ORIGINAL RESEARCH

Audiological Evaluation of Hearing Loss in Patients of Tubotympanic CSOM Depending On Duration, Site & Size of Perforation

[1]Mallikarjun S Tegnoor, [2]Ayesha Siddiqui, [3]Uzra Fatima, [4]Kiran Deshmukh

[1]Professor, Department of Otorhinolaryngology, MahadevappaRampure Medical College, Kalaburgi, Karnataka, India
[2]Junior Resident, Department of Otorhinolaryngology, MahadevappaRampure Medical College, Kalaburgi, Karnataka, India
[3]Junior Resident, Department of Otorhinolaryngology, MahadevappaRampure Medical College, Kalaburgi, Karnataka, India
[4]Professor and HOD, Department of Otorhinolaryngology, MahadevappaRampure Medical College, Kalaburgi, Karnataka, India.

Corresponding Author
Dr.Mallikarjun S Tegnoor
Professor, Department of Otorhinolaryngology, MahadevappaRampure Medical College, Kalaburgi, Karnataka, India
Email: drmstegnoor@yahoo.com

Received: 25April, 2023 Accepted: 30May, 2023

ABSTRACT

Background: Tympanic membrane perforation because of CSOM is one amongst the most common causes of hearing loss. This study is done to evaluate hearing loss in patients depending on duration, site & size of perforation.**Methods:**This Study is done in patients with unilateral inactive mucosal CSOM. Detailed history and thorough ENT examination is done where duration, size and site of perforation is noted. Further the Size of perforation is classified into four groups depending on number of quadrants involved and the site of perforation is categorized into four groups on basis of its relation to handle of malleus, finally hearing evaluation is done by pure tone audiometry and analysed.**Result:**50 patients belonging to age group of 15-80 years are included, 50% males and 50% females. The duration of perforation is <1 year in 30%, 1-5 years in 42% and >5 years in 28% individuals, in this the hearing loss increases with increasing duration of perforation. Site of perforation is anterior in 34%, posterior in 20%, inferior in 30% and subtotal in 16%, in this posterior quadrant perforation showed maximum hearing loss. Perforation size involving one quadrant is seen in 18%, 2 quadrants in 66% and 4 quadrants in 16% individuals, Single quadrant perforation shows less hearing loss as compared to others.**Conclusion:**Thus, we conclude that in our study that hearing loss at all the frequencies increases as duration of disease increase and this difference is statistically significant. Here we also conclude that hearing loss increases with increasing size of perforation and the location of tympanic membrane perforation plays a significant role in assessing hearing loss.

Key words: Tubo-Tympanic CSOM, Tympanic Membrane, Perforation, Hearing Loss, Pure Tone Audiometry

INTRODUCTION

Tympanic membrane (TM) perforations are a common phenomenon and usually the result of infection, ventilation tube insertion or trauma[1]. Perforation of tympanic membrane results in the reduction of surface area of the membrane available for transmission of sound pressure. As a result, sound to passes directly into the middle ear, which leads to pressure gradient becoming insignificant between 'inner' and 'outer' surfaces of the tympanic membrane. Many studies have come to a conclusion that, as the size of perforation increases the decibel loss also increases. A total absence of the tympanic membrane would lead to a loss in the transformer action of 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.[2] 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.[2] However, some workers believe that there is no significant effect associated with location of the perforation.[4,6] This difference of opinions in various studies is the reason for undertaking this study. To investigate the relationship between duration, size and site of perforation with magnitude of hearing loss. Accurate evaluation of perforation of TM is an important guide for a well-informed management of this problem. It is a highly prevalent condition and an important cause of preventable hearing loss.[4] Perforated eardrum results in conductive hearing loss, and this range is reported not to exceed 50 dB.[5-6]

Aim of Study

Evaluation of hearing loss in patients of tubotympanic CSOM depending on duration, site & size of perforation.

MATERIALS AND METHODS

Study Design: A prospective study.

Sampling Procedure: Simple random sampling technique.

Study Sample: 50 patients

This Study is done in patients with unilateral inactive mucosal CSOM. Detailed history and thorough ENT examination is done and the duration, size and site of perforation is noted. Further the Size of perforation is classified into four groups depending on number of quadrants involved and the site of perforation is categorized into four groups on basis of its relation to handle of malleus, finally hearing evaluation is done by pure tone audiometry and analysed.

Inclusion Criteria

1. Both sexes
2. Age group between 15 and 80 years
3. Patients with tubotympanic type of CSOM

Exclusion Criteria

1. Age below 15 years and above 80
2. Patients having sensorineural or mixed hearing loss
3. Patients with atticoantral disease
4. Patients with myringosclerosis
5. Patients with bilateral Chronic Suppurative Otitis Media.
6. Patients with congenital malformations in ear.
7. Patients with traumatic perforation.
8. Patients with previous surgical procedure is done on any ear.

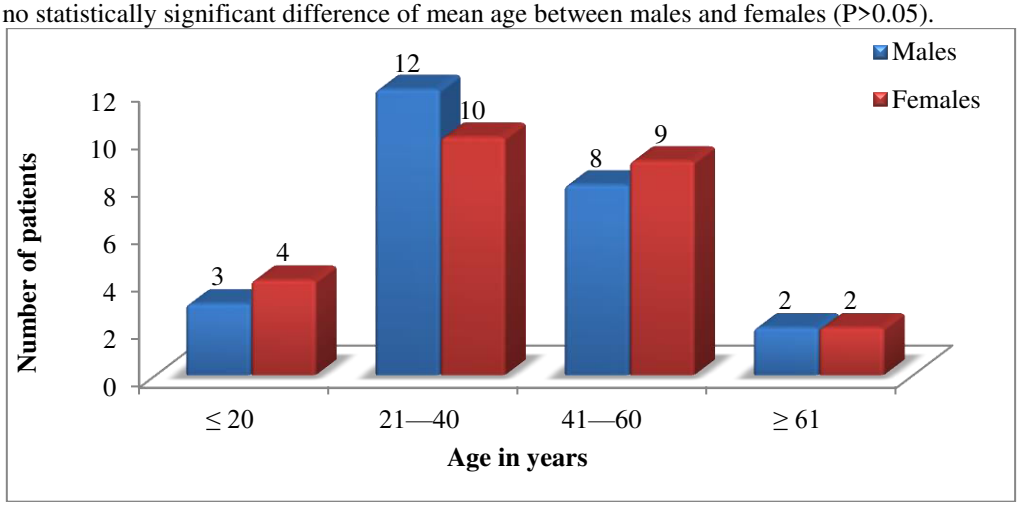
RESULTS

Table No.1: Age and gender wise distribution of patients

Age in years	Males		Females		Total	
	No.	%	No.	%	No.	%
≤ 20 years	3	12.0	4	16.0	7	14.0
21—40 years	12	48.0	10	40.0	22	44.0
41—60 years	8	32.0	9	36.0	17	34.0
≥ 61 years	2	8.0	2	8.0	4	8.0
Total	25	100.0	25	100.0	50	100.0
Mean ± SD	37.91 ± 15.31		37.42 ± 14.68		37.67 ± 14.78	
t-test, P-value & Sign	t = 0.908, P = 0.908, NS					

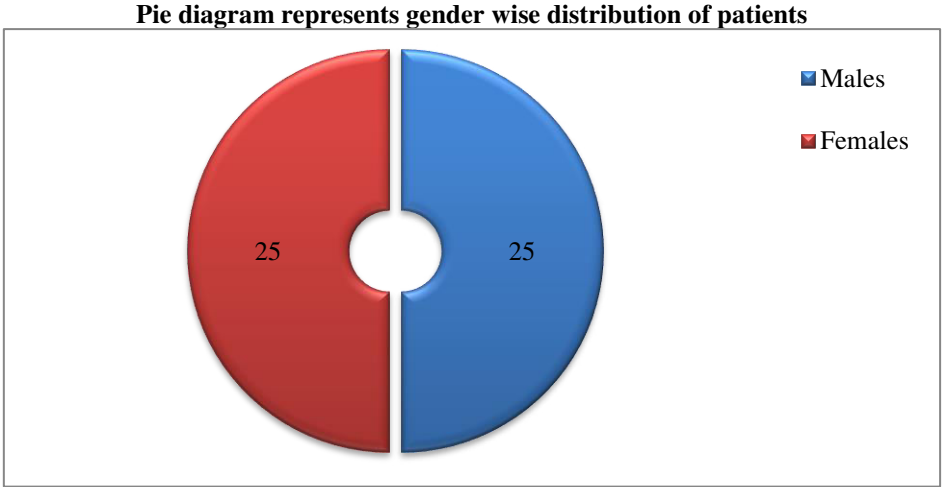
Out of 50 patients, maximum number 22 (44.0%) of patients belongs to the age group of 21—40 years, followed by 17 (34.0%) of patients were belonging to age groups of 41-60 years and 7 (14.0%) of patients in the age group of ≤ 20 years. The minimum age of patient is 16 years and maximum age is 78 years. The mean age of patients is 37.67 years.

There is no statistically significant difference of mean age between males and females (P>0.05).



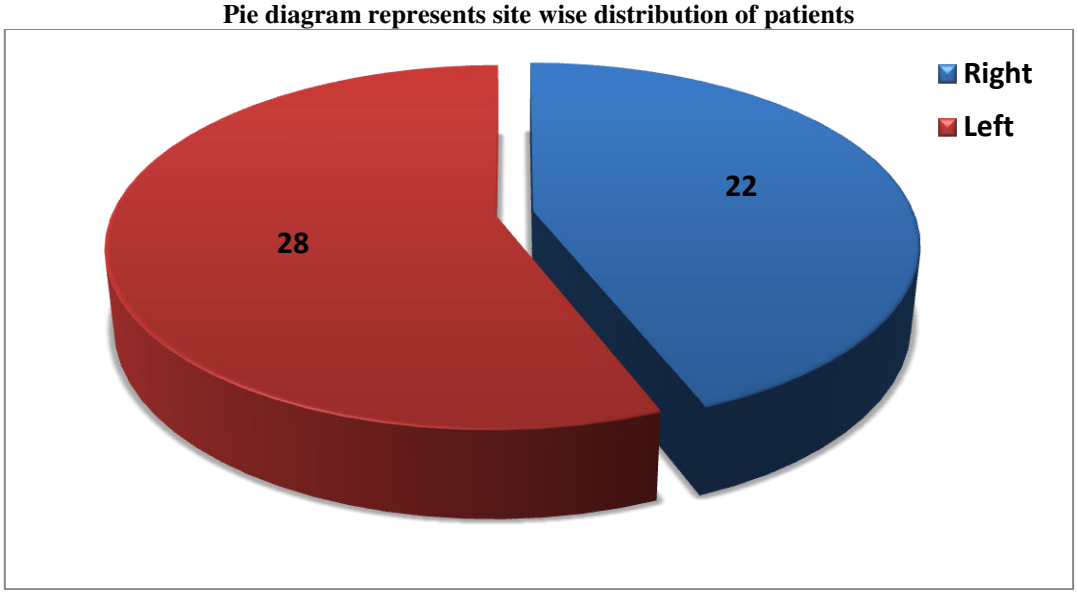
Multiple bar diagram represents age wise distribution of patients

Pie diagram represents gender wise distribution of patients



25 (50.0%) of patients are males and 25 (50.0%) of patients are females. The male to female ratio in the study is 1:1

Pie diagram represents site wise distribution of patients



In this study 22 (44.0%) patients shows right ear involvement and 28 (56.0%) patients shows involvement of left ear.

Table No.2: Duration of ear discharge wise distribution of patients

Age in years	**Number of patients**	**Percentage**
≤ 1 year	16	32.0
1—5 years	28	56.0
> 5 years	6	12.0
Total	50	100.0
Mean ± SD	2.96 ± 2.08 years	----

Study observes that in majority of patients i.e. 28 (56.0%) the duration of ear discharge is 1—5 years. 16 (32.0%) patients shows ≤ 1 year of ear discharge and 6 (12.0%) of patients shows > 5 years of ear discharge. The mean duration of ear discharge is 2.96 years.

Simple bar diagram represents duration of ear discharge wise distribution of patients

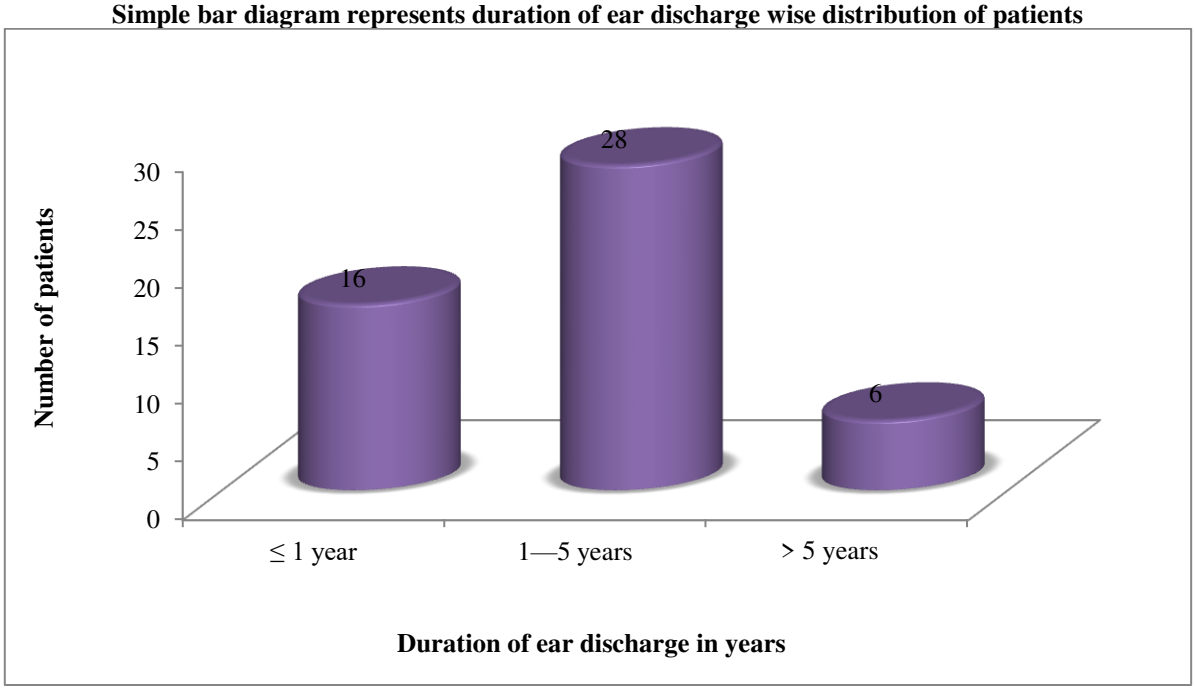


Table No.3: Correlation between duration of ear discharge and PTA

Duration of ear discharge	No. of patients	PTA	ANOVA Test, P-value & Significance
		Mean ± SD	
≤ 1 year	16	29.1 ± 11.4	F = 18.469 P = 0.000 HS
1—5 years	28	41.7 ± 6.5	
> 5 years	6	51.2 ± 4.6	
Total	50	------	
Correlation coefficient	r = +0.83, P =0.01 HS		

HS = highly significant

There is statistically highly significant difference of mean PTA with duration of ear discharge (P<0.001). Study reveals that, there is positive correlation between duration of ear discharge and PTA (P<0.01). As the duration of ear discharge increases the PTA values also goes higher.

Simple bar diagram represents association between duration of ear discharge and PTA

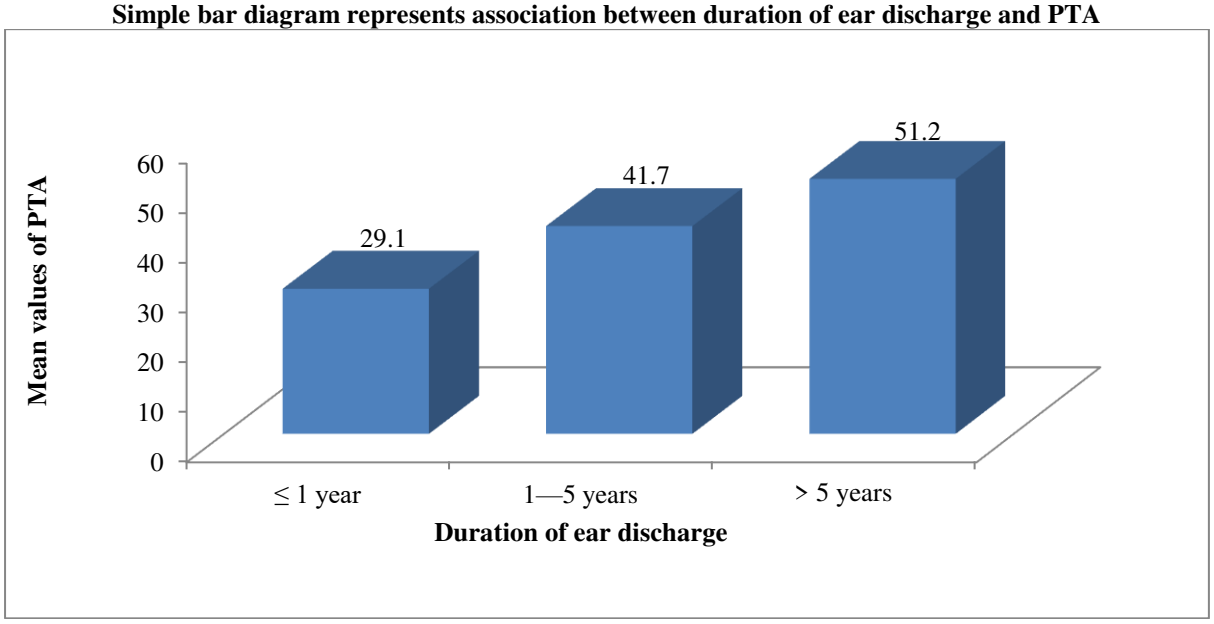


Table No.4: Site of perforation

Site	No. of patients	PTA Mean ± SD	Comparison between the sites	t-test, P-Value & significance
Anterior	17	29.74 ± 9.97	Anterior v/s posterior	t = 2.561, P = 0.017, S
Posterior	10	38.09 ± 16.34	Anterior v/s Inferior	t = 2.096, P = 0.045, S
Inferior	15	21.97 ± 10.29	Anterior v/s Subtotal	t = 3.623, P = 0.001, HS
Subtotal	8	45.68 ± 9.56	Posterior v/s Inferior	t = 2.900, P = 0.008, HS
Total	50	------	Posterior v/s subtotal	t = 1.098, P = 0.288, NS
ANOVA Test, P-value	----	F = 7.929, P = 0.000 HS	Inferior v/s Subtotal	t = 5.151, P = 0.000, HS

Ns = Not significant, S= Significant, HS = highly significant

There is statistically highly significant difference of mean PTA between anterior and subtotal, posterior and inferior and inferior and subtotal perforation (P<0.001) and there is statistically significant difference of mean PTA between anterior and posterior and anterior and inferior perforation (P<0.05), whereas there is no statistically significant difference of mean PTA between posterior and subtotal perforation (P>0.05).

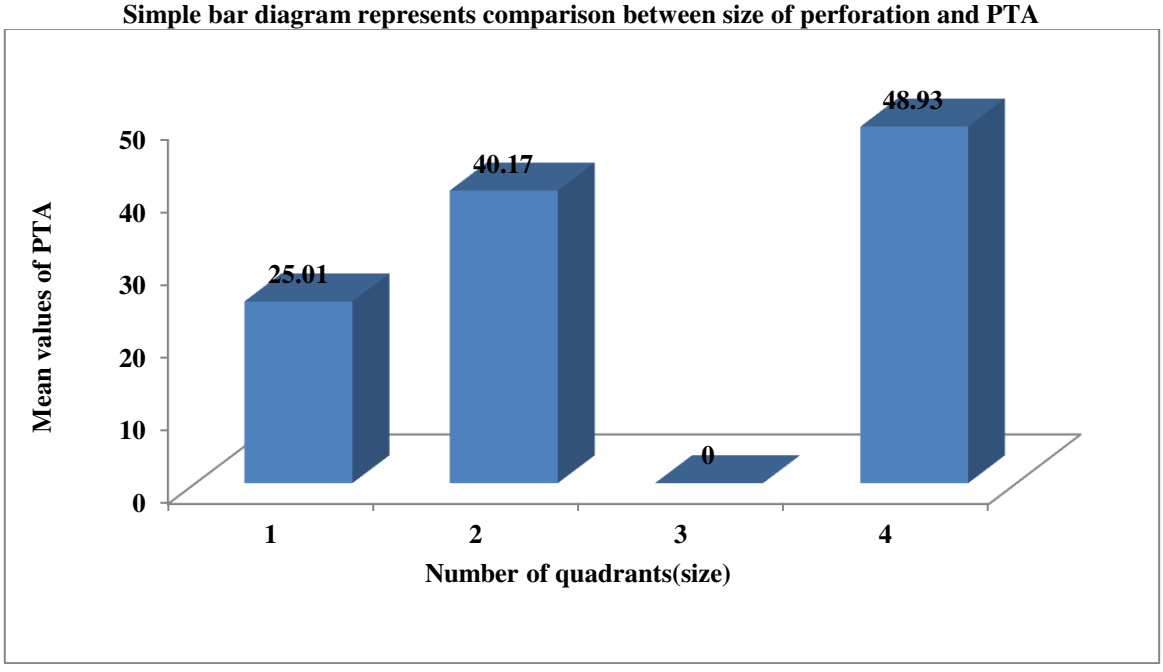
Table No.5: Comparison between size of perforation and PTA

Size of perforation	No. of patients	PTA Mean ± SD	ANOVA Test, P-value & Significance
1	9	25.01 ± 5.86	F = 17.448 P = 0.000 HS
2	33	40.17 ± 9.08	
3	0	0.0 ± 0.0	
4	8	48.93 ± 7.62	
Total	50	------	

HS = highly significant

There is statistically highly significant difference of mean PTA with respect to size of perforation (P<0.001). Comparison of mean size of perforation between pre-treatment and after (post) final treatment (P<0.001), after final treatment mean PTA is significantly increased as compare to pre-treatment.

Simple bar diagram represents comparison between size of perforation and PTA



Statistical data Analysis

Statistical data is analyzed by IBM SPSS 25.0 version software. Collected data is spread on excel sheet and master chart is prepared. Through the master chart tables and graphs are constructed. For quantitative data analysis t-tests and ANOVA tests are applied. For qualitative data analysis chi-square test is applied for statistical significance. If P-value is less than 0.05 considered as significant.

DISCUSSION

The study comprises of 50 patients. All cases here had unilateral involvement of ear and hence total number of ears involved in this study is also 50. Patients of age group between 15 and 80 years are included. In this study, most common affected age group is 20– 30 years. The possible reason for this could be that people in this group are socially more active and are more health conscious. 25 were males and 25 females. Right ear perforation was in 22 individuals and left ear in 28.

Hearing Loss According to the Duration of Perforation

In our study, hearing loss increased as the duration of disease increased. On comparing hearing loss in all the three groups, it was observed that average hearing loss increased significantly as the duration of disease increased. Our observation regarding the duration of disease is similar to Pannuet al.[7] and Aneesa et al[8]

Hearing Loss According to the Site of Perforation

In our study posterior quadrant perforations have higher mean hearing loss than anteriorly located perforations with statistically significant p value. However, hearing loss was highest in perforations involving multiple quadrants (i.e. in subtotal perforation). This view has been supported by Bianca et al and Malik et al.[10,11] This can be attributed to the direct exposure of round window to the sound waves resulting in cancellation of phase difference between the oval and round windows.

Hearing Loss According to the Size of Perforation

The present study showed a significant linear association between size of the tympanic membrane perforation and the degree of hearing loss with 'p' value of "0.0". Similar results were obtained by the Maharjan et al on 119 tympanic membrane perforation. They found patients with larger perforations involving all four quadrants with greater hearing loss and larger air–bone gap, with a strong trend for hearing loss to increase as the perforation size increased. The same findings were also shown by Pannu et al and Nepal et al in their respective studies who found perforation size to be the most important determinant of hearing loss.[7, 9] This can be explained as the larger perforation size result in greater loss of middle ear and mastoid volume, a significant predictor of hearing loss and also decreases the phase effect due to the direct exposure of round window to the sound pressure

CONCLUSION

1. Tympanic membrane perforation causes hearing loss ranging from mild to moderate.
2. From our study we concluded that mean hearing loss at all the frequencies increases as the duration of disease increase and the difference is statistically significant also hearing loss increases with increasing size of perforation .and the location of tympanic membrane perforation plays a significant role in assessing hearing loss.
3. A thorough knowledge of all these results would allow us to clinically predict the hearing loss based on size and site of perforation.

Statement and Declaration

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. T.S. Ibekwe, G.T. Ijaduola, O.G. Nwaorgu, Tympanic membrane perforation among adults in West Africa, Otol. Neurotol. 28 (2007) 348–352.
2. Ahmad SW, Ramani GV: Hearing loss in tympanic membrane perforations. JLO 1979, 93:1091-1098.
3. Roland NJ, McRae RDR, McCombe AW: From Chronic suppurative otitis media. In Key topics in Otolaryngology and head and neck surgery 2nd edition. Wales, Bios scientific publishers; 2001:38-41.
4. Nahata V, Patil CY, Patil RK, Gattani G, Disawal A, Roy A. Tympanic membrane perforation:Its correlation with hearing loss and frequency affected – An analytical study. Indian J Otol. 2014:20(1):10-5.
5. Voss SE, Rosowski JJ, Merchant SN, Peake WT. How do tympanic-membrane perforations affect human middle-ear sound transmission? ActaOtolaryngol. 2001;121(2):169-73.
6. Voss SE, Rosowski JJ, Merchant SN, Peake WT. Middle-ear function with tympanic-membrane perforations. II. A simple model. J AcoustSoc Am. 2001;110(3):1445-52.
7. Pannu KK, Chadha S, Kumar D, Preeti. Evaluation of hearing loss in tympanic membrane perforation. Indian J Otolaryngol Head Neck Surg. 2011;63(3):208–13.
8. Aneesa M et al. Int J Otorhinolaryngol Head Neck Surg. 2019 Sep;5(5):1213-1216.
9. Nepal A, Bhandary S, Mishra SC, Singh I, Kumar P. The morphology of central tympanic membrane perforations. Nepal Med Coll J. 2007;9(4):239–44
10. Bianca N, Doina V, Ermil T. Annals of the University of Lower Danube Galati. Medicine Beam XVII. 2011;2:17.
11. Malik S, Ashrafi K, Sohail Z, Afaq S, Nawaz A. Determinants of variable hearing loss in patients with chronic suppurative otitis media. Pak J Otolaryngol. 2012;28:45-7.