

SITE AND RATE OF OSSICULAR CHAIN EROSION IN PATIENTS UNDERWENT TYMPANOMASTOID SURGERY

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ABSTRACT

Background: Chronic suppurative otitis media (CSOM) is a common problem affecting middle ear and it's commonly presented with chronic ear discharge and decreased hearing. Hearing problem in CSOM is primarily caused perforated tympanic membrane and in some cases by the presence of erosion of the ossicular chain.

The study aimed to show the rate and site of ossicular chain erosion in patients with chronic suppurative otitis media underwent tympanomastoid surgery.

Patient and methods: a cross sectional study conducted on 87 patients performed tympanomastoid surgery for chronic middle ear infection where their ossicular status has been assessed intraoperatively.

Results: our study shows that 40% of the operated ears has at least a single bone erosion and the Incus bone was the most affected ossicle while the Malleus was the least one 54% and 14% respectively. No statistically significant difference was seen between bone erosion and gender as well as the side of operation.

Conclusion: ossicular erosion is a common problem affecting patient with chronic suppurative otitis media and the surgeons should be aware about this pathology and they should have the proper skill to correct such problem.

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Keywords: Chronic suppurative otitis media, Erosion ossicular chain, Middle ear

Chronic suppurative otitis media (CSOM) is a chronic inflammation of the middle ear mucosa with the presence of tympanic membrane perforation. It is generally divided in to two main types: Chronic suppurative otitis media without cholesteatoma in which there is chronic inflammation of the middle ear mucosa with granulation tissue formation and Chronic suppurative otitis media with cholesteatoma where there is keratinized squamous epithelium deposited in middle ear cavity.¹

Patient with chronic suppurative otitis media is commonly presented with perforated tympanic membrane, chronic on/off ear discharge and decreased hearing.^{2,3}

Destruction of the bony structure within the middle ear cavity is a common sequel of

both CSOM with and without cholesteatoma due to chronic inflammatory processes that cause resorption of this bony structure including the bony walls of the middle ear as well as the ossicular chain^{4,5}

The ossicular chain of the middle ear cavity is composed of Malleus, Incus and Stapes and partial or complete erosion of one or more than one of these ossicles is possible in all patients with chronic suppurative otitis media and if present it will cause more hearing problems.⁶

We have conducted this study to show the rate and site of ossicular chain erosion in patients with chronic suppurative otitis media underwent tympanomastoid surgery and to reveal that this potential problem not to be ignored by a surgeon performing such type of surgery.

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PATIENT & METHODS

This is a cross sectional study conducted at Azadi Teaching Hospital in Duhok–Iraq for patients performed tympanomastoid surgery from March 2019 till September 2022. At the beginning of the study the records of 113 patients have been reviewed, all patients with perforated tympanic membrane due to previous trauma and patient with revision tympanomastoid surgery have been excluded from the study. Only 87 patients have been found to fulfill the criteria of our study “patients with CSOM undergoing primary tympanomastoid surgery.”

All surgical procedures were carried out under general anaesthesia, and xylocaine and adrenaline were injected locally at a ratio of 1:100000. A C-shaped postauricular incision is made, and then, under a microscope, the posterior tympanomeatal flap is raised until it reaches the tympanic membrane annulus. The annulus of the tympanic membrane is then elevated by a needle so that the middle ear cavity can be seen. In some circumstances, curetting of the scutum is performed to improve the visibility of the ossicular chain. Moving the ossicles (if they are present) using a probe allows for an evaluation of the movement and the integrity of the ossicles to be carried out. After that, the finding of the patient is recorded in the patient file, and the operation is then carried out in accordance with those findings.

All surgeries have been performed by single surgeon (the Author).

Statistical analysis

The data were analyzed using SPSS program version 26. The age of patient was described by range, mean and standard deviation. Other categorical variables of gender, and operative findings were summarized by frequency and percentage with graphs. The association of bone erosion with age was tested by independent t-test and that with categorical variables by

Chi squared test. The p-value of 0.05 was used as the level of significance.

RESULTS

A total of 87 patients operated on were involved in the study. Their general characteristics were within a wide range of age from 8 to 70 years with a mean age of 32.29 years and a standard deviation of 12.75 years. Females made 56.3% of the study participants. The operation was done on the right side in 44.8% of patients compared to 55.2% on the left side. These characteristics are shown in table 1.

Table 1: General characteristics of the study sample

Characteristics	No.	%
Age (range: 8-70 years)	Mean: 32.29	SD: 12.75
Gender		
Male	38	43.7
Female	49	56.3
Side operated on		
Right	39	44.8
Left	48	55.2
Total	87	100.0

Table 2 clarifies the operative findings in regard to bones status. Bone erosion was seen in about 40% of the patients and all the others had intact (52%) or fixed bones (8%). Among those with eroded bones, 18.4% had only one bone involved, 14.9% two bones and in 5.7% all the three bones involved by erosion.

Table 2: Operative findings in regard to bone status

Findings	No.	%
Erosion		
Yes (any bone)	34	39.1
No (intact bone or fixed)	53	60.9
Bones status		
All intact	46	52.9
Fixed one or more	7	8.0
One bone eroded	16	18.4
Two bones eroded	11	14.9
All three bones eroded	5	5.7
Total	87	100.0

It is shown in figure (1) that incus bone was the most common one of the three ossicles affected by erosion as in 54.4% of patients

with bone erosion incus was included. The stapes involvement was 31.6% and least one affected was the malleus (14%).

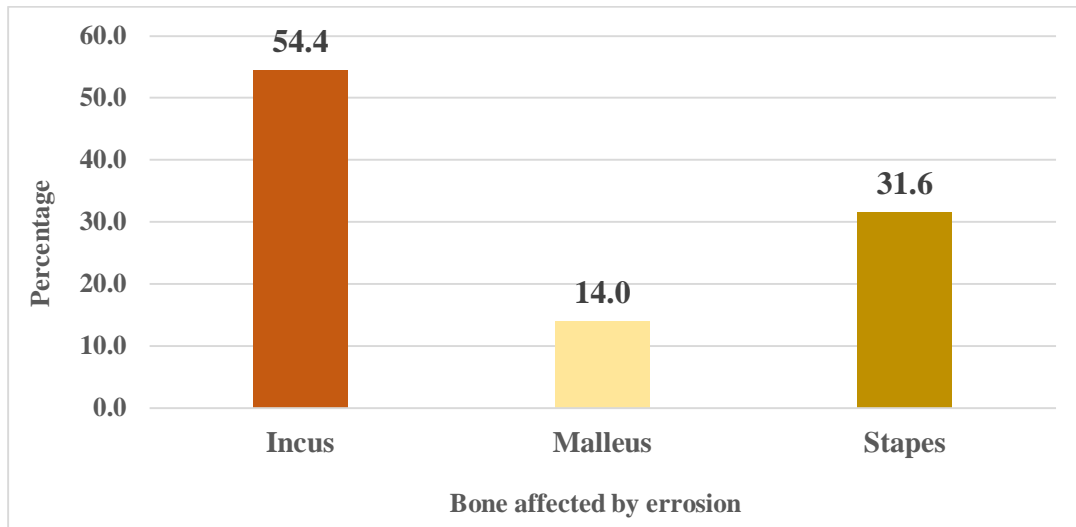


Figure 1: Frequency of erosion of the three ossicles

The association of bone erosion was studied with some factors like age as seen in table 3. The difference of mean age and standard deviation of age was statistically not significant between the group of erosion and the one of intact bones when tested by independent t-test.

Table 3: The association between age and bone erosion

Bone status	Age in years Mean (SD)	p-value*
Intact or fixed bones	31.79 (11.87)	0.654 (NS)
Eroded bones	33.06 (14.15)	

* by independent t-test

The association with categorical variables was done by Chi squared test and shown in table 4. The frequency of erosion among male patients was nearly similar to female patients and was statistically not significant. On the same way, no statistically significant difference was seen in regards to side of operation, whether right side or left.

Table 4: The association of bone erosion with gender, side of operation and year of operation

Factor	Bones status		p-value*
	Intact or fixed No. (%)	Eroded No. (%)	
Gender			
Male	20 (37.7)	18 (52.9)	0.189 (NS)
Female	33 (62.3)	16 (47.1)	
Side operated on			
Right	24 (45.3)	15 (44.1)	1.0 (NS)
Left	29 (54.7)	19 (55.9)	

* by chi-squared test

DISCUSSION

Chronic Suppurative otitis media is a long-standing middle ear inflammation with major two symptoms of chronic ear discharge and conductive hearing loss which mainly occur due to tympanic membrane perforation and in some patient due to ossicular chain erosion or damage⁷.

This study aims to identify the percentage and site of ossicular chain erosion and verify if the site of the involved ear or the gender have a significant impact on our results.

In our study 87 patients included with a wide range of age from 8 to 70 with median age of 32.29 year. This age is close to other studies conducted by Varshney et al, and Pragya Singh et al which show a median age of 29.78 years and 32.40 years, respectively^{8,9}

Female outnumbered the male in our study in which 43 female (56.3%) were included in our study this higher female percentage have been recorded in several studies conducted by Hsun-Mo Wang et al with (56%) female preference¹⁰, and (58%) in a study by Caroline De Vos et al¹¹. In contrast, other study conducted by OA Afolabi et al¹² show more male predominance(53.7%).

Intraoperatively, we have registered 7 out of 87 patients (8%) have fixation of the ossicles due to tympanosclerosis and all of them were Incudo-Malleal fixation. These results differ from a study performed by Aisha Larem et al 26.9% of their ears showed fixation of the ossicles and they had multiple level of fixation no single type like our study¹³

Overall erosion of the ossicle(s) whether single or multiple was 39% in our performed ears with single bone erosion was 18% and more than one ossicle erosion present in around 21%. However other similar studies show variable outcomes, while the study of Haider et al shows 23.66% erosion rate¹⁴ other study by Singh et al showed 51.32% erosion rate⁹

Incus erosion (partial or complete) was the most eroded ossicle in our study 54.4% followed by stapes 31%. These results are like other studies recorded that Incus is the most common eroded ossicles by Varshney et al⁸ where the Incus was eroded in 39% and the stapes was eroded in 21% and a study by Tripathi and Nautiyal where they recorded 35% rate of Incus erosion among their patients.

In contrast to Incus, Malleus was the most resistant ossicle to erosion, and it was eroded only in 12 out of 87 (14%) operated ears. These results show similarity to other study performed by Italian doctors where they found Malleus was also the least eroded ossicle in their study (20%) 28 out of 140 patients¹⁵.

The impact of gender difference has not been statistically significant although we found that ossicular erosion is slightly more common in males (52.9%). However, a study performed by Anwar et al shows ossicular damage is significantly more common in male (70%)¹⁶

CONCLUSION

Ossicular erosion is a common problem affecting patients with chronic suppurative otitis media. Surgeons should be aware of how to assess and treat such problem to gain maximum outcome from the surgery. We recommend a larger study to be conducted to shoe the sex difference and its impact on the percentage of erosion.

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پوخته

جه- وريژا ژناقچوونا ههستيكا لدهف نهخوشين نشتهرگهريا گوهي نافين بو هاتيه كرن

پيشهكي و نارمانج: كولبوونا دومدريژا گوهي نافين يا ب عه داڤ ئاريشه كا به ربه لاقه كو كارتيتكرني لسهر گوهي ناڤيت دكهت و ديار دبیت وهك فهريژين گوهي بين دومدريژ و كيمبوونا گوهليبووني. بشيوه كي سهره كي ئاريشا گوهليبووني ژنه گهري كونبوونا په ردا گوهي پهيدا دبیت وهندهك جارن ژبه ر ژناقچوونا زنجيرا ههستيكي گوهي.

نارمانج: ئارمانج ژفي فهكولينی دهستنيشانكرنا جه وريژا ژناقچوونا ههستيكا لدهف نهخوشين كولبوونا گوهي نافين هه و نشتهرگهريا گوهي نافين بو هاتيه كرن.

ريكين فهكولينی: شيوازي فوكولينه كا كه رتي هاته نه نجامدان لسهر $\square\square$ نه خوشين و نشتهرگهريا گوهي نافين بو هاتيه كرن بو چاره سه ركرنا كولبوونا دومدريژا گوهي نافين يا ب عه داڤ. رهوشا ههستيكي گوهي لدف فان نه خوشان هاته هه لسه نگاندن لدهمي نشتهرگهري.

نه نجام: دههكولينی دا دياربوو كو $\square\square\%$ ژ گوهين نشتهرگهري بو هاتيه كرن بين تووشی ژناقچوونا ههستيكا بووين بكمي لههستيكه كي. يي ژهه ميا پتر توووش بووي ههستيكي ئينكس بوو وي ژهه ميا كيمتر ههستيكي ماليهس بوو بريژا $\square\square\%$ و $\square\square\%$ لدويف ئيك. هيچ جياوازيه كا بهرچاڤ نه هاته ديتن دناڤه را ژناقچوونا ههستيكا دگل ره گهزي نه خوشي ههروه سا دگل رهخي نشتهرگهري بو هاتيه كرن. **دهر نه نجام:** ژناقچوونا ههستيكا ئاريشه كا به ربه لاقه كو كارتيتكرني دكهت لسهر نه خوشين كولبوونا دومدريژا گوهي نافين هه ويديقييه نشتهركار دئاگه هداربن لسهر في نه خوشي وشاره زايين گونجاي هه بن بو چاره سه ركرنا وي.

الخلاصة

موقع ومعدل تآكل السلسلة العظمية لدى المرضى الذين خضعوا لجراحة الطبلة والخشاء

الخلفية والأهداف: التهاب الأذن الوسطى القيحي المزمن (CSOM) هو مشكلة شائعة تؤثر على الأذن الوسطى وعادة ما تظهر مع إفرازات الأذن المزمنة وضعف السمع. تحدث مشكلة السمع في CSOM بشكل أساسي بسبب ثقب في الغشاء الطبلي وفي بعض الحالات بسبب وجود تآكل في السلسلة العظمية.

الأهداف: استهدفت الدراسة إلى إظهار معدل وموقع تآكل السلسلة العظمية في المرضى الذين يعانون من التهاب الأذن الوسطى القيحي المزمن الذين خضعوا لجراحة الطبلة الخشائية.

طرق البحث: هذه دراسة مقطعية أجريت على 87 مريضاً أجروا جراحة طبلة الأذن الوسطى لعلاج عدوى الأذن الوسطى المزمنة حيث تم تقييم حالتهم العظمية أثناء الجراحة.

النتائج: أظهرت دراستنا أن 40% من الأذنان التي خضعت للعملية الجراحية تعاني على الأقل من تآكل عظمي واحد وأن عظم السندان كان العظم الأكثر تضرراً وأن عظم المطرقة كان على الأقل 54% و14% على التوالي. لم يوجد اختلاف احصائي معنوي بين تآكل العظم مع جنس المريض وكذلك مع الجانب الذي أجريت عليه العملية.

الاستنتاجات: التآكل العظمي مشكلة شائعة تؤثر على المريض المصاب بالتهاب الأذن الوسطى القيحي المزمن ويجب أن يكون الجراحون على دراية بهذا المرض ويجب أن يكون لديهم المهارة المناسبة لتصحيح هذه المشكلة.