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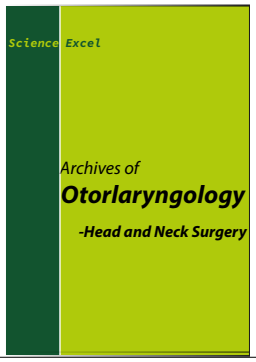

Is There an Association Between The Characteristics of The Tympanic Membrane Perforations And The Severity of The Hearing Loss?

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Abstract

Chronic otitis media is a chronic inflammation of the middle ear, with or without the presence of a perforation. It is an avoidable cause of hearing loss, especially in developing countries. It is mostly responsible of a conductive deafness and can also cause mixed and neurosensory deafness.

The aim of our study is to compare the severity of the hearing loss with the different otoscopic findings, and find a possible association between the size and the site of the tympanic membrane perforation and the level of the hearing loss.

pure tone audiometry, the mean hearing threshold was 44.05 dB (± 15.57[11.25- 87.50dB]) and the mean air bone gap was 24.99 dB (±8.21[6.25-47.50 dB]). the mean difference in each frequency depending on the tympanic membrane perforation showed a statistically significant difference between the subgroups. the ABG as per the tympanic membrane perforation size, the mean ABG for perforation ≤25% was 23.46 dB versus 25.41 dB for peroration size between 25% and 50% and 28.07 dB for perforation sizes >50%.The difference between the subgroups was statistically significant (p=0.004). Otologists should be aware of the association between the size and the site of the tympanic membrane perforations.

Introduction

Chronic otitis media is a chronic inflammation of the middle ear, with or without the presence of a perforation. It is an avoidable cause of hearing loss, especially in developing countries [1]. It is mostly responsible of a conductive deafness and can also cause mixed and neurosensory deafness [2].

The emerging discussion among the authors about the presence or the absence of a direct association between the characteristics of the patient's eardrum perforation; size and site; led to multiple studies that have been published [3].

The main objective of our study is to compare the severity of the hearing loss with the different otoscopic findings, and find a possible association between the size and the site of the tympanic membrane perforation and the level of the hearing loss.

Material and methods

We conducted a retrospective study of 155 patients treated for simple chronic otitis media (SCOM)in the ENT department of the University Hospital Mohammed VI of Marrakech.

- This study was conducted in accordance with the Declaration of Helsinki.

Included in our study:

All patients treated for SCOM in the ENT department who gave consent to this study

We excluded in this study:

- Patients with lysis or fixation of the ossicular chain associated with the tympanic perforation.
- Neurosensory hearing loss in the tonal audiometry

All patients benefited from an otoscopy and examination under a microscope and an tonal audiometry.

We considered:

- A perforation involving one quadrant any perforation involving a maximum of 25% of the tympanic membrane surface: antero-superior, antero-inferior, postero-superior, postero-inferior or central.

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- A perforation involving two quadrants any perforation involving two quadrants
- A posterior perforation includes postero-superior, postero-inferior, or both.
- Inferior perforation includes perforations involving the two lower quadrants (anteroinferior and postero-inferior).

Tone audiometry was performed using the frequencies 250, 500, 1000, 2000, and 4000Hz in bone conduction and air conduction in an audiometric booth with masking.

- The average hearing threshold is equal to the average of air conduction of the
- frequencies 500, 1000, 2000, and 4000Hz.
- The average bone conduction is equal to the average of the bone conduction of the frequencies 500, 1000, 2000 and 4000Hz.
- the Rinne for each frequency is equal to the difference of air conduction and bone conduction for each frequency. The average Rinne is equal to the difference between the average air conduction and the average bone conduction.

Statistical analysis used non parametrical tests and the correlations with a $p< 0.05$ was considered statistically significant.

Results

Out of 155 patients included, 60.04% were females and 39.61% were males, with a sex ratio F/M at 1.5. The mean age of our population was 36.25(±17.08).

Most patients have been presenting symptoms since childhood representing 46.1%.

The symptoms distribution in our population and the main complaint are presented in the table below (Table 1)

. Figure 1 shows the distribution of frequencies of each otoscopic aspect, The most found otoscopic aspect was the central perforation followed by the subtotal perforation, representing respectively 28.6% and 24.6 %.

On pure tone audiometry, the mean hearing threshold was 44.05 dB (± 15.57[11.25- 87.50dB]) and the mean air bone gap was 24.99 dB (±8.21[6.25-47.50 dB]).

Table 2 represents the mean hearing threshold for air and bone conduction and the mean Rinne on every frequency.

The mean Rinne was 22.42 dB for anterior perforations versus 24.13 dB for posterior perforations, 20,36 dB for inferior perforations, 28.19 dB for subtotal perforations and

23.98 for central peroration (Figure 3) , this difference was statistically significant (p=0.031).

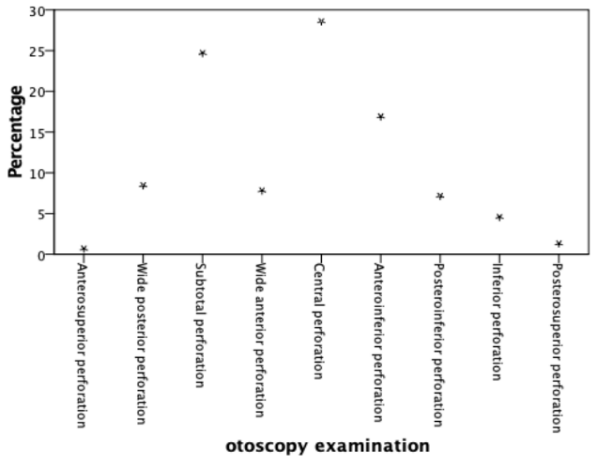

Figure 1. *Graphical representation of the otoscopic aspecto*

Table 1. *Symptoms distribution in our population and the main complaint*

Variable		N	%
Symtoms	Otorrhea	151	98.1
	Hypoacousia	149	96.8
	Tinitus	60	39
	Vertigo	6	3.9
Patient Main Complaint	Otorrhea	38	24.7
	Hypoacousia	35	22.7
	Both	81	52.6

Table 2. *CA hearing threshold, medium bone conduction threshold and mean rinne for each frequency*

	125 Hz	250 Hz	500 Hz	1000 Hz	2000Hz	4000 Hz	8000 Hz
Air Conduction	50.35	50.29	45.58	41.62	41.07	47.98	54.05
Bone Conduction		14.93	17.75	16.07	21.49	20.94	
Rinne		35.16	27.79	25.22	19.31	26.85	

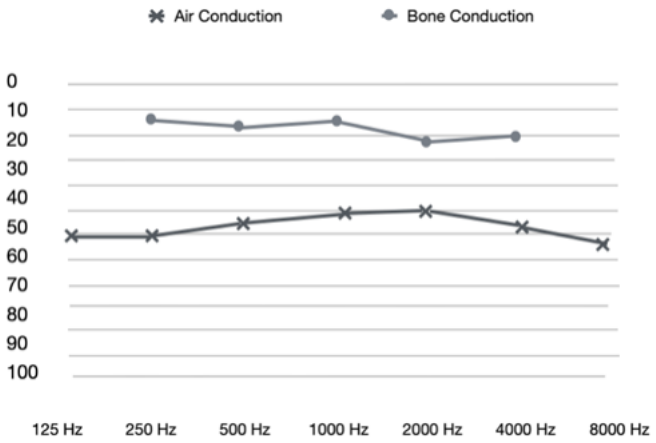

Figure 2. *Mean tone audiometric curve*

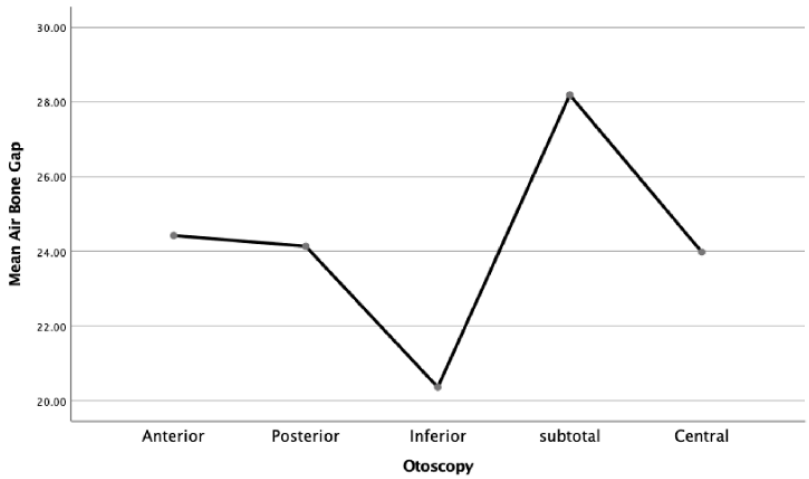

Figure 3. *Mean tone audiometric curve*

Table 3. *The mean ABG by frequency as per the tympanic membrane perforation*

Otoscopy	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
Anterior	30,77	25,51	23,85	20,90	27,18
Posterior	36,54	28,27	24,42	17,69	24,42
Inferior	34,29	21,43	22,86	14,29	22,14
subtotal	37,63	31,58	29,34	22,24	28,03
Central	36,25	27,27	23,75	17,16	27,73
p	0.027*	0.009*	0.004*	0.004*	0.003*

* <0.05 considered statistically significant

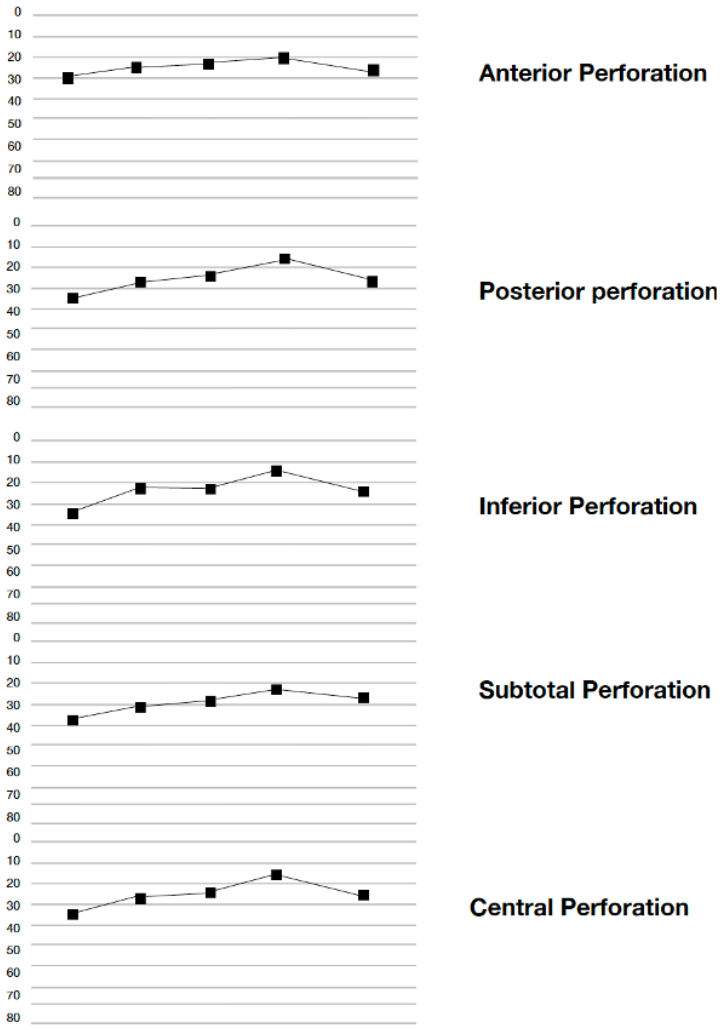

Figure 4. *Mean air bone gap by frequency as per different tympanic membrane perforation's location*

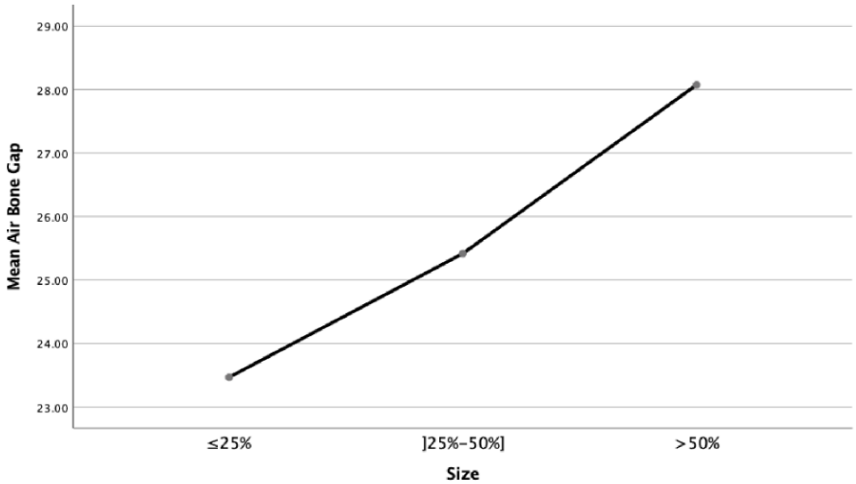

Figure 5. *Mean air bone gap by different perforations sizes*

We studied the mean difference in each frequency depending on the tympanic membrane perforation, the table and figure below, the statistical study showed a statistically significant difference between the subgroups.

The mean ABG by frequency for each size category shows an inverted V shape in each group. The bigger the size of the tympanic membrane perforation was, the more inverted was V. (Table 3, Figure 4).

We also studied the difference between the ABG as per the tympanic membrane perforation size, the mean ABG for perforation ≤25% was 23.46 dB versus 25.41 dB for peroration size between 25% and 50% and 28.07 dB for perforation sizes >50% (Figure 5) .

The difference between the subgroups was statistically significant (p=0.004).

Discussion

Chronic otitis media is public health issue worldwide, by its alteration of the quality of hearing and the alteration of the quality of life of patients by the symptoms that it causes [4].

It is defined by a chronic inflammation of the middle ear. It can be with open or closed eardrum. The tympanic membrane is known for its function as a transformer and a protector for the middle ear [5]. The presence of tympanic perforation affects the transmission and amplification of sound waves, which alters the hearing thresholds [4,6].

The Chronic otitis media with a perforated tympanic membrane can be responsible for conductive or mixed deafness [7].

ENT partitioners see multiple patients suffering with perforated chronic otitis media, and the medical care and support is based on the clinical examination by otoscopy and a tonal audiometry to assess the hearing loss threshold [8].

Professional otologists have Longley discussed the possibility of association between the site and size of the tympanic membrane perforation and the degree of the hearing loss threshold [9]. Thus, authors have found it important to conduct studies to evaluate the association between the tympanic membrane perforation characteristics and the degree of the hearing loss caused by it.

The mean age in our study was 36.25, the same results was found in the papers published, showing that this a pathology of young people [2,4,10,11].

Kharadi, et al. [10] reported that the most common patients' complaints were otorrhea and hearing loss, these two symptoms were present in our population in respectively 98.1% and 96.8%.

More and more authors have been finding a significant correlation between the site of the tympanic membrane perforation and the degree of hearing loss, Rana, et al. [12] have reported that the hearing loss was worse in posterosuperior quadrant perforation compared to the anterosuperior one, and was the worst in subtotal perforations, the same results were reported by Ahmad and al, Bhusal, et al.and Maharjan, at al. [13–15]. Gupta, et al. [4] explained that the reason behind it, is the protective role of the eardrum for the inner ear elements. Our results match those found in the literature as the perforations of multiple quadrants have more hearing loss than those of a single one.

Some authors findings were different from ours, Maalaj, et al. and Ibekew, et al. [5,6] stated that there was no association between the site of the perforation and the degree of hearing loss.

Kolluru, et al. [3] reported that there was a proportional positive effect between the size of the perforation and the hearing loss, as the bigger the perforation was the worse was the hearing loss. The same results were reported by Kharadi, et al. [10] finding that perforation occupying more than 25% of the eardrum had greater hearing loss than those occupying less than 25%. These findings concord to ours as the mean air bone gap was much greater in perforation involving >50% of the tympanic membrane [28.07 dB] than those involving <25% of it [23.46 dB]. Other studies match our results [4,16–18].

Yet other authors found no significant relationship between the size of the perforation and the severity of the hearing loss [9,11,19].

Conclusion

Otologists should be aware of the association between the size and the site of the tympanic membrane perforations.

Further studies must be conducted to evaluate the different aspects of the chronic otitis media and their direct association with the severity of the hearing loss.

Conflict of interest

The authors declare no conflict of interest.

Funding

None

Consent

Informed consent was obtained from all individual participants included in the study.

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