

Evaluation of the relationship between clinical findings before tympanoplasty and ossicular discontinuity and erosion in patients with chronic otitis media

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Abstract

Background: Chronic Otitis Media (COM) is a relatively common condition and the occurrence of hearing loss is probable. COM may lead to ossicular discontinuity, and unless the operation is performed, it won't be determined. Identifying possible cases of erosion and discontinuity of ossicles is helpful in surgical planning and in anticipation of the probable need for procuring ossicular prosthesis.

Purpose: The aim of this study was to evaluate the relationship between preoperative clinical findings and intraoperative findings.

Methods: This is a cross sectional study carried out in 2012 in two tertiary referral hospitals of Tehran, (the Loghman and the Taleghani hospitals). The sample under study consisted of COM patients who referred to the otolaryngology clinics and were tympanoplasty candidates. Two hundred and seven patients with the mean age of 36.2 ± 13.9 (ranging from 9-67 years) were enrolled in the study. Pre-surgical findings were investigated and the relationship between ossicular discontinuity and pre-surgical findings were evaluated.

Results: Incus-Stapes discontinuity (IS Discontinuity) and Incus-Malleus discontinuity (IM Discontinuity) were seen in 60 (29%) and 25 (12.1%) patients, respectively. We found IS Discontinuity in 38 (24.1%) patients with central perforation and 22 (48.9%) cases of marginal perforations ($P=0.005$). IM Discontinuity was observed in 14 (8.9%) cases with central perforation, while this was seen in 11 (22.4%) cases with marginal perforations ($P=0.011$). On the other hand, 34 (42%) patients with otorrhea had IS Discontinuity whereas 26 (20.6%) cases of dry ears showed this type of ossicular problem ($P<0.001$). IM Discontinuity was detected in 13 (16%) and 12 (9.5%) cases with and without otorrhea, respectively ($P=0.011$). IS Discontinuity and IM Discontinuity were significantly more common in the patients with Air Bone Gap of more than 40 db.

Conclusion: Our finding showed that surgical results may be unpleasant in the patients with marginal perforation, otorrhea and $ABG > 40$ db.

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Introduction

Chronic otitis media (COM) is a relatively common condition in different societies and accounts for one of the most common otolaryngology visits. This is not usually accompanied by considerable mortality rate except for cases of intracranial complications, nevertheless, the main reason why considerable attention should be paid to this disorder is that the occurrence of hearing loss complication is probable. The severity of

hearing loss can increase with age and health condition (1, 2)

The hearing loss is conductive in most cases, but it can also be sensorineural, and if left untreated, permanent loss may develop (3). Hearing loss can be detected in almost all patients and it can reach 50-60 dB in cases of ossicular disruption or fixation (4). Inner ear involvement is probably due to the effect of infectious agents on permeable round window

membrane and damage to the hearing end organs (5, 6).

Tympanic Membrane (TM) perforations can arise from a variety of causes. Major causes include trauma and middle ear disease (1). Most of these perforations especially, those caused by acute trauma heal spontaneously while others remain open and need surgical closure (7).

The surgical treatment of COM has two main goals: eradication of the infection and hearing restoration. Different surgical techniques can be used depending on the severity of the disease (8). These surgical operations are associated with achieving socially acceptable hearing levels ($>30\text{dB}$) in 80-90% of cases, although in more complex procedures the range will come down to 60-80% (9). Consequently, some patients do not experience acceptable postoperative improvement which is mainly the result of ossicular erosion or discontinuity (10).

In this regard, otologists wonder what factors are prognostic in the erosion or discontinuity of ossicles. The answer to this question is important from two viewpoints: firstly, the possible cases of erosion and discontinuity of ossicles can be identified which can help surgical planning and the anticipation of the probable need for procuring ossicular prosthesis. Secondly, with regard to patients with poor outcome, it will be possible to inform the patient- or the executor- about the purposes and consequences of the operation. In this study, we decided to evaluate the relationship between preoperative factors and ossicular erosion/ discontinuity.

Patients and Methods

This is a cross sectional study carried out in 2012 in two teaching hospitals of Tehran, (the Loghman and the Taleghani hospitals). This study was approved by the Ethics Committee of Shahid Beheshti University of Medical Sciences, Tehran, Iran.

The sample under study consisted of COM patients who referred to the otolaryngology clinics and were tympanoplasty candidates.

The patients that were excluded from the study:

- Patients with acute otitis media
- The ones requiring another operation on the involved ear
- Cases of preoperative permanent hearing loss in the involved ear

Convenience or accessible sampling method was used and all patients who met the inclusion criteria were assessed.

We applied the equation that uses the proportion of an attribute in a population for calculating the sample size.

According to the estimation of ossicular disruption in similar patients (16%), first type error (α) of 0.05 and level of precision (0.05), the sample size was calculated to be 207 patients. After letting the patients know about the goals and methods of the study, an informed consent was obtained.

Preoperative clinical findings included the location of tympanic membrane perforation, the condition of the middle ear mucosa, presence or absence of otorrhea, the status of incudostapedial (I-S) joint and air bone gap (ABG).

These data were obtained through physical examinations and audiometry. During the operation, it was examined to find out whether or not ossicular erosion and discontinuity were presented.

The relationship between preoperative and intraoperative findings was assessed.

We used frequency and frequency percentage to report quantitative data and the Chi-square test to compare the proportions. The significant level was considered less than 0.05. The statistics software SPSS-15 was used.

Table 1. The preoperative clinical findings and their frequencies.

Preoperative clinical findings	Frequency (%)
Perforation	
Central	158(76.3)
Marginal	49(23.7)
Middle ear mucosa	
Normal	119(57.5)
Edematous	88(42.5)
Otorrhea	
Present	81(39.1)
Absent	126(60.9)
I-S joint	
Exposed	49(23.7)
Non- exposed	158(76.3)
ABG	
<20dB	66(31.9)
20-40dB	80(38.6)
>40dB	61(29.5)
I-S joint: incudostapedial joint ABG: air bone gap	

Results

Two hundred and seven patients with the mean age of 36.2 ± 13.9 (ranging from 9-67 years) were enrolled in the study. Table 1 and 2 show

the pre and intraoperative clinical findings and their frequencies.

Table 3 shows the frequency distribution of each intraoperative finding in terms of the location of tympanic membrane perforation. Consequently, the location of perforation is correlated with ossicular discontinuity and incus erosion.

Table 4 demonstrates the frequency of different intraoperative findings in terms of presence or absence of otorrhea and indicates that there is a correlation between the otorrhea and ossicular discontinuity, incus and malleus erosion.

Table 5 displays the frequency of each intraoperative finding with reference to the air bone gaps. Its contents establish that there are statistically significant relationship between ABG and factors of ossicular discontinuity, erosion and fixation.

Discussion

In our study, most patients were suffering from central perforations (with a central to marginal ratio of 3:1).

Since central perforation is of more benign nature, most patients in this study belonged to the group with more favorable prognosis. The middle ear mucosa was normal in more than half of the patients. Otorrhea was observed in

less than 50% of the cases. The I-S joint was exposed in about 25% of subjects. ABG of more than 40 dB was seen in one third of the patients. Therefore in the majority of the cases clinical conditions were favorable.

Table 2. The intraoperative clinical findings and their frequencies.

Observation	Frequency (%)
IS discontinuity:	
+	60(29)
-	147(71)
MI discontinuity:	
+	25(12.1)
-	82(87.9)
Incus erosion:	
+	76(36.7)
-	131(63.3)
Malleus erosion:	
+	26(12.6)
-	181(87.4)
Stapes erosion:	
+	40(19.3)
-	167(80.7)
IS fixation:	
+	59(28.5)
-	148(71.5)
MI fixation:	
+	33(15.9)
-	174(84.1)
IS:incudostapedial MI: malleoincudeal:	

Table 3. Frequency distribution of each intra operative finding in terms of the location of tympanic membrane perforation.

Finding	Perforation	Frequency (%)	P value**	Odds ratio (95% CI)
IS discontinuity				
	Central	38(24.1)	0.005*	1.37 (1.06-1.8)
	Marginal	22(48.9)		
MI discontinuity				
	Central	14(8.9)	0.011*	1.2 (1.01-1.4)
	Marginal	11(22.4)		
Incus erosion				
	Central	49(31)	0.002*	1.53 (1.1-2.1)
	Marginal	27(55.1)		
Malleus erosion				
	Central	16(10.1)	0.058	1.13 (0.97-1.31)
	Marginal	10(20.4)		
Stapes erosion				
	Central	27(17.1)	0.144	1.13 (0.97-1.31)
	Marginal	13(26.5)		
IS fixation				
	Central	43(27.2)	0.461	1.1 (0.87-1.3)
	Marginal	16(32.7)		
MI fixation				
	Central	25(15.8)	0.933	1 (0.87-1.16)
	Marginal	8(16.3)		
IS: incudostapedial MI: malleoincudeal: *significant **chi-2 test				

Table 4. Frequency of different intraoperative findings in terms of presence or absence of otorrhea.

Finding	Otorrhea	Frequency (%)	P value**	Odds ratio (95% CI)
IS discontinuity	+	34(42)	0.001*	2.8 (1.5-5.2)
	-	26(20.6)		
MI discontinuity	+	13(16)	0.160	1.8 (0.78-4.21)
	-	12(9.5)		
Incus erosion	+	39(48.1)	0.006*	2.23 (1.25-3.99)
	-	37(29.4)		
Malleus erosion	+	16(19.8)	0.012*	2.8 (1.22-6.66)
	-	10(7.9)		
Stapes erosion	+	20(24.7)	0.117	1.74 (0.87-3.5)
	-	20(26.1)		
IS fixation	+	19(23.5)	0.197	1.12 (0.95-1.33)
	-	40(31.7)		
MI fixation	+	13(16)	0.973	1.01 (0.47-2.17)
	-	20(15.9)		
IS: incudostapedial MI:malleoincudeal: *significant **chi-2 test +: presence _: absence				

Table 5. The frequency of each intraoperative finding with reference to the air bone gaps.

Finding	ABG	Frequency (%)	P value**
IS discontinuity	<20dB	1(1.5)	<0.001*
	20-40dB	24(30)	
	>40dB	35(57.4)	
MI discontinuity	<20dB	1(1.5)	<0.001*
	20-40dB	7(8.8)	
	>40dB	17(27.9)	
Incus erosion	<20dB	4(6.1)	<0.001*
	20-40dB	32(40)	
	>40dB	40(65.6)	
Malleus erosion	<20dB	2(3)	<0.001*
	20-40dB	9(11.3)	
	>40dB	15(24.6)	
Stapes erosion	<20dB	1(1.5)	<0.001*
	20-40dB	13(16.3)	
	>40dB	26(42.6)	
IS fixation	<20dB	3(4.5)	<0.001*
	20-40dB	31(38.8)	
	>40dB	25(31)	
MI fixation	<20dB	2(3)	<0.001*
	20-40dB	11(13.8)	
	>40dB	20(32.8)	
IS: incudostapedial MI:malleoincudeal *significant **chi-2 test			

With a glance at the intraoperative findings, it can be seen that most patients did not show any signs of ossicular erosion or discontinuity, however there is actually a significant correlation between these complications and some of the preoperative findings. For example, in the case of marginal perforation, the risk of ossicular discontinuity increased 1.2 to 1.4 fold. Additionally, marginal perforation was associated with 1.5 times increase in the risk of incus erosion.

There was a stronger relationship between otorrhea and erosion than the one between marginal perforation and ossicular erosion and discontinuity, but the strongest correlation was found to be between ABG and these complications so that there were very uncommon and almost negligible in patients who had ABG of 20 dB or less.

However, in patients with more than 40 dB gap, ossicular erosion, discontinuity, and even fixation were found to be much more common. It is noteworthy that these complications were not related to age and exposure of I-S joint.

In comparison to previous similar studies, some new prognostic factors were taken into account. Most of earlier studies carried out on this issue evaluated the correlation between surgical results and cholesteatoma which now is a well understood concept.

A study conducted by Carrillo and colleges showed that in chronic suppurative otitis media (CSOM) without cholesteatoma ABG of 20 or less at 500 Hz and 30 or less at 1 KHz decreased the probability of ossicular discontinuity from 33 to 5.6% and 15.5%, respectively. The ability of ABG to alter probability of ossicular discontinuity was not significant in the presence of cholesteatoma (11).

In the study of Ebenezer and colleges, factors associated with incus necrosis were reported as: active ear discharge, anterosuperior location of perforation, exposure of I-S joint, edematous middle ear mucous membrane, middle ear granulations, foreshortening of the handle of malleus, moderate to moderately severe hearing loss and ABG>40 dB (12).

Jeng showed that in the cholesteatoma ears, both cholesteatoma extension into the tympanic sinus and persistently draining ears were predictive of ossicular discontinuity. The ABG was not significantly correlated with ossicular discontinuity (13).

Another study carried out by Dadgarnia and associates revealed that the average

improvement of hearing threshold was +7.9 dB in patients without cholesteatoma and -1.1 in patients with cholesteatoma. An average ABG increase of 6.4dB was reported in patients with cholesteatoma whilst, while in patients without cholesteatoma it decreased by 5.3 dB (14).

Feng and others showed that in patients with COM there is a significant correlation between the ossicular discontinuity and ABG, marginal perforation of tympanic membrane, otorrhea and cholesteatoma (15).

Conclusion:

Our observations disclosed that in patients with marginal perforation of tympanic membrane, otorrhea and more importantly patients with ABG of 40 dB or more, one should expect poor postoperative hearing outcome and the treatment team should keep this issue in mind while planning the operation and inform the patients and their families about the risks and outcomes of surgery.

Conflict of Interest:

The authors report no conflict of interests.

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