

## Preoperative Predictors Of ossicular Erosion in Chronic Suppurative Otitis Media

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**Abstract:** Chronic suppurative otitis media (CSOM) is a common condition in otorhinolaryngology. Ossicular erosion is most commonly seen in atticointral type i.e. CSOM with cholesteatoma. However it has been well established that ossicular erosion can be seen even in tubotympanic type of CSOM. Discontinuity of ossicular chain is typically confirmed only at surgery but there are various type of preoperative parameter described in studies that can predict the presence of ossicular erosion thus helping us to further plan for the ossicular reconstruction. One of the modality that may be useful in ascertaining ossicular integrity is preoperative HRCT scan of temporal bone but low affordability and high degree of radiation exposure limits its routine use in many parts of the world. A Cross sectional study consisting of 100 patients was carried over a period of 2 years. Objective of study was to study the predictors of preoperative clinical findings with ossicular erosion in patients with chronic suppurative otitis media. All patients underwent a detailed clinical, otoscopic and otoendoscopic examination. Patient's hearing levels was assessed preoperatively by calculating PTA and ABG and compared with intraoperative findings of ossicular erosion. So this study was intended to identify the indicators of ossicular erosion in patients with chronic suppurative otitis media through common pre-operative clinical symptoms, signs and audiological evaluation without the use of HRCT temporal bone.

**Keywords:** Ossicular erosion, CSOM, granulation, cholesteatoma

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### I. Introduction

CSOM refers to a chronic infection of the mucosa lining the middle ear cleft and defined by otorrhoea of at least six weeks duration in the presence of a chronic tympanic membrane perforation. CSOM has been classified as Tubotympanic disease (safe type) and Atticoantral disease (Unsafe type). In more recent classification, CSOM is referred to as mucosal type if there is a perforation of the pars tensa and squamous type if there is a perforation or retraction of the pars flaccida with retained squamous epithelial debris.<sup>1</sup>

Malleus, incus and stapes along with tympanic membrane are vital for impedance matching mechanism of the middle ear. Discontinuity of ossicular chain is typically confirmed only at surgery but various preoperative parameters are described in studies that can predict the presence of ossicular erosion. Thus helping us to further plan for ossicular reconstruction. One of which is HRCT scan of temporal bone but low affordability and high degree of radiation exposure limits its routine use in many parts of the world.

Pre-operative evaluation of ossicular discontinuity enables surgeon to plan for longer duration of surgery, requirement of Ossicular replacement prosthesis for ossiculoplasty in addition to type 1 tympanoplasty.

It also helps anesthetists to tailor use of anesthetic drug according to duration of surgery. Overall surgeon needs to predict ossicular status to plan of surgery and discuss possible outcome for higher patient satisfaction. So this study was intended to identify indicators of ossicular erosion in patients with chronic suppurative otitis media through common pre-operative clinical symptoms, signs and audiological evaluation without the use of HRCT temporal bone.

### II. Materials And Methods

A cross sectional study was carried over a period of 2 years (Oct 2014 – Sept 2016) in Department of Otorhinolaryngology, RIMS, Imphal. A total of 100 patients with chronic suppurative otitis media planned to undergo tympanoplasty or tympanomastoid exploration were included in the study.

Patients with age <10 years having tympanosclerosis, revision mastoid surgeries, patients with intracranial complication of CSOM, sensorineural hearing loss (SNHL) were excluded from study.

All patients underwent a detailed clinical, otoscopic and otoendoscopic examination to evaluate size of perforation, granulation tissue and cholesteatoma. We used otoendoscope integrated endoscopy camera system to examine the patients. Patients who were having active discharge further were managed conservatively by oral antibiotics with or without ear drops for 10 to 14 days.

Patient's hearing levels was assessed with calibrated audiometer at frequencies 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz and 8000 Hz respectively. PTA and ABG was calculated and compared by taking averages of bone conduction and air conduction at frequencies of 500, 1000 and 2000 Hz. Hearing loss was then classified according to Goodman scale in mild (26-40 dB) moderate (41-55 dB), moderately severe (56-70 dB), severe (71- 90 dB). On the day of surgery after elevating tympanomeatal flap intraoperative findings of ossicular chain status and presence of granulation tissue were noted.

Written informed consent was taken from all participants and Institutional Ethics Committee RIMS, Imphal approval was taken before starting the study.

Descriptive statistical analysis was carried out using SPSS Statistics Version 20. Each parameter considered in present study were classified into erosion present or erosion absent based on intraoperative finding of ossicular erosion. In order to test significant for categorical data chi square ( $\chi^2$ ) test was applied while for quantitative Independent sample t-test is used.

### III. Results

Out of 100 CSOM patients who were included in the study, 21 patients were having ossicular erosion and 79 patients were having intact ossicles based on the intraoperative finding.

The mean age of CSOM patients with ossicular erosion was  $29.10 \pm 10.47$  years as against of  $28.99 \pm 12.96$  years of those with no ossicular erosion ( $P=0.972$ ). Female patients is found higher than that male in both ossicular erosion groups and no erosion group ( $P= 0.423$ ). Majority of 52% patients belonged to low socio economic status, 28% patients were from mid socio economic status and 20% patients were from high socio economic status.

Hearing loss was the most common presenting complaint (78%) followed by ear discharge (65 %), ringing sensation (16%) pain (6%), itching (6%).

Regarding Distribution of ossicular erosion among unilaterally involved study population number of right sided cases were higher than that of left side ( $p=0.822$ ).

Mean duration of disease for patients with ossicular erosion is  $20.10 \pm 6.33$  years and for patients without erosion is  $12.7 \pm 3.94$  years. Difference is statistically significant ( $p<.001$ ) with longer duration of disease among patients with ossicular erosion.

**Table 1:** Relationship of cholesteatoma with ossicular erosion

Ossicular erosion	Cholesteatoma	Non cholesteatoma	Total	p-value
Present	10(47.6%)	11(13.9%)	21(21.0%)	.001
Absent	11(52.4%)	68(86.1%)	79(79.0%)	
Total cases	21	79	100	

Table 1 shows that among 21 patients of cholesteatoma 10 (47.6%) had ossicular erosion. In non-cholesteatoma patients out of 79 patients 11(13.9%) cases were associated with ossicular erosion. Ossicular erosion was high in cholesteatoma patients as compared to non-cholesteatoma patients, difference was statistically significant ( $p<.001$ ).

**Table-2: Relationship of Ossicular erosion and size of perforation**

Size of Perforation	Ossicular erosion in Non-cholesteatoma patients		Total	p-value
	Present	Absent		
Small	0	25(36.7%)	25(31.6%)	0.002
Medium	1(9.0%)	18(26.4%)	19(24.0%)	
Large	3(27.2%)	14(20.5%)	17(21.5%)	
Sub total	7(63.6%)	11(16.1%)	18(22.7%)	

Table 2 shows that among 79 cases of non-cholesteatoma group ossicular erosion was present in 11 patients. Among cases of erosion group highest percentage (63.6%) belongs to subtotal perforation, next is large size of perforation (27.2%) and then medium size of perforation (9.0%). None case of erosion found among cases of small size of perforation. The test value indicates that there is definite relationship between ossicular erosion and size of perforation ( $p=0.002$ ).

**Table 3:** Relationship of ossicular erosion with granulation tissue in patients without cholesteatoma

		Ossicular erosion			p-value
		Present	Absent	Total	
Granulation tissue	Absent	4(36.4%)	68(100.0%)	72(91.1%)	<.001
	Present	7(63.6%)	0	7(8.9%)	

Table 3 shows relationship of ossicular erosion with granulation tissue in patients without cholesteatoma group (79 cases). Ossicular erosion was present in 11 patients. Out of these 11 erosion cases 7 patients (63.6%) were having granulation tissue. While granulation tissue was absent in all patients where ossicular chain were intact. The dissimilarity is tested and found to be highly significant (p<.001).

In present study average hearing loss of cases with ossicular erosion is 57.79 ±10.14dB while of cases without erosion is 36.9 ±7.93 dB. The difference i.e. 20.88 dB was found to be statistically significant (P<.005).Result also shows that all 21 cases with ossicular erosion had either moderate, moderately severe or severe hearing loss. No case with ossicular erosion had mild hearing loss.All 4 cases with severe hearing loss and 4 out of 5 patients with moderately severe hearing loss were having ossicular erosion. (P<0.005).

**Table 4:** Distribution of AB gap in study group

Mean of AB gap(dB)	Ossicular erosion		P-value
	Present (n=21)	Absent (n=79)	
	34.92 ±10.52	18.91 ± 5.06	<.001

Table 4 shows cases with Ossicular erosion have Mean AB gap of 34.92±10.52dB whereas it is 18.9±15.06dB in cases without erosion. The difference is statistically significant (P<.001).

**Table 5:** Correlation of large air-bone gap (> 40 dB) with presence of Ossicular erosion

AB GAP(dB)	Ossicular erosion			P-value
	Present	Absent	Total	
< 40	13(61.9%)	79(100.0%)	92(92.0%)	<.001
> 40	8(38.1%)	0	8(8.0%)	

None of the cases of non-erosion had AB gap above 40dB while 38.1% of erosion group had AB gap above 40 whereas 61.9% had AB gap of below 40dB. This difference was found out to be highly significant statistically (P=<.001).

**Table 6:** Distribution of ossicular erosion according to ossicle involvement

Ossicle involved		No. of cases	Percentage
Incus	Entire incus erosion	4	19.0
	Lenticular process erosion	11	52.4
	Long process erosion	6	28.6
Malleus	Handle of malleus erosion	5	23.8
	Intact	16	76.2
Stapes	Stapes superstructure erosion	6	28.6
	Intact	15	71.4
Total		21	100.0

Among 21 ossicular erosion cases incus was most commonly involved ossicle and its erosion was present in all 21 cases of ossicular erosion. Incus was eroded with stapes superstructure in 6 cases whereas with handle of malleus in 5 cases. Isolated stapes erosion or malleus erosion was not noted. Analysing incus erosion, it was noted that most common site of erosion was lenticular process followed by long process of incus.

#### IV. Discussion

The main focus of this study was to identify preoperative factor that can predict ossicular erosion in patients of chronic suppurative otitis media (CSOM). Mean age of study group patients was 29.04±11.7 years with majority of patients 28(28.0%) and 36(36.0%) belonging to 10-20 and 20-30 years of age group respectively indicating CSOM is common in younger age group population as shown in various previous studies.In a study by Orji FT etal<sup>2</sup> concluded that CSOM affects younger population with mean age 27.6 ± 19.3 years.

In our study 21 out of 100 (21%) cases had ossicular erosion with mean of 29.10±10.47 years while 79 out of 100 (79%) were without ossicular erosion. A total of 13 (51.9%) belonged to 10-30 years age group suggesting that it is common age group affected by CSOM related to ossicular erosion. This may be due to fact

that CSOM is a common finding in ossicular erosion group which may lead to hearing loss (secondary to ossicular necrosis).

In our study 40% cases are male and 60% were female. Ossicular erosion group had female preponderance i.e. 52.4% cases as compared to males 47.6 % (  $p=0.423$ ). Similar results were present in a study done by Jayakumar CJ et al<sup>3</sup> ossicular erosion group had female preponderance 62.5%.

Most of cases in our study presented with hearing loss (78%) and discharge from ear (65%), followed by ringing sensation (16 %), pain (6%) and itching of ear (6%). Previous studies by Asma A et al<sup>4</sup>, Deshmukh S et al<sup>5</sup> studies also showed that hearing loss and ear discharge are common presenting symptoms of CSOM.

The mean duration of symptoms was  $16.4\pm 5.5$  years. Cases with ossicular erosion had longer duration of symptoms  $20.10\pm 6.33$  years as compared to case without ossicular erosion  $12.72\pm 3.94$  years, difference is statistically significant ( $p < .001$ ). Saboo R et al<sup>6</sup> also reported similar findings in his study.

Among cases with ossicular erosion, 6 (28.8%) had bilateral CSOM with rest having unilateral involvement i.e. 15(71.4%) ( $p=0.705$ ). Among unilaterally involved patients 46.6% had right sided ear involvement and 53.4% had left sided involvement of ossicles. Jeng FC<sup>7</sup> also found similar findings in 190 patients with unilateral involvement 64% and bilateral in 36% patients.

As showed in many previous studies Varshney S et al<sup>8</sup>, Jayakumar CJ et al<sup>3</sup> presence of cholesteatoma is a significant risk factor for presence of ossicular erosion. In our study 10 out of 21(47.6%) cases with ossicular erosion had cholesteatoma in comparison to ossicular erosion without cholesteatoma i.e. 11 out of 79 (11.9%) cases ( $p < 0.001$ ). Thus presence of Cholesteatoma is a significant risk factor for ossicular erosion.

Chronic inflammation may lead to granulation tissue formation, both in Unsafe and Safe CSOM. Granulation tissue is usually visible preoperatively in unsafe CSOM patients through perforated tympanic membrane. In present study of all safe CSOM cases with ossicular erosion 7 out of 11(62.6%) had granulation tissue and rest were without granulation tissue. While there was no granulation tissue in cases without ossicular erosion. Thus presence of granulation tissue was significantly associated ( $p < .001$ ) with ossicular erosion. This finding was also reported by Chole RA et al<sup>9</sup> and Schacheran et al<sup>10</sup>.

On audiological evaluation mean pure tone audiometric (PTA) hearing loss was  $41.29\pm 11.97$  dB. The mean hearing loss was higher  $57.79\pm 10.14$  dB in patients with ossicular erosion when compared with patients without ossicular erosion who had mean hearing loss of  $36.91\pm 7.93$  dB. The difference was highly significant ( $P < .001$ ) demonstrating that high hearing loss is an important predictor of ossicular necrosis in CSOM patients as also earlier reported by Saboo R et al<sup>6</sup>.

On further accessing hearing loss using Goodman Scale patients were divided into 4 categories (Mild 26-40dB, Moderate 41-55dB, moderately severe 56-70 dB, severe 71-90 dB). The majority of patients with ossicular erosion (17 out of 21 or 81%) belonged to moderate to moderately severe hearing loss categories while in patients without ossicular erosion (91%) belonged to mild to moderate hearing loss categories. The more hearing loss in patients ossicular erosion is statistically significant ( $p < 0.001$ ) as compared to patients without ossicular erosion. Thus in patients with moderate to severe hearing loss there is high probability of ossicular erosion as also earlier reported by Ebenezer J et al<sup>11</sup>.

In our study air bone gap among patients was  $< 40$ dB in 13 out of 21 (61.9%) cases with ossicular erosion whereas  $> 40$  dB in 8 out of 21(38.1%) cases ( $p < 0.001$ ). So presence of high air bone gap can be considered a good predictor of ossicular erosion, as also earlier reported by Ebenezer J et al<sup>11</sup>.

Analysing 21 ossicular erosion cases in our study, incus was most commonly involved ossicle and its erosion was present in all 21 cases. Incus was eroded with stapes superstructure in 6 cases and with handle of malleus in 5 cases. Isolated stapes erosion or malleus erosion was not noted. Anatomically in incus erosion most common structure involved was lenticular process (52.4%) followed by long process of incus (28.6%). The same is reported by Jayakumar CJ et al<sup>3</sup>.

#### **IV. Conclusion**

Long duration of the disease, moderate to severe hearing loss, subtotal perforation, air bone gap  $> 40$ dB, presence of cholesteatoma and granulation tissue are the most important preoperative findings for the presence of ossicular erosion. The presence of these should arouse the suspicion of ossicular erosion even without using HRCT, thus helping us in planning and management of patients preoperatively without exposure to harmful and expensive HRCT. Larger sample size could have contributed to more statistically significant results.

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**Ethical approval:** Permission to conduct the above study was obtained prior to start of study by the ethical committee of the hospital of affiliation of the authors.

**Informed consent:** Informed consent to publish the case series was taken from the patients included in the study.

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