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REVIEW ARTICLE

Degree of Hearing Loss in Association with Site of Tympanic Membrane Perforation: A Systematic Review

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ABSTRACT

Background: Tympanic Membrane perforation is commonly seen in a middle ear pathology called chronic otitis media that affects at least 0.5% of the total world population.
Aim: To evaluate the nature of hearing loss in tympanic membrane perforation (TMP) based on the site of perforation.
Study design: Systemic review.
Methodology: All the articles were taken from Google Scholar, Cochrane Library, Pub Med, NCBI (NLM Catalog) and HEC Digital Library within five years range: 2017-2021. All the researchers were screened widely by a well-intentioned peer review group.
Results: Articles (n=19) were included in the review. In case of site of perforation, most of the articles compared anterior site with posterior and central, depicting that posterior site causes more hearing loss than anterior site, while central perforations had greater hearing loss than anterior/posterior site. The total sample size of these 19 articles collectively was (n=1,650). Most severe hearing loss with respect to site of TM perforation was demonstrated in only 1 study (5.26%) out of 19 and that was 61-80 decibels. One study (5.26%) showed no correlation between hearing loss and site of TM perforation.
Practical Implication: Sometimes, it is seen in ENT practices that there was a dilemma regarding the severity of hearing loss with respect to site of perforation. It benefited otolaryngologists to find a systematic review on the provided topic, to learn and know more about the association between hearing loss and site of TMP.
Conclusion: We concluded that anterior sites of perforations cause less hearing loss than posterior, central or marginal.
Keywords: Hearing loss; Tympanic membrane perforation; Site of TM perforation.

INTRODUCTION

Tympanic Membrane (TM) perforation is commonly seen in a middle ear pathology called chronic otitis media (COM) that affects at least 0.5% of the total world population.[1] Owing to perforation, there is a shift in sound pressure and decrease in ossicular pairing. Various authors have recognized relation between tympanic membrane perforation and hearing loss.[2] COM generates mild (from 26 dB) to moderate (up to 55 dB) conductive hearing loss (CHL) in more than the fifty percent cases, usually[3].

HL is categorized as a decline in hearing ability which ranges from minimum loss to maximum HL.[4] HL is a chief issue that often goes ignored. It comprises three major types (conductive, mixed and sensorineural).[5] Degree of HL is the intensity at which hearing thresholds of a person lie i.e. mild degree hearing loss (26-40 dB) or moderate/severe degree hearing loss (>40 dB).[6]TMP may possibly take place after an acute or chronic infection of the middle ear or after a shock.[7] Whereas the effect of perforation on the system of the middle ear is multifaceted and not fully definite, we know that in single membrane perforations with the ossicles remaining undamaged, CHL up to 50 decibels can occur.[8] The site and the size of the TMP as well as the volume of the middle ear and that of the mastoid are various factors that affect the intensity of the hearing impairment[9]. Outcomes obtained in the few prior studies illustrate that larger perforations that are posteriorly located add to the CHL level, particularly at lower frequencies. There has been much contradictory information about commonness of hearing loss related with TMP in association with size, site or duration.[10]The effect of TMP on conduction of sound is not easy to correlate due to extra pathological change in the middle ear. An improved considerate thought about effect of perforation on middle ear will assist us predict the extent and frequency of hearing loss[11].

Sometimes, it is seen in ENT practices that there is a dilemma regarding the severity of hearing loss with respect to site of perforation. It was beneficial for otolaryngologists to find a systematic review on the provided topic, to learn and know more about the association between hearing loss and site of TMP.

The objective of the study was to evaluate the nature of hearing loss in tympanic membrane perforation (TMP) based on the site of perforation.

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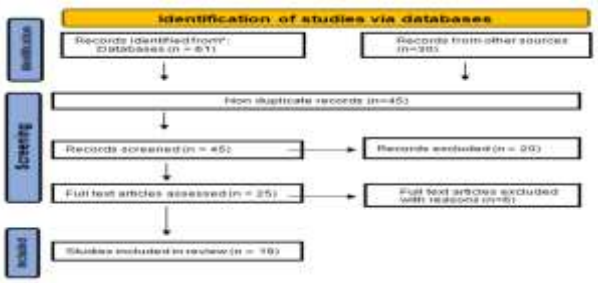
METHODOLOGY

Different search-engines/databases (Google Scholar, Cochrane Library, PubMed, NCBI (NLM Catalog) and HEC Digital Library) were brought into browsing dated 31/10/2021 to search the articles related to our topic. Many keywords were used in many possible combinations to search the articles related to our research i.e.: hearing loss, tympanic membrane perforation, degree of hearing loss, type of hearing loss, site of TMP, audiological findings in TMP, association of hearing loss and TMP. Only the articles from 2017-2021 were. Only full text free articles, published in English language, were included. Paid & non permitted articles were excluded.

The search on databases/search-engines identified 61 topics related to our topic, among which only 32 were as per requirement. Out of it, 7 articles were abstracts only, so they were excluded as well. Out of the remaining 25 full text free articles, 6 were excluded because they were discussing other pathologies too besides association between type and degree of hearing loss and site of TMP. Finally, 19 articles were found eligible to carry systematic review forward with them. All the researchers were inspected widely by a well-intentioned peer review group.

Figure-1: Depicting Identification of studies via database



RESULTS

For site of perforation, different terminologies were used to describe site of perforation and nature of HL. All of these terminologies along with association were given in Table-1. Moreover, all the perforations were dry.

Table-1: Site of perforation and nature of hearing loss

Study	Perforation Site	Degree of HL (dB)	Prevalent Type of HL
Hardik Darad 2017 [12]	Anterior & Non Malleolar	Lesser	Conductive
	Posterior &Malleolar	Greater	Conductive
M Radef Dawood 2017 [13]	Anterior Central	34.7	Conductive
	Posterior Central	37.8	Conductive
	Central Malleolar	39.2	Conductive
Teja Deepak Dessai 2017 [14]	Large Central	41.6	Conductive
	Small Central	22	Conductive
	Posterior	27.5	Conductive
	Anterior	41.3	
Sushil Gaur 2017 [15]	Large Central	20.2	Conductive
	Large Peripheral	14	Conductive
	Small Central	17.6	Conductive
	Small Peripheral	17	Conductive
	Anteroinferior	18.4	Conductive
	Posteroinferior	19.8	Conductive
David J. Carpenter 2017[16]	This study did not correlate hearing loss with site of perforation but size of perforation.		
Johnson Ediale 2018 [17]	Central Anterior	26-40	Conductive
	Central Posterior	26-40	Conductive
	Marginal	61-80	Conductive
Ravi Dudda 2018 [18]	Anterior	32.65	Conductive
	Central	43.20	Conductive
	Posterior	46.61	Conductive
KartikHerkal 2018 [19]	Posterior	28.6	Conductive
	Anterior	26.5	Conductive
	Subtotal	34.2	Conductive
AparaajitaUpadhyay 2018 [20]	Anterior	Mild-Moderate	Conductive
	Posterior	Mild-Moderate	Conductive
Arvinder Singh Sood 2018 [21]	Central	39.34	Conductive
	Posteroinferior	34.82	Conductive
	Anteroinferior	35.25	Conductive
	Anterosuperior	15	Conductive
Amjed H Ali 2018 [22]	Central	37	Conductive
	Posterior	25.6	Conductive
	Anterior	24.8	Conductive
Emmanuel ChofforNchinda 2018 [23]	Anterior	30	Conductive
	Posterior	32.9	Conductive
	Both	37.9	Conductive
Rabeea J Atiyah 2018 [24]	Most of the sites	Mild (16-40)	Conductive
Satish Kumar Bandaru 2019 [25]	Anterior	32.1	Conductive
	Posterior	35.5	Conductive
	Both	36.4	Conductive
Ramandeep Singh Virk 2019 [26]	Postero-superior	15 dB AB Gap	Conductive
	Postero-inferior	0.5 dB AB Gap	Conductive
	Central	9.5 dB AB Gap	Conductive
	Antero-superior	8 dB AB Gap	Conductive
	Antero-inferior	13 dB AB Gap	Conductive
Anil HT 2019 [27]	Antero-inferior (AI)	25	Conductive
	Postero-inferior (PI)	28	Conductive
	Antero-superior (AS) +AI	30	Conductive
	PS+PI	35	Conductive
	AI+PI	38	Conductive
	AS+AI+PI	39	Conductive
	AS+AI+PS+PI	45	Conductive
Shubhangi Gupta 2019 [28]	Anterior	29.9	Conductive
	Posterior	35.8	Conductive
	Multiple	44.9	Conductive
	Total	38.7	Conductive
MirzaAneesa 2019 [29]	Anterior	27.11	Conductive
	Posterior	36.96	Conductive
	Central	42.4	Conductive
MuntazirHussain 2021 [30]	Anterior	Anterior ones have 5.5 dB greater HL than posterior.	Conductive
	Posterior		

Table-2 represented association of HL & perforation site but with an addition of a column representing number of studies that stated the given intensity of HL as per site.

Table-2: Degree of hearing loss as per site of perforation

Perforation Site	Degree of HL	No. of Studies
Anterior Central	Mild	2*(Dawood et al 2017, Edial et al 2018)* [13,17]
Posterior Central	Mild	2*(Dawood et al 2017, Edial et al 2018)* [13,17]
Central	Mild	3*(Dawood et al 2017, Sood et al 2018, Ali et al 2018)* [13,21,22]
Large Central	Moderate	1*(Dessai et al 2017)* [14]
Small Central	Normal Hearing	2*(Dessai et al 2017, Gaur et al 2017)* [14,15]
Posterior	Mild	8*(Dessai et al 2017, Herkal et al 2017, Nchinda et al 2018, Upadhyay et al 2018, Bandaru et al 2019, Anil HT et al 2019, Gupta et al 2019, Aneesa et al 2019)* [14,19,23,20,25,27,28,29]
Anterior	Moderate	1*(Dessai et al 2017)* [14]
Large Central	Normal Hearing	1*(Gaur et al 2017)* [15]
Large Peripheral	Normal Hearing	1*(Gaur et al 2017)* [15]
Small Peripheral	Normal Hearing	1*(Gaur et al 2017)* [15]
Antero-inferior	Normal Hearing	2*(Gaur et al 2017, Anil HT et al 2019)* [15,27]
Postero-inferior	Normal Hearing	1*(Gaur et al 2017)* [15]
Marginal	Moderately Severe	1*(Ediale et al 2018)* [17]
Anterior	Mild	8*(Dudda et al 2018, Herkal et al 2017, Nchinda et al 2018, Upadhyay et al 2018, Bandaru et al 2019, Anil HT et al 2019, Gupta et al 2019, Aneesa et al 2019)* [18,19,23,20,25,27,28,29]
Posterior	Moderate	1*(Dudda et al 2018)* [18]
Central	Moderate	2*(Dudda et al 2018, Aneesa et al 2019)* [18,29]
Subtotal	Mild	1*(Herkal et al 2018)* [19]
Postero-inferior	Mild	2*(Sood et al 2018, Anil HT et al 2019)* [21,27]
Antero-inferior	Mild	1*(Sood et al 2018)* [21]
Antero-superior	Normal Hearing	1*(Sood et al 2018)* [21]
Posterior	Normal Hearing	1*(Ali et al 2019)* [22]
Anterior	Normal Hearing	1*(Ali et al 2019)* [22]
Multiple	Moderate	1*(Gupta et al 2019)* [28]
Total	Mild	1*(Gupta et al 2019)* [28]

Though it was found that most of the studies established mild degree hearing loss with most of the sites of perforations but looking at the individual intensities in decibels, posterior perforations had greater hearing loss than anterior ones. The studies that discussed central perforations depicted that central one had greater hearing loss than anterior and posterior perforations. Only one (Ediale et al 2018) of the studies discussed marginal perforation that had moderately severe degree of conductive hearing loss. It is the highest degree of hearing loss seen in included articles while other studies depicted hearing loss no greater than 55 dB. One study (5.26%) showed no correlation between hearing loss and site of TMP.

DISCUSSION

We have established by comparing all the studies that anterior sites of perforations cause less hearing loss than posterior, central or marginal.

Ediale et al 2018 led a cross sectional study in Benin City of Nigeria. They tracked down that CHL had the most noteworthy commonness; 64.3% in right ear and 55.9% in left ear. Slight degree of CHL was found very common. Nonetheless, the

seriousness of hearing disability expanded with the size and furthermore vitiated with respect to the area of TM perforation[17]. A study conducted in Karachi, Pakistan by Hussain et al 2021 stated similar results. They resulted that a distinction of 5.5 decibels was noted among different TMPs of posterior and anterior area. Off course, posterior sites had greater HL[30].

Darad et al 2017 concluded that it was seen that there is immediate connection among site of TMPs and HL. There was observed less hearing impairment in small TMPs. Posterior TMPs had a more prominent HL than anterior TMPs and multi quadrants. This study was from Gujrat, India focusing different parameters of HL and TMPS and their correlation[12]. Another study by Alsarhan (2016) in Iraq assessed that there was an increase in hearing loss with the increase in the size of perforation. They also stated that TMP site was related to HL as we stated; their result was statistically significant with a P value 0.037 stating that TMPs in the posterior quadrants had greater HL than other quadrants[31].

CONCLUSION

We concluded thatanterior sites of perforations cause less hearing loss than posterior, central or marginal. Type of HL in all the studies was conductive.

Limitations: Further reviews can be conducted by including a wider range of years and including paid articles as well in the study. Not many articles in our review discussed central and marginal perforations.

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Conflict of Interest: None to declare

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