

Original Article

Relationship of Preoperative Hearing loss with Peroperative Ossicular Discontinuity in Chronic Otitis Media

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Abstract:

Background: Chronic Otitis Media (COM) is a common disease in our country. COM with or without cholesteatoma may lead to ossicular discontinuity. However, the discontinuity of the ossicular chain is usually confirmed during operation. The purpose of the study was to find out the correlation between preoperative hearing loss and the status of ossicular chain at surgery.

Methods: This cross-sectional study was conducted in the department of otolaryngology-Head & neck surgery, Bangabandhu Sheikh Mujib Medical University from January 2013 to June 2014. At least 113 patients of COM were selected as per inclusion and exclusion criteria. Relevant data were collected in a predesigned data collection sheet and analyzed with standard statistical method. Statistically significant inferred for P value <0.05. No groups whose ability to give voluntary informed consent questionable was not included. No potential risks exist in designed this study.

Results: Out of 34 patients with mild degree of hearing loss 31(39.7%) had intact ossicular chain whereas discontinuity was seen in 3(8.6%) cases, 37 patients with moderate degree of hearing loss 16(45.7%) had ossicular discontinuity. Among 23 patients with moderate to severe degree of hearing loss 14(17.9%) had intact ossicular chain whereas ossicular discontinuity was found 9(25.7%), 9 patients of severe degree of hearing loss 7(20%) had ossicular discontinuity. Cases with moderate and severe degree of hearing loss had significant ossicular discontinuity ($p < 0.05$). Air-bone gap > 40 dB was found in 60% cases of ossicular discontinuity, followed by air bone gap 31-40 dB(17.14%), 21-30 dB(14.29%) and 11-20 dB(8.57%) respectively. So ossicular discontinuity was in higher air-bone gap group and it was statistically significant ($p < 0.001$).

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Conclusion: *COM with or without cholesteatoma may cause ossicular disconnection.. If preoperative information can be gathered to determine whether or not the ossicular chain is intact, the patient can be managed better in ossiculoplasty.*

Key words: *COM, non-cholesteatoma COM, ossicular discontinuity, hearing loss, A-B gap, Per-operative.*

Introduction:

Chronic otitis media (COM) with or without cholesteatoma is a common condition in Otorhinolaryngology. It is more prevalent in developing countries. In Bangladesh prevalence of COM is 6.2%.¹

Chronic otitis media with or without cholesteatoma may cause ossicular chain erosion.² Among ossicles in the middle ear, the long process of the incus and stapes suprastructure are most frequently affected in COM.^{3,4,5,6,7} The propensity for ossicular erosion is more prevalent in COM with cholesteatoma ears than non-cholesteatoma COM.^{3,7,8}

In non-cholesteatoma COM adherence of perforation edges adhering to the promontory may confine the granulation tissues and inflammatory products in a small, dead space, therefore inducing further ossicular discontinuity.^{9,10,11}

Pathologies that interrupt the ossicular chain result in much hearing loss. Complete disruption of the ossicular chain can result in a 60 dB hearing loss.¹²

The difference in the thresholds of air and bone conduction (A-B gap) is a measure of the degree of conductive deafness. The air conduction threshold and air -bone gap in patients with ossicular discontinuity are higher than that in patients with ossicular continuity.

Per-operative assessment is the gold standard method of confirmation of the discontinuity of the ossicular chain. But it would be of great help if we can predict it before surgery.

A wide air bone gap at higher frequencies (i.e. > 30 dB at 2 kHz and > 40 dB at 4 kHz) suggests presence of ossicular discontinuity. So, subjects with a high chance of ossicular discontinuity as assessed by pure tone audiometry should undergo exploration of the ossicular chain with reconstruction when possible.^{13,14}

High resolution computed tomography scan can help to define the middle ear ossicles and identify discontinuity.⁷ It is not a confirmatory pre-operative investigation. This is not a routine for patients with chronic otitis media, especially those without cholesteatoma.

The status of the ossicular chain is important when selecting the type of intervention and also to establish the prognosis. Surgery is the treatment of choice for COM. Successful operation is to obtain a permanently dry ear and close the perforation and restore or improve hearing depending upon the pathology. If the ossicular discontinuity is predicted before surgery, it allows the surgeon to know the possibility of performing an ossiculoplasty. Additionally, sufficient explanation and more accurate information regarding the status of the ossicular chain, the probability of performing an ossiculoplasty and the possible surgical complications and results can be provided to the patient. In this study relationship of preoperative hearing loss with peroperative ossicular chain discontinuity in chronic otitis media has been assessed

Methods:

This is an observational type of cross-sectional study conducted in the department

of otolaryngology-Head & neck surgery, Bangabandhu Sheikh Mujib Medical University from January 2013 to June 2014. At least 113 patients of COM were selected as per inclusion and exclusion criteria. Inclusion criteria were: a) All patients of COM who were admitted during study period into department of Otolaryngology-Head & Neck Surgery in BSMMU, b) Patient was agreed for undergoing surgery offered to him/ her, c) Patient gave consent for the study upon him/ her, d) Patient came for regular follow up and comply with the medical advice and exclusion criteria: were a) Patient who had previously undergone ear surgery, previous radiation treatment to head and neck, b) Patients with congenital cholesteatoma, c) Age less than 4 & more than 60 years, d) Profound hearing loss, e) Patient did not give consent for study upon him/ her and f) Patients with ear canal obstruction, intracranial complication and ossicular fixation. All patients with a clinical diagnosis of COM underwent a detailed clinical examination including otoscopic and microscopic examination and all findings were recorded, and Audiological evaluation was done by pure tone audiogram. All patients underwent tympanoplasty with or without mastoidectomy under general anesthesia. Pure Tone Audiometry (PTA), Air-Bone gap, presence of Cholesteatoma, presence of granulation tissue was used as outcome variables. All patients were operated by regular otology surgeons and intraoperative findings of ossicular discontinuity with related features were noted. Then the findings were recorded and relationship between the pre-operative and per-operative ossicular discontinuity with PTA and Air bone gap was find out.

Type of sampling: Purposive, non-random sampling.

Data collection technique:

Relevant data were collected in a predesigned data collection sheet for each

of the patient with chronic otitis media. Diagnosis was made by history, clinical, otoscopic, microscopic examination and radiological investigation and peroperative findings.

Analysis of data:

Data were processed manually and analyzed with the help of SPSS (Statistical package for social sciences) Version 19.0. Quantitative data were expressed as mean and standard deviation and comparison were done by student "t" test. Qualitative data were expressed as frequency and percentage comparisons were carried by chi-square (X^2) test. Other statistical test was done whenever it is necessary. A probability value (p) of less than 0.05 was considered to indicate statistical significance.

Results:

Table I:

Age group distribution of the patients (n=113)

| Age in years | Number | Percentage (%) |
|---------------|---------------------|----------------|
| 5-15 | 15 | 13.27 |
| 16-30 | 77 | 68.14 |
| 31-45 | 12 | 10.62 |
| 46-60 | 09 | 7.96 |
| Total | 113 | 100.00 |
| Mean \pm SD | 23.79(\pm 10.33) | 7-53 years |

Table II:

Distribution of symptoms among study patients (n=113)

| Symptoms | Number | Percentage(%) |
|--------------------|--------|---------------|
| Ear discharge | 113 | 100 |
| Hearing impairment | 86 | 76.11 |
| Earache | 11 | 9.73 |
| Vertigo | 01 | 0.88 |
| Headache | 03 | 2.65 |

Table III :
Distribution of site of perforation among patients (n=113)

| | Number | Percentage |
|----------|--------|------------|
| Central | 82 | 72.57 |
| Attic | 23 | 20.35 |
| Marginal | 08 | 07.08 |
| Total | 113 | 100.00 |

Table IV :
Distribution of granulation tissues and cholesteatoma among study population (n=113)

| | Number | Percentage |
|--------------------|--------|------------|
| Granulation Tissue | 25 | 22.12 |
| Cholesteatoma | 32 | 28.32 |

Table V :
Relation between preoperative degree of hearing loss with per operative Ossicular discontinuity (n=113)

| Degree of hearing loss | Status of Ossicular chain | | |
|--------------------------|---------------------------|---------------------|---------|
| | Intact n (%) | Discontinuity n (%) | p value |
| Normal (n=10) | 10(12.8) | — | 0.02* |
| Mild(n=34) | 31(39.7) | 03(8.6) | 0.001* |
| Moderate (n=37) | 21(26.9) | 16(45.7) | 0.04* |
| Moderately severe (n=23) | 14(17.9) | 09(25.7) | 0.36 |
| Severe (n=09) | 02(2.7) | 07(20.0) | 0.003* |
| Total | 78(100) | 35(100) | |

* significant

Table VI :
Relation between pre-operative air bone gap with per operative ossicular discontinuity (n=113)

| Air bone gap (dB) | Status of ossicular chain | | | P value |
|-------------------|---------------------------|---------------|-------|---------|
| | Intact | Discontinuity | Total | |
| 0-10 (dB) | — | — | — | — |
| 11-20(dB) | 10(12.82) | 03(8.57) | 13 | 0.38 |
| 21-30(dB) | 47(60.25) | 05(14.29) | 52 | 0.001* |
| 31-40(dB) | 13(16.67) | 06(17.14) | 19 | 0.95 |
| > 40(dB) | 08(16.67) | 21(60.0) | 29 | <0.001* |
| Total | 78(100) | 35(100) | 113 | |

Table VII :
Relation between perforation edge with ossicular discontinuity (n=81)

| Perforation Edge | Status of Ossicular chain | | Total | p value |
|------------------|---------------------------|---------------|---------|---------|
| | Intact | Discontinuity | | |
| Attached | 1(6.7) | 14(93.3) | 15(100) | <0.001 |
| Free | 65(98.48) | 01(1.52) | 66(100) | |
| Total | 66(81.48) | 15(18.51) | 81(100) | |

Table VIII :
Relation between cholesteatoma with per-operative status of ossicular chain (n=32)

| Cholesteatoma | Status of ossicular chain | | P value |
|---------------|---------------------------|--------------------|---------|
| | Intact n(%) | Discontinuity n(%) | |
| Present | 04(12.5) | 28(87.5) | <0.001 |

Table VII shows that perforation edge attached to promontory where ossicular discontinuity was 93.3% and perforation edge free to promontory was 6.7%. Perforation edge attached to promontory was higher in ossicular discontinuity which was highly statistically significant ($p < 0.001$).

Discussion:

Ossicular discontinuity is the long-standing sequelae of Chronic Otitis Media (COM) with or without cholesteatoma. The discontinuity of the ossicular chain can be assumed before surgery by analyzing pre-operative audiological and imaging findings. But it is usually confirmed during operation.

This study showed 77(68.14%) of the study population were in the age group 16-30 years, followed by 13.27% in 5-15 years, age group between 31-45 years of age was 10.62% and age group between 46-60 years was 7.96%. Majority of the study population were in the age group 16-30 years. Mean age was 23.79(± 10.33) years. This is near to similar findings was found in a study where mean age was 29.78 (± 13.09) and the number of cases in the 16–25 years age group was 77 (51.33%).⁴

The present study showed that male was 59% and female was 41%. Male female ratio was 1.45: 1. Male were clearly majority in number. In different studies, it was shown that COM affected more male than female.^{15,16,17,18} This might be due to increase prevalence of COM among the male or it might be simple reflection of overall high male attendance in hospital.

In this study 113 patients (100%) presented with otorrhoea followed by hearing impairment 86(76.11%), earache 11(9.73%), vertigo 01(0.88%) and headache 03(2.65%). Most of the patients presented with more than one symptom. Commonest presenting complaint was history of ear discharge and hearing impairment. These results are comparable to the studies done by other authors.^{19,20}

In this study, discharge from right ear was 41(36.28%), and from left ear 55(48.67%) and discharge from both ears was 17 (15.04%). That is dissimilar to another study.⁴

In current study, presence of central perforation was the commonest finding which was 82(72.57%), followed by

23(20.35%) were attic and 08(7.08%) were marginal. This finding was correlated with study of Srinivas et al.²¹

In present study, out of 34 patients with mild degree of hearing loss, 31(39.7%) had intact ossicular chain whereas discontinuity was seen in 3(8.6%) cases. Out of 37 patients with moderate degree of hearing loss, 16(45.7%) had ossicular discontinuity. Out of 23 patients with moderate to severe degree of hearing loss, 14(17.9%) had intact ossicular chain whereas ossicular discontinuity was found 9(25.7%). Out of 09 patients of severe degree of hearing loss, 7(20%) had seen in ossicular discontinuity. Cases with moderate and severe degree of hearing loss had significant ossicular discontinuity ($p < 0.05$). These findings are consistent with results of other study.²²

In this study, majority of ossicular discontinuity (60%) was seen when average air bone gap was > 40 dB, this was followed by air bone gap between 31-40 dB were 17.14%, 21-30 dB were 14.29% and 11-20 dB were 8.57% respectively. That means if air bone gap is greater, ossicular discontinuity is more ($p < 0.001$) and statistically highly significant. This is similar to Jung et al. study.²³

In this study, when the perforation edge was attached to promontory then ossicular discontinuity was 93.3% and if perforation edge is free to promontory, the rate of ossicular discontinuity was 6.7%. Perforation edge attached to promontory was higher in ossicular discontinuity which was highly statistically significant ($p < 0.001$). This was correlated with findings of other studies.^{10,22,23}

In current study, out of 25 granulation tissues cases, ossicular discontinuity was found in 21(84%) and intact ossicular chain was found in 4(16%). That was statistically significant ($p < 0.01$).

Out of 32 cholesteatoma cases, ossicular discontinuity was found in 28(87.5%) and intact ossicular chain was found in 4(12.5%). That was also statistically significant ($p < 0.001$). Another study¹³ showed that with the presence of cholesteatoma, the chance of ossicular chain discontinuity was 88%.

Wide air bone gap suggests presence of ossicular chain discontinuity. So, in preoperative pure tone audiometry with higher air-bone gap or increased conductive threshold exploration of the ossicular chain with possible reconstruction is suggested on subjects with a high chance of ossicular chain discontinuity. The presence of cholesteatoma and granulation tissues warrants ossicular chain exploration.

Conclusion:

COM with or without cholesteatoma may cause ossicular disconnection. Pure tone audiometric (PTA) threshold is significantly greater in moderate and severe hearing loss group with ossicular discontinuity. Majority ossicular discontinuity found when average air bone gap > 40 dB. Greater the air bone gap, the conductive hearing loss is more; number of ossicular discontinuity is also more. Ossicular discontinuity was also found more in cases where there is attachment of perforation edge to promontory, granulation tissues and presence of cholesteatoma. If preoperative information can be gathered to determine whether or not the ossicular chain is intact, the patient can be better informed, counseled for ossiculoplasty before surgery.

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