

## CORRELATING THE SITE OF TYMPANIC MEMBRANE PERFORATION WITH HEARING LOSS

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**ABSTRACT: AIMS AND OBJECTIVES:** To study the various sites of perforation in patients with chronic suppurative otitis media (CSOM)-Safe type and to study the relationship of the perforator quadrant with the degree of hearing loss. **MATERIALS AND METHODS:** Cross sectional prospective study conducted between June 2014 - June 2015 in the department of ENT; 103 ears of 88 patients with tympanic membrane perforation-chronic suppurative otitis media (Safe type) at Chettinad hospital and research institute; Chennai. **RESULTS:** The sites/locations of perforations on the tympanic membrane were correlated with their mean hearing levels (dB) using chi-square test. Out of 103 perforated tympanic membranes, 29 had all four quadrant perforation (28.16%). Out of these 29 patients 7 had severe conductive hearing loss (24%) and 16 had moderate conductive hearing loss (55%). **CONCLUSION:** The location of perforation on the tympanic membrane has effect on the magnitude of hearing loss. It has a significant impact in chronic suppurative otitis media.

**KEYWORDS:** CSOM; Site of Perforation; Hearing loss; Tympanic Membrane Perforation.

**INTRODUCTION:** Chronic suppurative otitis media (CSOM) has been defined as chronic inflammation of the mucoperiosteal layer of the middle ear cleft associated with or without a perforation of the tympanic membrane.<sup>[1]</sup> CSOM with a perforation is often accompanied by past and present history of intermittent otorrhea and conductive hearing loss. As ENT surgeons, we evaluate Tympanic membrane pathologies on a daily basis; however, accurately predicting hearing loss in tympanic membrane perforations is not always straightforward.

There is quite a discrepancy in the estimation of a perforation size.<sup>[2]</sup> It is a highly prevalent condition and an important cause of hearing loss. According to a classification by the World Health Organization (WHO) for the burden of CSOM, India was put into the highest (>4%) prevalence group.<sup>[3]</sup> In other study, posterior perforation found to have more hearing loss than the anterior perforation due to the presence of ossicles in the posterior superior quadrant and round window niche in posterior inferior quadrant.<sup>[4]</sup>

The location of the perforation as believed by some schools of thought as to have a significant effect on the magnitude of hearing loss. It has been established that the larger the perforation on the tympanic membrane, the greater the decibel loss in sound perception. A total absence of tympanic membrane would lead to a loss in the transformer action of the middle ear.<sup>[5]</sup>

Some workers believe that there is no significant effect associated with the location of perforation.<sup>[5]</sup> Intact tympanic membrane protects the middle ear cavity from infections and shields the round window from direct sound waves which is referred to as the "Round Window Baffle".<sup>[6]</sup> A perforation of the tympanic membrane reduces the surface area of the membrane available for sound pressure transmission and allows the sound to pass directly in to the middle ear.

## ORIGINAL ARTICLE

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As a result the pressure gradient between the inner and the outer surface of the membrane virtually becomes insignificant, the effectiveness with which the tympanic membrane transmits motion to the ossicular chain is thus impaired along with the level of hearing.<sup>[7,8]</sup>

Due to this divergent opinion, we set to investigate the relationship between the location of perforation in the tympanic membrane and the magnitude of hearing loss with an aim to contribute to the body of knowledge on this subject.

### **MATERIALS AND METHODS:**

**Study Design:** Cross sectional prospective study conducted between June2014-June2015 in the department of ENT, Chettinad hospital and research institute in patients with tympanic membrane perforation- Chronic suppurative otitis media-safe type [fig-1 & 2].

**Sample Size:** 103 ears in 88 patients.

**Study Location:** Chettinad Hospital and Research Institute, Kelambakkam, Chennai.

### **Inclusion Criteria:**

1. Patients with chronic suppurative otitis media (Safe type).
2. Age above 18 years.

### **Exclusion Criteria:**

1. Acute suppurative otitis media.
2. Traumatic perforation.
3. Actively discharging ear.
4. Chronic suppurative otitis media (Attico antral disease-unsafe type).
5. Chronic suppurative otitis media (Safe type) with
  - (a). Total perforations.
  - (b). Marginal perforations.
6. Age less than 18 years.
7. Previously operated ears.

**METHODOLOGY:** Permission obtained from ethical committee review board. A cross sectional prospective study was made and the sample size was 103 ears in 88 patients of CSOM-safe type with tympanic membrane perforations attending the department of ENT, Chettinad hospital and research institute, between June2014 - June2015. Unilateral/Bilateral CSOM of safe type were selected of age above 18years and irrespective of gender [Fig-3 & 4]. Instruments used for data collection include Karl Storz 0degree otoendoscopy and Harp Inventis pure tone audiometry.

All recruits will be explained about the nature of the study and informed consent was obtained. All cases underwent detailed history taking and ENT examinations. Otoendoscopy was done using Karl Storz 0degree endoscope and images were saved in computer software by BMP image format. Tympanic membrane perforations are divided in to four categories.

1. Anterosuperior (AS); 2. Posterosuperior (PS); 3. Antroinferior (AI); 4. Posteroinferior (PI).

In Addition to these four categories we have AS & AI; PS & PI; PI & AI; AS, AI & PI and all 4 quadrants; Patients hearing level were assessed with Harp Inventis pure tone audiometry in anacoustically reated

## ORIGINAL ARTICLE

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Sound proof room and the pure tone average (For 500HZ, 1KHZ and 2KHZ frequencies) are calculated. The degree of hearing loss was assessed according to the WHO classification of hearing impairment. Pure tone audiometry was done on dry ears only. Statistical analysis was made using chi-square test.

**RESULTS:** Eighty eight patients (41-male, 47-female) with 103 perforated ear drums and age range 18-60years were studied. Bilateral tympanic membrane perforations were seen in 15 patients (17.05%); Right alone in 43 patients (48.86%); Left alone in 30 patients (39.09%) respectively [Fig-5].

The sites/locations of perforations on the tympanic membrane were correlated with their mean hearing levels (dB) using the chi-square test. 88 patients with 103 ears of tympanic membrane perforations [Fig-6]-29 patients had all four quadrants; 24 had AS & AI quadrant perforations; 18 had AI quadrant perforation; 10 had AS, AI & PI quadrant perforations; 7 had PI quadrant perforation; 5 had PS quadrant perforations; 4 had PI&AI quadrant perforation; 3 had PS & PI quadrant perforation and 3 had AS quadrant perforation. [Table 1].

Out of these 29 patients with all four quadrant perforations-16 patients (55.1%) had moderate conductive hearing loss and 7 patients (24.1%) had severe conductive hearing loss [fig-7]. The statistical analysis were made using chi-square test and it has significant P value of <0.00001. [Table 2] In our study all four quadrant perforation has significant effect on hearing loss.

In our study 5 patients had PS perforation in which 3 had mild conductive hearing loss and 2 had severe conductive hearing loss and 7 patients had PI perforation- 5 had mild conductive hearing loss and 1 had moderate conductive hearing loss and 1 had sensori neural hearing loss.

According to our study; posterior quadrant perforation does not have significant effect on hearing loss than the anterior perforation.

**DISCUSSION:** Kumar et al and Pannu et al observed that the degree of hearing loss increases with the size of perforation and has no relation to the site of perforation.<sup>[9,10]</sup> Malik et al in a 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.<sup>[11]</sup> Ritvik et al in his study observed that the hearing loss does not vary substantially with the location of the perforation.<sup>[12]</sup> Ahmad S.W. Ramani G.V. observed that the perforations of the posteroinferior quadrant cause more hearing loss than those in the anteroinferior quadrant.<sup>[13]</sup>

In our study, 88 patients with 103 tympanic membrane perforations-29 patients had all the four quadrant perforation. Out of these 29 patients-16 had moderate conductive hearing loss (55.1%) and 7 had severe conductive hearing loss (24.1%). We found perforation of all four quadrant effect on hearing loss. [Table 2]

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Site of Perforation	Total	Percentage (%)
AS	3	2.9%
AI	18	17%
PS	5	4.8%
PI	7	6.8%
AS&AI	24	23%
PS&PI	3	2.9%
PI&AI	4	3.8%
AS, AI&PI	10	9.7%
ALL 4	29	28%

**Table 1: No. of patients based on quadrants of perforation**

\*AS-ANTEROSUPERIOR

†AI-ANTEROINFERIOR

‡PS-POSTEROSUPERIOR

§PI-POSTEROINFERIOR

||ALL 4- AS, AI, PS & PI

## ORIGINAL ARTICLE

Site of perforation	MILD CHL	MODERATE CHL	SEVERE CHL	SNHL	MHL	TOTAL	PERCENTAGE (%)	CHI-SQUARE VALUE
AS	3	-	-	-	-	3	2.9%	<0.00001
AI	17	-	-	1	-	18	17%	
PS	3	-	2	-	-	5	4.8%	
PI	5	1	-	1	-	7	6.8%	
AS&AI	12	11	-	1	-	24	23%	
PS&PI	-	2	1	-	-	3	2.9%	
PI&AI	2	2	-	-	-	4	3.8%	
AS, AI & PI	1	9	-	-	-	10	9.7%	
ALL 4	4	16	7	1	1	29	28%	

Table 2: Distribution Of Perforation Based On Site With Hearing Loss

\*AS- ANTEROSUPERIOR

†AI-ANTEROINFERIOR

‡PS- POSTEROSUPERIOR

§PI-POSTEROINFERIOR

||ALL 4- AS, AI, PS & PI

\*\*CHL- CONDUCTIVE HEARING LOSS

††SNHL- SENSORINEURAL HEARING LOSS

‡‡MHL- MIXED HEARING LOSS



**Fig. 1: Tympanic membrane perforation  
Active stage [all 4 quadrant]**



**Fig. 2: Tympanic membrane perforation  
Inactive stage [all 4 quadrant]**

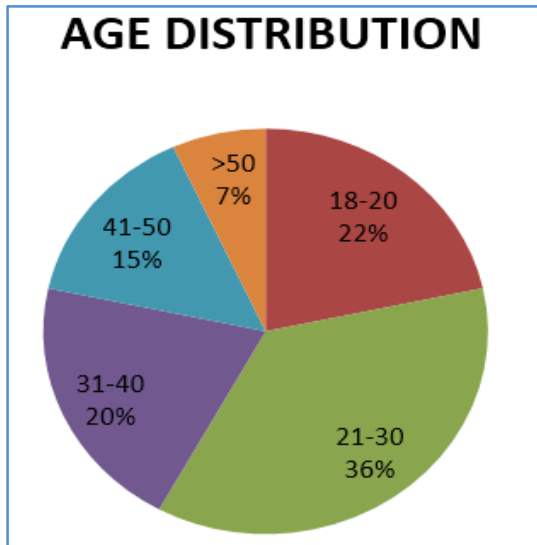


Fig. 3

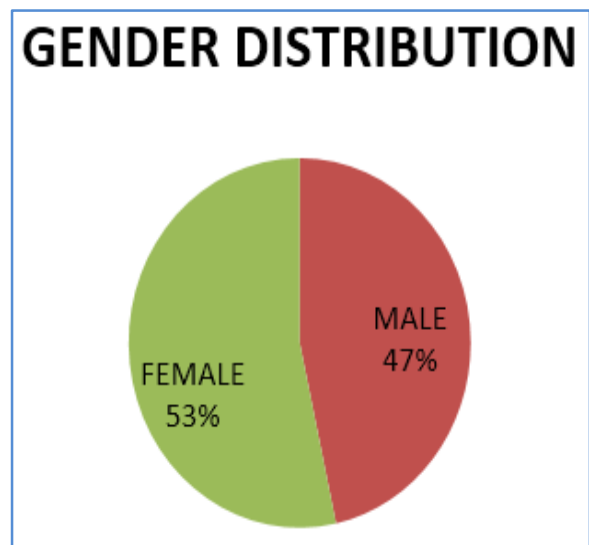


Fig. 4

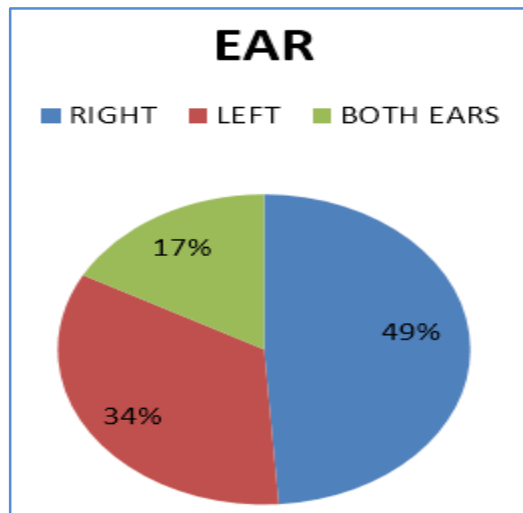


Fig. 5

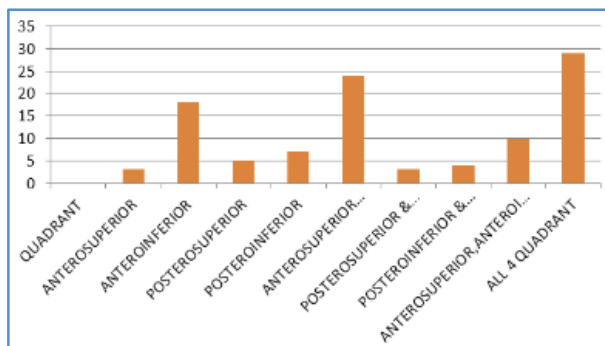


Fig. 6

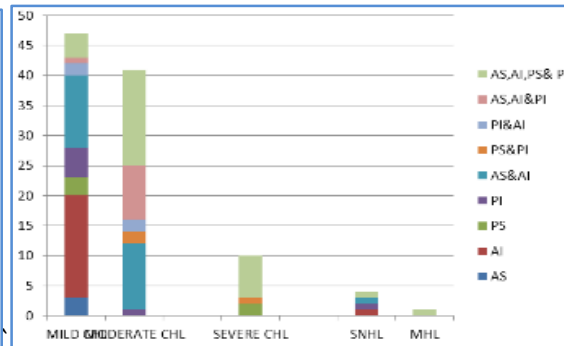


Fig. 7

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