

## OSSICULAR CHAIN STATUS IN ADULTS WITH CHRONIC OTITIS MEDIA MUCOSAL AT A TERTIARY REFERRAL HOSPITAL IN NEPAL

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**ABSTRACT**

**Introduction:** Chronic Otitis Media (COM) is common condition characterized by perforation of tympanic membrane and inflammation of middle ear cleft mucosal lining for at least 2-6 weeks. This study was carried out to find out the status of the middle ear ossicles in patients with COM mucosal and to correlate with clinical parameters.

**Methods:** This retrospective clinical study comprises 106 myringoplasty patients at the department of ENT, Shree Birendra Hospital. Their preoperative PTA, four frequencies (500 Hz, 1000 Hz, 2000 Hz and 4000 Hz) Air Conduction Thresholds (ACT) and Air Bone Gap (ABG) were recorded. Ossicular chain integrity and mobility evaluated intraoperatively were noted. Ossicular chain status was analyzed with ACT and ABG.

**Results:** The ossicles were intact and mobile in 91.5%, either fixed/restricted or disrupted in 8.5%. Mean ACT and ABG comparisons in intact and ossicular chain defect groups was statistically significant. Frequency specific ACT at all four frequencies, and ABG except at 4000 Hz in the two groups were also statistically significant to predict the ossicular involvement. The group with ossicular defect had moderate to severe Conductive Hearing Loss (CHL).

**Conclusions:** Average as well as frequency specific ACT and ABG can be considered as potential preoperative predictors for ossicular chain status in COM mucosal.

**Keywords:** air bone gap; chronic otitis media; conductive hearing loss; ossicular status; pure tone audiometry

**INTRODUCTION**

Chronic Otitis Media (COM) mucosal is inflammation of middle ear mucoperiosteal lining leading to recurrent ear discharge through a permanent pars tensa perforation for at least 2-6 weeks.<sup>1</sup> It is the leading cause of acquired conductive hearing impairment in adults,<sup>2</sup> and an important cause of preventable hearing loss, particularly in the developing world.<sup>3</sup> In Nepal, 3.04% of the population above 5 years of age have COM mucosal.<sup>4</sup> It has perforation in the pars tensa and is treated by myringoplasty.<sup>5</sup> Though ossicular chain involvement is less common in COM mucosal, associated hearing loss may be due to perforation in the tympanic membrane or ossicular chain erosion/fixation (loss of ossicular coupling).<sup>6,7</sup> Simple closure of tympanic membrane in the presence of ossicular discontinuity or fixity will further decrease the quality of life due to long term acoustic failure in around 50 to 60% patients.<sup>8</sup> Pure Tone Audiometry (PTA), a routine preoperative procedure performed prior to myringoplasty, can help predict the severity of hearing loss and reflect the integrity of ossicular chain status.<sup>9</sup> It helps in preoperative planning, counsel patients regarding their hearing status and

results of the surgery.<sup>10,11</sup>

Present study aims to correlate with clinical parameters for ascertaining the ossicular status preoperatively and to plan appropriate surgery for improved hearing. The study will also provide information on burden of ossicular chain problem in COM.

**MATERIAL AND METHODS**

This is a retrospective cross-sectional study carried out at the department of ENT Head and Neck Surgery (ENT-HNS), Shree Birendra Hospital (SBH), Kathmandu, Nepal. Patients eighteen years and above who underwent myringoplasty for COM mucosal from January 2018 to January 2019 were included. The exclusion criteria were patients with revision myringoplasty, retraction pocket, cholesteatoma, sensorineural hearing loss, and cases where the ossicular status was not assessed during surgery. A total of 106 cases met the inclusion criteria. Ethical committee approval was obtained from the NAIHS Institutional Review Committee, approval number 245. Consent for the study was received from the

department of ENT-HNS, SBH. The demographic details, chief complaints and their duration were obtained from the OT record. Preoperative PTA was analyzed and frequency specific ACT (Air Conduction Threshold) and ABG (Air Bone Gap) were noted. Hearing was calculated as mean of 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz for both bone conduction and air conduction thresholds. Ossicular status during myringoplasty was noted. Data of four frequencies pure tone averages were compared with intra-operative ossicular chain status by using SPSS version 22. Correlation was made between ossicular status, ABG, ACT, symptoms and duration of COM.

**RESULTS**

Total of 106 cases of myringoplasty fulfilling the inclusion criteria were included. Out of 106 cases, 53 were right (50%) and 53 were left (50%) ears. Age ranged from 18 to 55 years with the mean of 28.1. There were 86 males (81.1%) and 20 females (18.9%). Among their complaints, recurrent ear discharge was the main complaint in 67 (63.21%) and hearing loss in 39 (36.79%). Eighty-one cases (76.41%) were symptomatic since childhood and 25 (23.59%) had symptoms for an average of 1.36 years.

On grouping the patients based on intra-operative ossicular chain status, ossicles were intact and mobile in 91.5%, and ossicular chain defect was present in 8.5% (Table:1).

**Table 1. Intraoperative ossicular chain status**

Ossicular chain status	Number of cases	Percentage (%)
Intact and Mobile	97	91.5
Fixed	5	4.7
Restricted	3	2.8
Discontinuity	1	0.9
<b>Total</b>	<b>106</b>	<b>100</b>

On evaluating the preoperative PTA, majority of the patients had either mild or moderate hearing loss. Severe hearing loss was present in 2.83%. All cases with ossicular chain defect (fixed/restricted or discontinuous) group had moderate to severe hearing loss (Table:2).

**Table 2. Degree of preoperative hearing and ossicular chain status**

Hearing Loss (dB)	Number of cases and Ossicular chain status				Total (106)
	Intact & Mobile	Fixed	Restricted	Discontinuity	
Normal (≤ 25)	10	0	0	0	10
Mild (26 - 40)	48	0	0	0	48
Moderate (41 - 60)	38	4	2	1	45

Severe (61 - 80)	1	1	1	0	3
Profound (≥ 81)	0	0	0	0	0

The mean ACT of the study group was 39.83 dB. The difference in mean ACT between the two groups was statistically significant (Table 3).

**Table 3. Mean ACT for normal and ossicular chain defect groups**

Ossicular chain status group	Mean ACT (dB)
Normal and Mobile	38.37
Ossicular chain defect	55.55
p value	0.000

Frequency specific ACT for normal and ossicular chain defect group was statistically significant (Table: 4).

**Table 4. Frequency specific mean ACT in dB for normal and ossicular chain defect groups**

Ossicular chain status	500 Hz	1000 Hz	2000 Hz	4000 Hz
Intact and mobile	42.73	39.12	36.75	34.85
Ossicular chain defect	62.78	58.89	52.22	48.33
p value	0.000	0.000	0.000	0.021

Four frequencies mean ABG for normal and ossicular chain defect group was statistically significant (Table:5).

**Table 5. Mean ABG in dB for normal and ossicular chain defect groups**

Normal ossicular chain	27.95	p value
Ossicular chain defect	37.36	0.043

The ABG difference amongst normal and ossicular chain defect group was statistically significant at 500 Hz, 1000 Hz and 2000 Hz (Table:6).

**Table 6. Distribution of frequency specific mean ABG in dB**

Ossicular chain status	500 Hz	1000 Hz	2000 Hz	4000 Hz
Normal and mobile	31.54	30.05	24.17	26.03
Defect group	43.33	42.22	32.22	31.66
p value	0.006	0.004	0.016	0.292

**DISCUSSION**

Our study patients were young adults with the mean age of 28.1 years which is comparable to other studies.<sup>6,10,12</sup> Sex distribution was 81.1% males and 18.9% females with the male:female ratio of 4.3:1 in contrast to Tripathi P et.al. where the ratio was 1:1.03.<sup>6</sup> Our study has higher male predominance compared to others that had only slight male predominance.<sup>7,13-16</sup>

In our study, 91.5% patients had intact and mobile (normal) ossicular chain and the hearing loss ranged from minimal to moderate. Other studies had intact and mobile ossicles in 78.3%, 89.2%, and 89%.<sup>6,9,12</sup> Albera R et. al. concluded that ossicular chain damages are present in no more than 10% in patients with COM mucosal.<sup>17</sup> Our study had 8.4% cases with ossicular involvement (2.8% restricted, 4.7% fixed and 0.9% with erosion). Compared to other studies, it is low. In other prospective studies, ossicular involvement were noted to be 3.1%, 10.6%, 21.7% (fixed ossicles in 18.3% and 3.4% erosion) and 46.7%.<sup>6</sup> Due to tenuous blood supply, incus is the commonest ossicle to get eroded<sup>18</sup> and in our study also incus was the only ossicle involved. Similar studies had incus erosion in 17% and 33.33% with COM mucosal.<sup>19–21</sup> Our study has the lowest number of erosion 0.9% compared to others.

A positive correlation between duration of disease (more than 10 years) and ossicular defect was noted.<sup>6,12,22</sup> All our cases with ossicular involvement had disease since childhood and hearing loss was the primary complaint.

Abo Elfotoh Ali Msc MI et. al. in a prospective study with 50 patients of COM mucosal, type of hearing loss was 88% conductive and 12% mixed; most of them had mild (38%) and moderate (40%) hearing loss, and 22% with severe hearing loss.<sup>22</sup> In another study, 83% had CHL (50.5% moderate CHL) and 17% had MHL.<sup>9</sup> Our study had 99.06% CHL and only 0.94% MHL. Amongst normal ossicular chain group, 10.3% had normal hearing, 49.5% had mild, 39.2% had moderate and 1.0% had severe hearing loss; the finding of normal hearing in COM mucosal was not apparent in other studies. In ossicular chain defect group, 77.77% had moderate and 22.22% had severe hearing loss. This finding predicts that COM mucosal with moderate to severe hearing loss could have ossicular chain defect.

Mohanty S in a retrospective study of 20 patients who underwent ossicular reconstruction, the mean preoperative ACT was 52.38 (45 - 64) dB HL. He concluded that complete disruption of the ossicular chain can result in 60 dB hearing loss.<sup>18</sup> In ours, mean ACT in cases with intact and mobile ossicular chain was 38.37±10.08 dB; in ossicular chain defect group it was 55.55±10.40 dB (fixed 57.25 dB, restricted 52.92 dB, necrosed incus had 55 dB). The difference in the two groups was statistically significant. In other studies, mean hearing loss ranged from 31.93±8.14 dB to 52.05±15.66 dB for prediction of ossicular necrosis.<sup>9,18</sup> These study findings are similar to ours. In our study, fixed ossicle was the commonest finding with the highest mean ACT of 57.25±10.87 dB amongst the ossicular defect group. Tripathi P had mean ACT of 46.2±20.1 dB in patients with intact ossicular chain; 65.7±14 dB in ossicular discontinuity group (P = 0.04).<sup>6</sup> The finding is again similar to ours, however, our

study is retrospective.

In our study, mean ABG was 37.36±8.46 dB for ossicular chain defect group; in normal ossicular group it was 27.95±9.37 dB. The prospective study by Tripathi P in COM mucosal had similar results with mean ABG 23.9±9.8 dB in patients with intact ossicular chain; 35.1±10.3 dB in ossicular discontinuity group (P = 0.001).<sup>6</sup> Sheikh R et. al. stated ABG degree and pattern should be able to predict an ossicular chain dysfunction in the form of ossicular chain fixation or discontinuity.<sup>23</sup> Surprisingly, ABG was not significantly correlated with ossicular discontinuity in a study by Mohanty S.<sup>18</sup> In other studies, ACT and ABG were reliable predictors of ossicular discontinuity in COM mucosal.<sup>6,12</sup>

Study conducted by Rashid S, Hassanin A et. al. concluded that studies of ossicular chain dysfunction must be frequency specific since the ossicular chain and tympanic membrane have different efficiencies across frequencies. Increased mean ACT values at lower frequencies both 1000Hz and 2000Hz are the most reliable variables associated with ossicular discontinuity.<sup>23</sup> Similar conclusion was made by Bhavya B M et. al.<sup>9</sup> Our study finding showed increased ACT values at all four frequencies.

In our study, frequency specific ABG for normal ossicular chain group was 31.54 dB, 30.05 dB, 24.17 dB, and 26.03 dB at 500 Hz, 1000 Hz, 2000 Hz, and 4000 Hz respectively; for ossicular chain defect group it was 43.33 dB, 42.22 dB, 32.44 dB and 31.66 dB. The difference in ABG was statistically significant at 500 Hz, 1000 Hz, and 2000 Hz for the two groups. Jeng et. al. and Carillo et. al. studied the association between preoperative ABG in six patients with ossicular discontinuity; upsloping audiogram with more hearing loss at lower frequency had ossicular defects in all.<sup>11,24</sup> In our observation, cases with ossicular fixation or restriction had upsloping audiogram in seven out of eight cases, and down-sloping pattern was noticed in patient with ossicular discontinuity. Bhavya et. al. concluded ABG and ACT at 500 Hz, 1000 Hz, and 4000 Hz were statistically significant for predicting ossicular discontinuity. The mean ABG was > 30 dB at 500 Hz, > 30 dB at 1000 Hz, > 35 dB at 2000 Hz, and > 25 dB at 4000 Hz which were statistically significant.<sup>9</sup> Compared to the above study, our result showed higher values of mean ABG at each frequency except at 2000 Hz (slightly lower, 32.22 dB). In their study, up-sloping audiogram had erosion of incus or discontinuation of joints (malleo-incudal and or incudo-stapedial) and down-sloping audiogram had more than one ossicle erosion. It concluded that higher ABG and ACT at lower frequencies (500 Hz and 1000 Hz) was significant and can predict ossicular chain defect in COM. Our finding matches with the above study.

Carillo R et. al. found out specific ABG cut off values at different frequencies in COM with gross ossicular discontinuity and stressed wide ABG at higher frequencies i.e., > 30 dB at 2000 Hz and > 40 dB at 4000 Hz suggested presence of ossicular discontinuity. They concluded that a narrow ABG at lower frequencies (i.e. ABG of 20 dB or less at 500 Hz and 30 dB or less at 1000 Hz) suggested absence of ossicular discontinuity while ABG of > 50 dB at 500 Hz, > 30 dB at 2000 Hz and > 50 dB at 4000 Hz best predicts presence of ossicular discontinuity in general.<sup>11</sup> In our study, ABG for normal ossicular chain group was less than 35 dB at 500 Hz and 1000 Hz; for ossicular chain defect group ABG was more than 40 dB at both the frequencies. This difference in the value could be due to Carillo included both COM mucosal and squamous with multiple ossicles involvement whereas our study was on COM mucosal and had a single case with incus erosion.

### CONCLUSION

Average as well as frequency specific ACT and ABG can be considered as potential preoperative predictors for ossicular chain status in COM mucosal. It can influence the surgical decision in myringoplasty to improve hearing. Longer the duration of COM, higher will be the chances of ossicular chain defect.

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