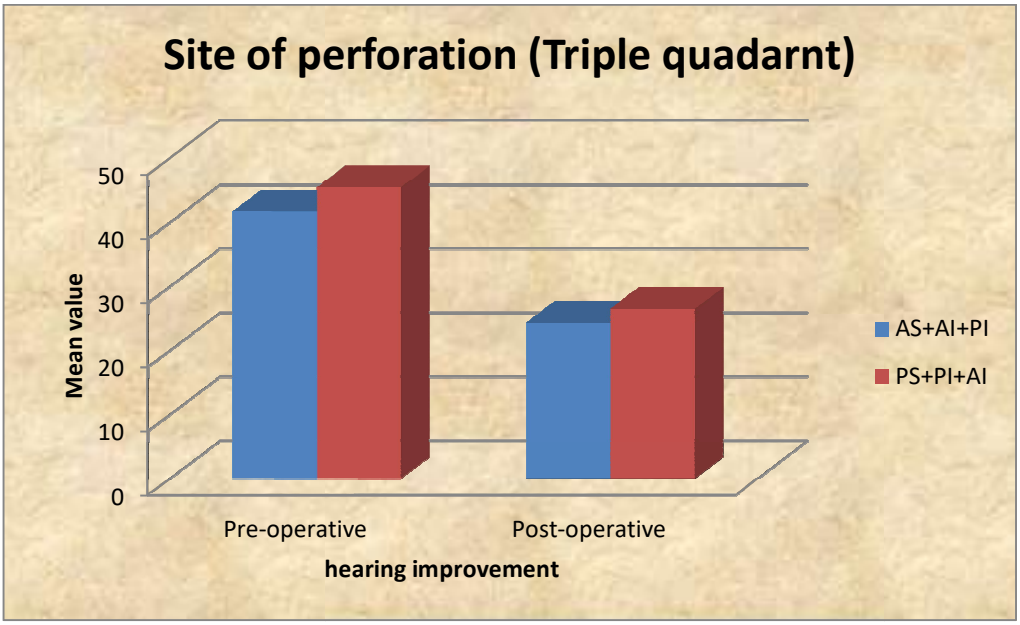
Site of perforation (Single quadrant)	Difference of mean	SD	t-value	p-value
AI	7.234	1.035	6.989	<0.0001***
PI	13.51	1.001	13.50	<0.0001***
AS	3.333	5.270	0.6315	0.5614
PS	10.000	3.536	2.828	0.0513

Table 6: Hearing loss respect to the site of perforation

Site of perforation (Double quadrant)	Pre-operative	Post-operative
AI+PI	36.54±6.086	23.46±5.276
AS+AI	34.44±4.501	21.67±2.970
PS+PI	38.48±6.058	22.42±3.775

Table 7: Hearing improvement respect to the site of perforation

Site of perforation (Double quadrant)	Difference of mean	SD	t-value	p-value
AI+PI	13.08	1.290	10.14	<0.0001***
AS+AI	12.78	1.271	10.05	<0.0001***
PS+PI	16.06	1.243	12.93	<0.0001***



Graph 3: Hearing loss respect to the site of perforation

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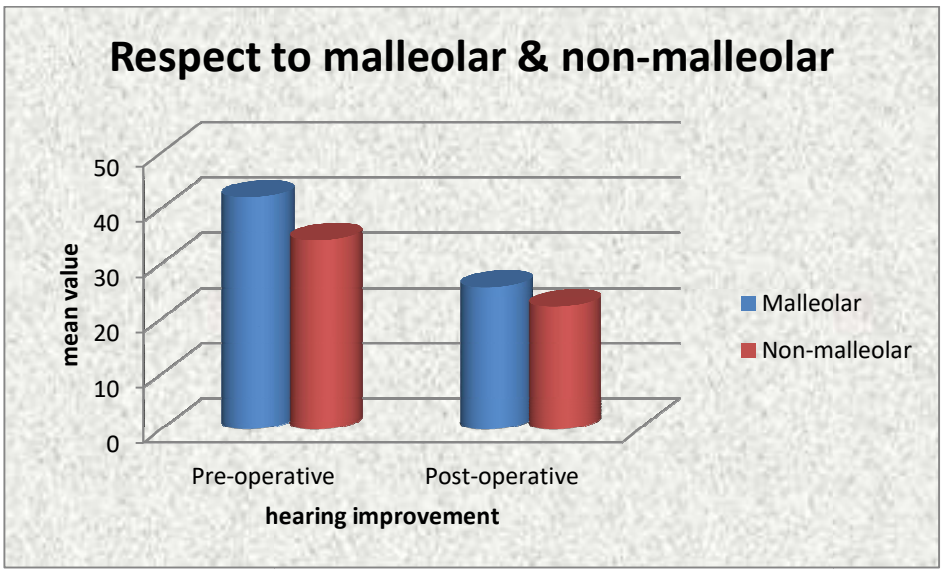
Table 8: Hearing loss respect to the site of perforation

Site of perforation (Four quadrant)	Pre-operative	Post-operative
AS+AI+PS+PI	46.18±3.762	26.76±5.574

The above table depicts that the hearing loss in site of perforation (four quadrant) AS+AI+PS+PI was 46.18±3.762db.

Table 9: Hearing improvement respect to the site of perforation

Site of perforation (Four quadrant)	Difference of mean	SD	t-value	p-value
AS+AI+PS+PI	19.41	1.631	11.90	<0.0001***



Graph 4: Hearing loss respect to malleolar and non-malleolar

Table 10: Correlation of graft rejected with site of perforation

	Site of perforation according to quadrant	Graft rejected	Percentage
Single quadrant	AI	1	4.76%
	PI	1	4.76%
Two quadrant	AS+AI	4	19.04%
	PS+PI	2	9.52%
	AI+PI	1	4.76%
Three quadrant	AS+AI+PI	4	19.04%
Four quadrant	AS+AI+PS+PI	8	38.09%
Total		21	100%

Discussion:

In present study showed that the mean age of patients was 30.67 years and the majority of patients were seen in 15 years to 35 years (70%) of age group. The reason for more number of patients in this age group may be attributed to the patients becoming more cautious socially about their hearing at this age and because of professional necessities or due to marriageable age group.

Tai CF, Ho KY, Juan KH (1998)[10] found mean age 37.9 years old. Mallikarjun S. Tegnoor, Kazim Ali, Sutrave Mithun (2017)[11] found lowest and highest age of patients at presentation is 13 and 55 years respectively with a mean age of 26.6 years. Kulwant Kaur Pannu et al (2011)[8] found age of patient ranged from 15–55 years, the mean age of presentation being 28.27 ± 11.59.

Size of Perforation and Hearing Loss:

In our study showed that the perforation size in between 1-14mm^2 (small) had average hearing loss was 31.63 db, while sudhakar Vaidya et al (2014)[12] found average hearing loss was 34.26 dB in small size perforations. Another study done by Kumar et al.[7] found 28.23 dB average hearing loss in small size perforation.

In our study showed that the perforation size in between 15-27mm^2 (medium) had average hearing loss was 36.33 db, while sudhakar Vaidya et al (2014)[12] found average hearing loss was 44 dB in medium size perforations. Another study done by Kumar et al.[7] found 32.42 dB average hearing loss in medium size perforation.

In our study showed that the perforation size in between 28-41mm^2 (large) had average hearing loss was 40.0 db, while sudhakar Vaidya et al (2014)[12] found average hearing loss was 45.50 dB in large size perforations. Another study done by Kumar et al.[7] found 36.26 dB average hearing loss in large size perforation.

In our study showed that the subtotal perforation size in between 42-55mm^2 had average hearing loss was 46.67 db, while sudhakar Vaidya et al (2014)[12] found average hearing loss was 49.31 dB in extra large size perforations. Another study done by Kumar et al.[7] found 44.62 dB average hearing loss in extra large size perforation.

Ahmad and Ramani[13] stated that the hydraulic action arising from the difference in area of TM and of the stapedial footplate is the most important factor in impedance matching. When the surface area is decreased, there will be decrease in amplification and hearing loss will be proportionate to size of perforation.

Site of Perforation and Hearing Loss:

Our study showed that the most of the site perforation in single quadrant was AI (24.54%) & hearing loss was 25.00 db, while sudhakar Vaidya et al (2014)[12] found average hearing loss was 30.36 dB in anteroinferior (AI) perforations. Kumar et al.[7] found 26.6 dB in AI and Nepal et al.[14] had reported 50 % of AI quadrant perforations with mild, 29 % with moderate & 21 % with minimal hearing loss.

Posteroinferior (PI) quadrant perforations had 35.68 db average hearing loss in our study. A study done by sudhakar Vaidya et al (2014)[12] found average hearing loss was 39.10 dB in Posteroinferior (PI) perforations. Kumar et al.[7] found 32.4 dB in PI and Nepal et al.[14] had reported 50 % of these perforations had mild, 39 % moderate & 11 % had minimal hearing loss.

In single quadrant anterosuperior (AS) perforation (only 3 cases) & posterosuperior (PS) perforation (3 cases) in our study had hearing loss of 25 dB & 32.5 db. A study done by sudhakar Vaidya et al (2014)[12] found anterosuperior (AS) perforation (only 1 case) had hearing loss of 25 dB. Nepal et al.[14] had reported 50 % of these perforations had had moderate, 25 % had mild & 25 % had minimal hearing loss.

In two quadrant AI+PI was most common (19.09%) followed by PS+PI (15.90%) and AS+AI (8.63%).

Two quadrants perforations Postero-superior & postero-inferior (PS+PI) in our study had shown average hearing loss was 38.48 db, which was consisted with kumar et al[7] found average hearing loss in PS+PI was 36.6 db. Another study done by sudhakar Vaidya et al (2014)[12] found average hearing loss in PS+PI was 46.83 db.

In anteroinferior & postero-inferior (AI+PI) average hearing loss was 36.54 db showed in our study, which was consisted with kumar et al[7] found average hearing loss in AI+PI was 32 db. Another study done by sudhakar Vaidya et al (2014)[12] found average hearing loss in AI+PI was 42.15 db.

Two quadrants perforations Anterosuperior & Antero-inferior (AS+AI) in our study had shown average hearing loss was 34.44 db, which was consisted with sudhakar Vaidya et al (2014)[12] found average hearing loss in AS+AI was 37.12 db. Another study done by kumar et al[7] found average hearing loss in PS+PI was 28.6 db.

In three quadrant AS+AI+PI were 1.36% cases and PS+PI+AI only 0.90% cases. Average hearing loss in site of perforation (triple quadrant) PS+PI+AI was 45.50 db, which was consisted with sudhakar Vaidya et al (2014)[12] found average hearing loss in AS+AI was 46 db.

Average hearing loss in AS+AI+PI was 41.67 db in our study. Kumar et al.[7] they had only studied anterosuperior, anteroinferior & posteroinferior (AS+AI+PI) perforations and average hearing loss was 36.6 dB.

In four quadrant AS+AI+PS+PI were involved 8.18% cases & average hearing loss had 46.18 db, which was consisted with sudhakar Vaidya et al (2014)[12] found average hearing loss in AS+AI+PS+PI was 48.88 db. According to Kumar et al.[7] average hearing loss in AS+AI+PS+PI was 44.6 db. Another study done by Nepal et al.[14] had noted that 12 cases of all quadrant perforations which had moderate hearing loss, while two of these had mild hearing loss.

Our results were conflicted with various studies Voss et al.[15] stated that hearing loss does not depend on the location of perforation.

Shambaugh[16] in a study of 42 ears with tympanic membrane perforation classified group C perforation (size 20–30% of surface area of TM) into anterior and posterior groups and found that there was no statistically significant difference between two means at any frequency.

Mehta et al.[17] stated that hearing loss does not vary substantially with location of the perforation. Effects of location, if any, are small.

Hearing improvement according to size of perforation:

Average hearing improvement in 1-14mm^2 size of perforation was 9.775 db followed by 13.83 db in 15-27 mm^2 size, 16.00 db in 28-41 mm^2 and 17.00 db in 42-55 mm^2 size of perforation. Which was statistical significant when compare in between pre-operative and post operative (P<0.0001) in our study. Nitin V. Deosthale et al (2015)[18] found to be more in subtotal perforation, i.e., 45.5dB followed by hearing loss in large perforation (38.48dB), moderate perforation (35.95dB), and small perforation (28.13dB). After surgical treatment, average hearing improvement was 6.03dB in small perforation. In Subtotal perforation average hearing improvement was found to be maximum i.e., 19.25dB as preoperative hearing loss was also more in those cases. Another study done by Vidya S et al.19 observed average hearing improvement of 14.03dB in small sized perforation, 16.08dB hearing improvement in medium sized perforation, 15dB in large sized perforation and 16.25dB hearing improvement in subtotal perforation.

Hearing improvement according to site of perforation:

In single quadrant, average hearing improvement in site of perforation was 13.51 db in postero-inferior (PI) followed by 10 db in postero-superior (PS), 7.234 db in anteroinferior (AI) and 3.33 db in anterosuperior (AS) site of perforation. In AI & PI site of perforation was statistical significant (P<0.0001).

In double quadrant, average hearing improvement was 16.06 db in postero-superior & postero-inferior (PS+PI) followed by anteroinferior & postero-inferior (AI+PI) was 13.08 db and 12.78 db in anterosuperior & antero-inferior (AS+AI) site of perforation. Which was statistical significant (P<0.0001***).

In triple quadrant, average hearing improvement in PS+PI+AI was 19.00 db and in AS+AI+PI was 17.60 db. In four quadrant AS+AI+PS+PI average hearing improvement had 19.41 db, which was statistical significant (P<0.0001).

Nitin V. Deosthale et al (2015)[18] found average hearing improvement was more in PI quadrant perforation than AS and AI quadrant perforation. Average hearing improvement was greater in perforations involving all four quadrants (AS+AI+PS+PI). These results are consistent with Vaidya et al.[19] study, in which average hearing improvement in PI quadrant perforation was of 17.04dB. In AS quadrant perforation, hearing improvement was of 12.94 and in all four quadrant perforation, hearing improvement was of 16 dB.[19]

Hearing Loss in Malleolar/Non-malleolar Perforation:

Our study showed that the average hearing loss in malleolar was 41.94±7.266 db and in non-malleolar was 34.17±6.467 db in our study. hearing improvement in malleolar was 16.29 db and in non-malleolar was 12.02 db in our study. Which was statistical significant (P<0.0001). A study done by Kulwant Kaur Pannu et al (2011)[8] found average hearing loss in malleolar perforation was 43.02 ± 9.70. Average hearing loss in non-malleolar perforation

was 28.25 ± 10.90. Hearing loss in malleolar perforation was more than non-malleolar perforation. Difference was significant statistically ('p' value<0.001). Another study done by Shah et al.[20] is his study observed that malleolar perforations had significantly greater hearing loss than nonmalleolar perforations.

Post-operative Follow Up: Graft Uptake and Residual Perforations:

Our study showed graft uptake on 220 patients, in follow-up period only 21 graft rejected (9.54%) due to site and size of perforation. Maximum no. of graft rejected in four quadrant (38.09%) followed by three quadrant (AS+AI+PI) was 19.04% and in two quadrant (33.33%). Out of which in two quadrant, maximum graft rejected seen in AS+AI (19.04%). A study done by Nitin V. Deosthale et al (2015)[18] found that complete graft uptake was in 86.96% patients and failure in 13.04% patients. Graft failure was more in larger perforations than small ones and those occupying all four quadrants.

In Vaidya S et al.[19] study, graft intact was in 86% cases and residual perforation in 14% cases. In his study residual perforation was more in subtotal perforation (37.5%) and those involving all four quadrants (33.33%). In Kumar et al.[7] study, graft was intact in 80% patient and rejected in 20% patients. In Kumar et al.[7] study, graft uptake rate had not been not studied in relation to size and site of perforation.

Conclusion:

We have observed that there is a relationship between size and site of perforation with hearing impairment in tubotympanic type of CSOM. The larger the perforation greater is the hearing loss. Average hearing improvement was also found to be greater in larger perforations. Posterior quadrant perforations were having more hearing loss and greater hearing improvement after surgery as compared to those with anterior quadrant perforation. Rate of graft uptake is directly proportional to size of perforation.

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