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Original Research Article

STUDY OF EXTENT OF OSSICULAR CHAIN EROSION IN PATIENTS UNDERGOING MODIFIED RADICAL MASTOIDECTOMY FOR UNSAFE CHRONIC SUPPURATIVE OTITIS MEDIA, AT TERTIARY CARE HOSPITAL - AN OBSERVATIONAL STUDY

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ABSTRACT

BACKGROUND

This study was conducted to study the extent of ossicular chain erosion in detail using HRCT findings and intraoperative findings for a better understanding of the disease.

METHODS

This was a hospital-based observational study conducted among 40 patients with unsafe chronic suppurative otitis media who underwent modified radical mastoidectomy in the Department of Otorhinolaryngology, Tertiary Health Care Center, over a period of 24 months (2 years) from January 2020 to December 2021, after obtaining clearance from the institutional ethics committee and written informed consent from the study participants.

RESULTS

On HRCT temporal bone scans, the incus was found to be eroded in the majority. In intraoperative findings, Malleus was found intact in 80% of the patients and absent in only 2.5% of the patients. The head of the malleus was eroded in 5% of patients, and the handle of the malleus was eroded in 10% of patients, while both (head and handle) were found to be

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 1, 2024

eroded in 2.5% of the patients. Incus was absent in 15% of patients. Isolated long process erosion was found in 10% of patients. Long process and lenticular process erosion was found in 35% of patients. Body of incus + long process erosion was found in 5% of patients. 35% of patients showed intact incus. 65% of the patients showed intact stapes. Suprastucture of stapes was eroded in 32.5% of patients. Both the suprastructure and footplate were eroded in 2.5% of the patients.

CONCLUSION

Intraoperatively, the ossicular findings were 25% of the patients showed an intact ossicular chain, while 75% showed ossicular erosion, isolated incus erosion was found in 40% of patients, incus + stapes erosion in 15% of patients, incus + malleus erosion in 7.5% patients, all three ossicles (malleus + incus + stapes) erosion in 12.5% of patients. In the individual ossicle status, incus was found to be intact in 35%, absent in 15%, isolated long process erosion in 10%, long process + lenticular process erosion in 35%, and body of incus + long process erosion in 5% of patients. Stapes was found to be intact in 65%, suprastucture was eroded in 32.5%, and both the suprastructure and footplate were eroded in 2.5% of patients. Malleus was found to be intact in 80%, absent in only 2.5%, head of the malleus eroded in 5%, handle eroded in 10% and both (head + handle) eroded in 2.5% of patients.

KEYWORDS

Ossicular Chain Erosion, Modified Radical Mastoidectomy, Chronic Suppurative Otitis Media.

INTRODUCTION

OM (Otitis Media) is considered the second most common disease of childhood after viral upper respiratory tract infections.[1] The chronic infection of the mucosal lining of the middle ear cleft which lasts for at least 12 weeks or more in duration is CSOM (Chronic Suppurative Otitis Media).[2]

CSOM is of the following two types - tubotympanic disease (safe CSO) and atticoantral disease (unsafe CSOM). As per recent classification, CSOM is referred to as having the following types:

1. Mucosal type, which is associated with perforation of the pars tensa.
2. Squamous type, which is associated with perforation or retraction of the pars flaccida along with retained squamous epithelial debris.

Based on the presence of inflammation and the production of pus, the CSOM is labelled as an active or inactive disease. Although, there is always the potential for the inactive ear to become active.[3]

Active mucosal CSOM can commonly show resorption of parts of the ossicles or all of the ossicular chain and it is known as resorptive osteititis.[4] Bony resorption can be due to active mucosal as well as active squamosal CSOM. There is hyperaemia with proliferation of capillaries and prominent histiocytes in the ossicles in such cases of resorption of bone.[5] The long process of the incus, stapes crura, body of the incus and manubrium are involved in that order of frequency. The hearing loss due to CSOM is preventable. Patients usually ignore the

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 1, 2024

otorrhea until complications arise, which can be dangerous to life. The incidence rate of CSOM is 4, which leads to 76 per thousand people for a total of 31 million cases. Globally, every year approximately 21 thousand people, i.e., 33 per 10 million people show mortality due to the complications of otitis media.[6]

Even if ossicular chain erosion can occur in both types of CSOM, it is less frequently seen in tubotympanic CSOM. High-resolution computed tomography can help in diagnosing ossicular erosion preoperatively. However, this is not routinely done for all patients with chronic otorrhea. Hence, ossicular chain erosion often comes as a surprise finding intraoperatively. Nowadays, high-resolution computed tomography has become the primary imaging modality for the radiological assessment of the temporal bone.[7] HRCT provides excellent inherent contrast for demonstrating bone, soft tissue and air. HRCT has the ability to identify subtle bony erosion, which makes it an ideal investigation for the assessment of middle ear disease and helps in deciding the surgical approach to management.[8] Pre-operative radiological evaluations of ossicular necrosis help in better planning the surgical procedure to be done and arranging specific equipment and materials required for the surgery.

The surgeon can discuss the prognosis of the disease, the surgical complications and the expected outcome with the patient prior to surgery and obtain consent. As a considerable number of patients with atticoantral disease come to the otorhinolaryngology department of our tertiary care centre, it was felt necessary to study the extent of ossicular chain erosion in detail using HRCT findings and intraoperative findings for a better understanding of the disease.

Aims and Objectives

- This is an observational study to observe the ossicular chain erosion in unsafe CSOM patients using radiological and intraoperative findings.
- To observe which ossicle or part of ossicle is eroded in patients with unsafe CSOM who are undergoing modified radical mastoidectomy.
- To observe the degree of hearing loss in such patients with unsafe CSOM with ossicular erosion.

METHODS

This was a hospital-based observational study conducted among 40 patients with unsafe chronic suppurative otitis media who underwent modified radical mastoidectomy at the Department of Otorhinolaryngology, at a Tertiary Health Care Center, over a period of 24 months (2 years) from January 2020 to December 2021, after obtaining clearance from the institutional ethics committee and written informed consent from the study participants.

Inclusion Criteria

- Clinically diagnosed patients with unsafe chronic suppurative otitis media of either gender without any complications who are to be posted for surgical intervention.
- Patients suffering from unsafe CSOM above the age of 12 and below the age of 60.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 1, 2024

Exclusion Criteria

- Patients below 12 years and above 60 years of age.
- Patient with tubotympanic disease (safe CSOM).
- Congenital deaf and mute patients

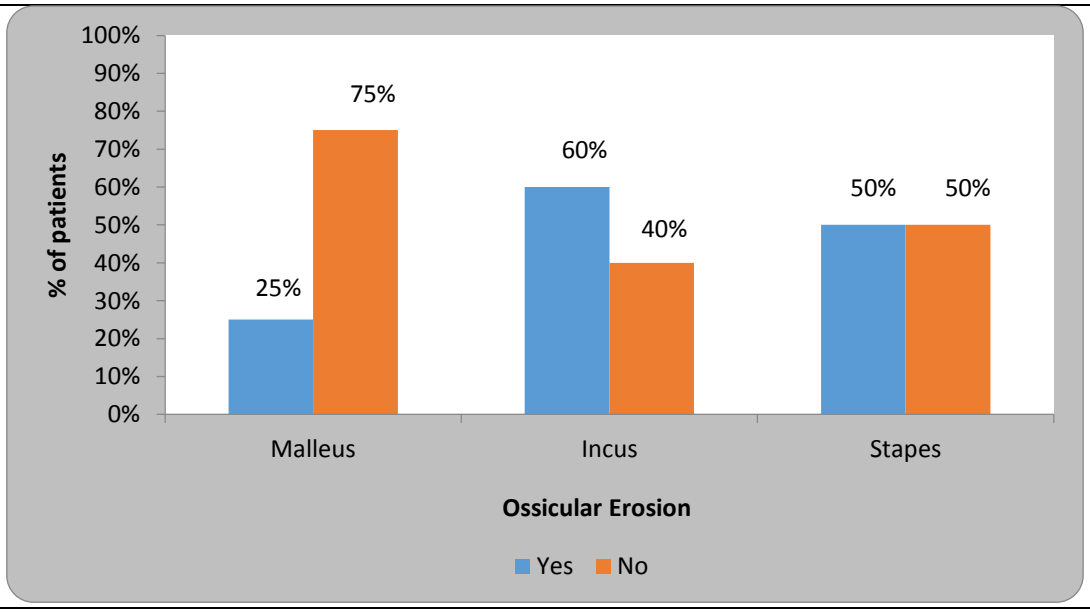
Statistical Methods

Data was entered in MS Excel and analyzed using SPSS software. The results were presented as tables.

RESULTS

Ossicular Erosion	Yes	No	Total
Malleus	10(25%)	30(75%)	40(100%)
Incus	24(60%)	16(40%)	40(100%)
Stapes	20(50%)	20(50%)	40(100%)

Table 1. Distribution of Patients According to Ossicular Erosion on HRCT Temporal Bone Scans



Graph 1: Distribution of patients according to ossicular erosion on HRCT temporal bone scans

Number of patients in terms of percentage on the vertical axis and ossicular erosion on HRCT temporal bone on the horizontal axis.

The malleus was found to be eroded in 10 (25%) patients and not eroded in 30 (75%) patients out of the total 40 patients.

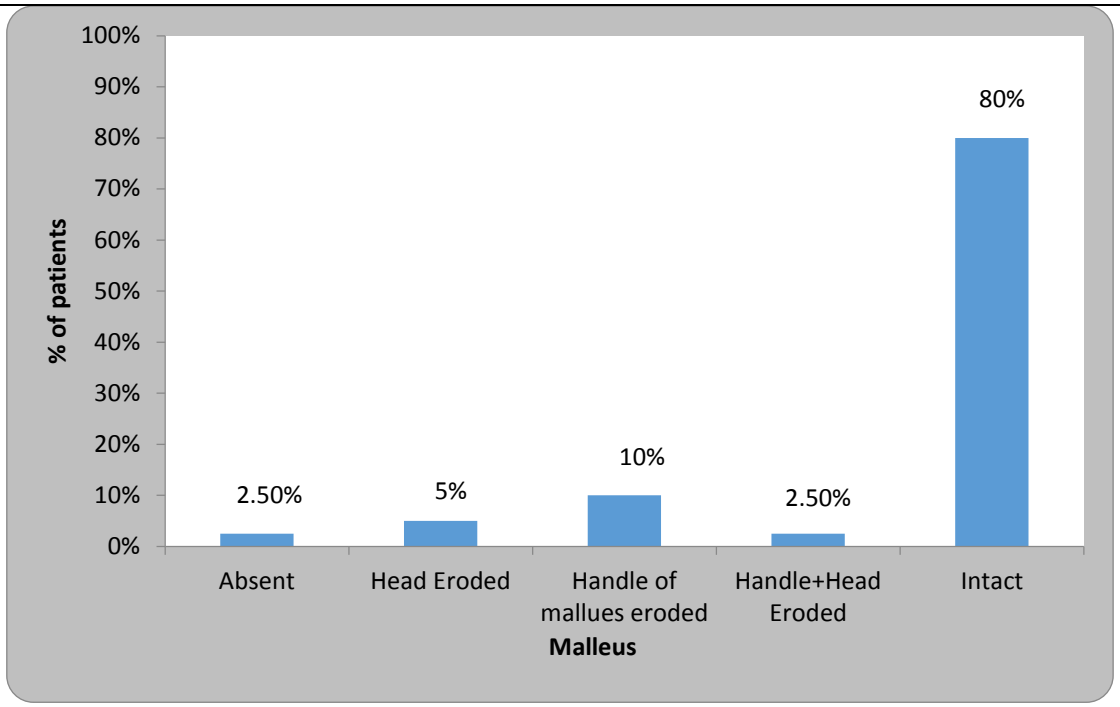
The incus was found to be eroded in 24 (60%) patients and not eroded in 16 (40%) patients out of the total of 40 patients.

The stapes were found to be eroded in 20 (50%) patients and not eroded in 20 (50%) patients out of the total of 40 patients.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 1, 2024

Malleus	No. of Patients	Percentage
Absent	1	2.5%
Head Eroded	2	5%
Handle of malleus eroded	4	10%
Handle+Head Eroded	1	2.5%
Intact	32	80%
Total	40	100%

Table 2: Distribution of Patients According to Erosion of Malleus based on Intraoperative Findings



Graph 2: Distribution of patients according to erosion of malleus based on intraoperative findings

Number of patients in terms of percentage on the vertical axis and status of malleus erosion based on the intraoperative observations on the horizontal axis.

In the present study, malleus was found to be absent in 1 (2.5%) patient. The head of the malleus was found to be eroded in 2 (5%) patients, the handle of the malleus was found to be eroded in 4 (10%) patients and both (head + handle) were found to be eroded in 1 (2.5%) patient.

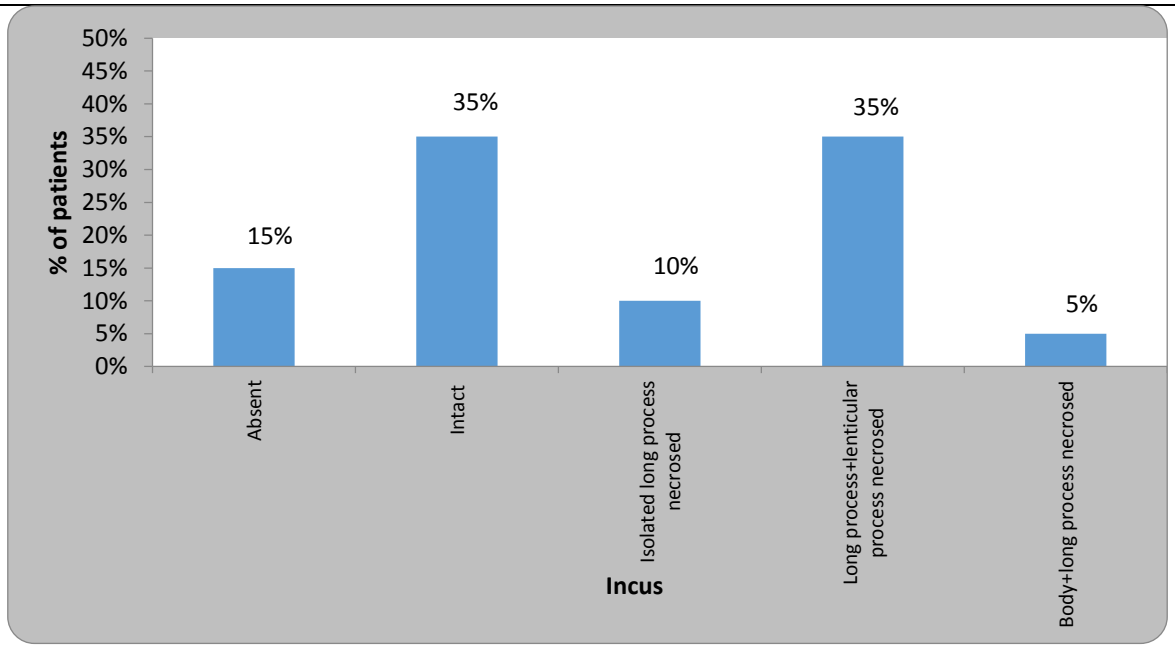
Out of the total 40 patients, 32 (80%) patients showed intact malleus.

Incus	No. of Patients	Percentage
Absent	6	15%
Intact	14	35%
Isolated long process necrosed	4	10%
Long process + lenticular process necrosed	14	35%
Body + long process necrosed	2	5%

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 1, 2024

Total	40	100%

Table 3: Distribution of Patients According to Pattern of Erosion of Incus based on Intraoperative Findings



Graph 3: Distribution of patients according to pattern of erosion of Incus based on intraoperative findings

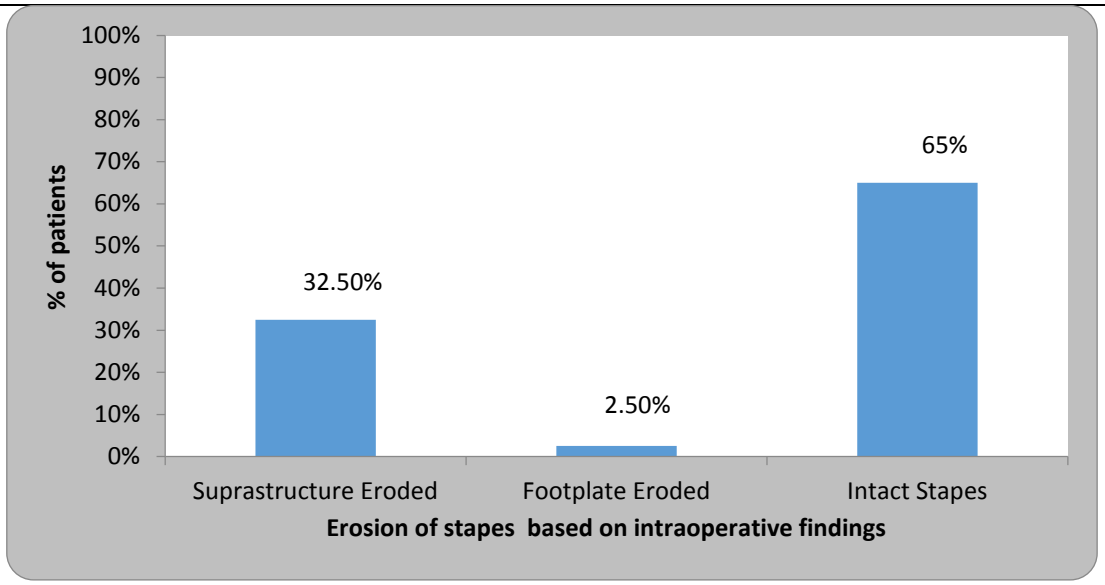
Number of patients in terms of percentage on the vertical axis and pattern of incus erosion based on the intraoperative observations on the horizontal axis.

In the present study, incus was found to be absent in 6 (15%) patients. Isolated long process erosion was found in 4 (10%) patients; long process and lenticular process both were found to be eroded in 14 (35%) patients; body and long process of incus were found to be eroded in 2 (5%) patients. Out of the total 40 patients, 14 (35%) showed intact incus.

Stapes	No. of Patients	Percentage
Suprastructure Eroded	13	32.5%
Suprastucture + Footplate Eroded	1	2.5%
Intact Stapes	26	65%
Total	40	100%

Table 4: Distribution of Patients According to Erosion of Stapes based on Intraoperative Findings

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 1, 2024



Graph 4: Distribution of patients according to erosion of stapes based on intraoperative findings

Number of patients in terms of percentage on the vertical axis and pattern of stape erosion based on the intraoperative observations on the horizontal axis.

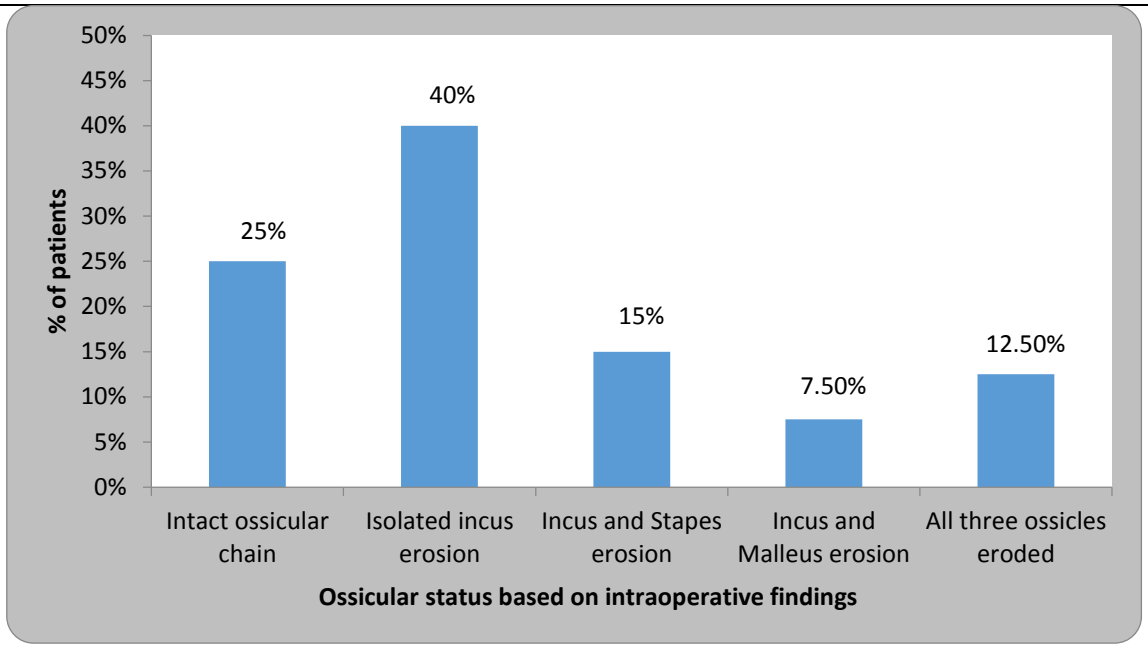
In the present study, the suprastucture of stapes was found to be eroded in 13 (32.5%) patients. Both the suprastructure and footplate were found to be eroded in 1 (2.5%) patient.

Out of the total 40 patients, 26 (65%) showed intact stapes.

Ossicular Status	No. of Patients	Percentage
Intact ossicular chain	10	25%
Isolated incus erosion	16	40%
Incus and Stapes erosion	6	15%
Incus and Malleus erosion	3	7.5%
All three ossicles eroded	5	12.5%
Total	40	100%

Table 5: Distribution of Patients According to Ossicular Status based on Intraoperative Findings

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 1, 2024



Graph 5: Distribution of patients according to ossicular status based on intraoperative findings

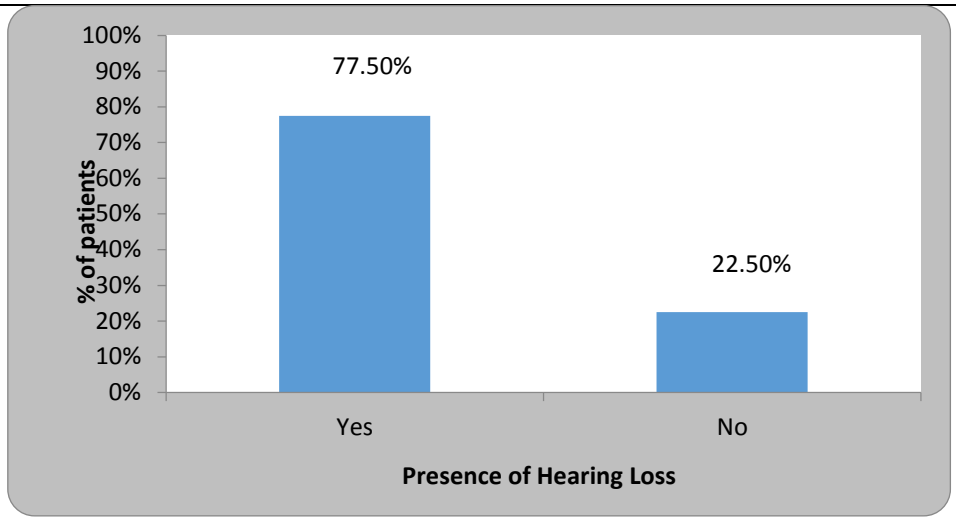
Number of patients in terms of percentage on the vertical axis and ossicular status based on the intraoperative observations on the horizontal axis. In the present study, 10 (25%) patients showed an intact ossicular chain. Isolated incus erosion was found in 16 (40%) patients. Incus and stapes erosion was found in 6 (15%) patients, while incus and malleus erosion was found in 3 (7.5%) patients.

Out of a total of 40 patients, 5 (12.5%) patients showed erosion of all three ossicles (malleus + incus + stapes).

Hearing Loss	No. of Patients	Percentage
Yes	31	77.5%
No	9	22.5%
Total	40	100%

Table 6: Distribution of Patients According to Presence of Hearing Loss

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 1, 2024

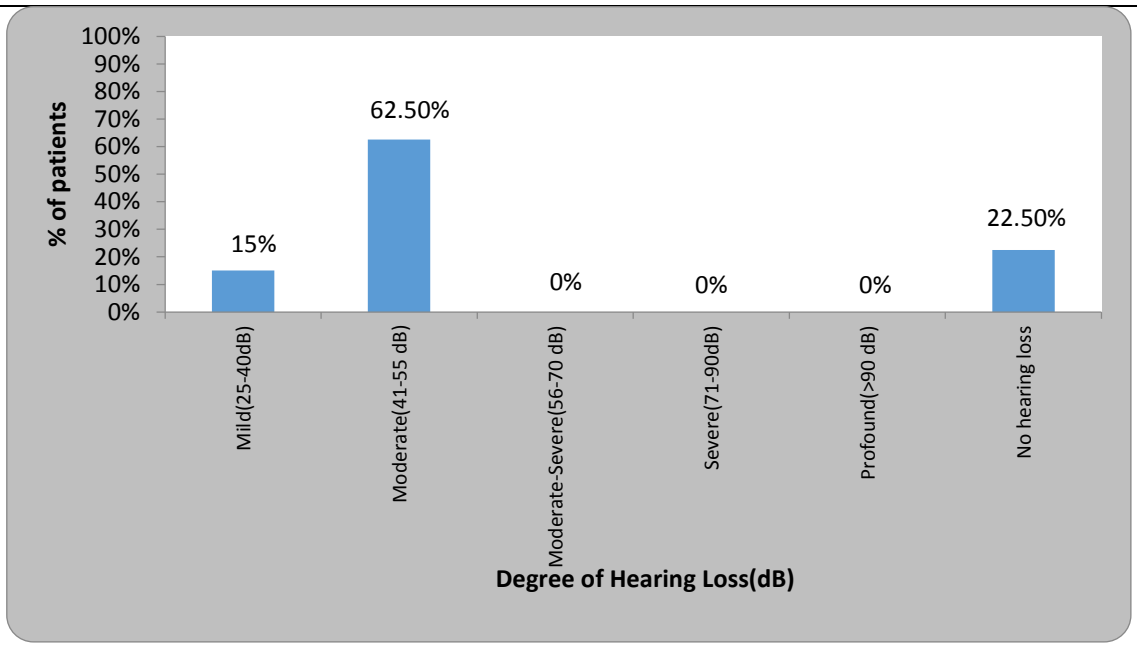


Graph 6: Distribution of patients according to presence of hearing loss

In the present study, out of a total of 40 patients, hearing loss was present in 31 (77.5%) patients. No hearing loss was found in 9 (22.5%) patients.

Degree of Hearing Loss	No. of Patients	Percentage
Mild (25-40dB)	6	15%
Moderate (41-55 dB)	25	62.5%
Moderate-Severe (56-70 dB)	0	0%
Severe(71-90dB)	0	0%
Profound (>90 dB)	0	0%
No hearing loss	9	22.5%
Total	40	100%

Table 7: Distribution of Patients According to Degree of Hearing Loss



Graph 7: Distribution of patients according to degree of hearing loss

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 1, 2024

In the present study, 6 (15%) patients showed mild hearing loss, 25 (62.5%) patients showed moderate hearing loss, and the remaining 9 (22.5%) patients showed no hearing loss.

DISCUSSION

In the Study Conducted by Mukhtar Hussain et al.[9] the ossicular status in cases of chronic suppurative otitis media was studied. Total of 100 cases of CSOM were studied for a period of 1 year from November 2018 to October 2019. Out of the total 100 patients, 51 (51%) were of safe CSOM and 49 (49%) were on unsafe CSOM. 39% of patients were between 21 and 30 years of age. There were 69 male patients and 31 female patients. Among the total unsafe CSOM cases (49), malleus was found absent in 2 (4.08%) patients. The head of the malleus was found eroded in 2 (4.08%) patients, the handle of the malleus was found eroded in 4 (8.16%), and the remaining 41 (83.68%) patients showed intact malleus. Hence, malleus was normal in majority (83%) of the cases, damaged in 12.2% and absent in 4% of the cases, suggesting it to be the most resistant ossicle. Incus was absent in 4 (8.16%) patients. The long process of incus was eroded in 31 (63.26%) patients, the short process was eroded in 9 (17.64%) patients, and 4 (10.22%) patients showed intact incus. Hence, in unsafe CSOM, incus was normal in 10.2% of cases, damaged in the majority of the cases (81.63%), and absent in 8.16% of the patients. The structure of the stapes was found to be eroded in 2 (4.08%) patients and intact in 10 (20.40%) patients, while the footplate was found intact in all cases (100%). Hence, stapes were unharmed in 79.5% of the cases and damaged in 20.4% of the cases. In this study, in unsafe CSOM patients, they did not find an intact ossicular chain in any of the patients. Isolated incus erosion was seen in 31 (63.2%) cases; incus and stapes erosion was found in 10 (20.4%) cases; and malleus and incus erosion with intact stapes suprastructure was found in 8 (16.3%) cases.

In our study, a total of 40 patients with unsafe CSOM were studied. Patients were aged from 13 to 60 years and 37.5% were found in the age group of 21-30 years. There were 18 (55%) female patients and 22 (45%) male patients out of the total 40 patients. The right side was affected in 19 (47.5%) patients and the left side in 21 (52.5%) patients. Based on the intraoperative findings, malleus was found absent in 1 (2.5%) patient. The head of the malleus was found eroded in 2 (5%) patients, the handle of the malleus was found eroded in 4 (10%) patients and both (head + handle) were found eroded in 1 (2.5%) patient, while 32 (80%) patients showed intact malleus. Hence malleus was noted as the most resistant ossicle in our study as well. Incus was absent in 6 (15%) patients. Isolated long process erosion was found in 4 (10%) patients; long process + lenticular process erosion was found in 14 (35%) patients; body + long process erosion was found in 2 (5%) patients and 14 (35%) patients showed intact incus. Suprastucture of stapes was found to be eroded in 13 (32.5%) patients. Both the suprastructure and footplate were found to be eroded in 1 (2.5%) patient, while 26 (65%) patients showed intact stapes. In the present study, 10 (25%) of the patients showed an intact ossicular chain. Isolated incus erosion was found in 16 (40%) patients. Incus + stapes erosion was found in 6 (15%) patients. Incus + malleus erosion was found in 3 (7.5%) patients. While 5 (12.5%) of the patients showed erosion of all three ossicles (malleus + incus + stapes).

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 1, 2024

In the Study Conducted by Payal G et al.[10] total of 60 patients with unsafe CSOM were studied. Radiological examination of these patients was done using HRCT temporal bone to note the pathological anatomy in unsafe CSOM. Various components, like soft tissue mass, erosion of the sinus plate, or tegmen tympani, were noted, along with erosion of the ossicles. On HRCT, out of the total 60 patients, Malleus was eroded in 24 (40%) and intact in 36 (60%) patients. Incus was eroded in 34 (56.67%) patients and intact in 26 (43.33%) patients. While stapes were eroded in 34 (56.67%) patients and intact in 26 (43.33%) patients,

In our study, a total of 40 patients with unsafe CSOM were studied. All patients underwent a preoperative HRCT temporal bone scan. A senior radiologist at the institute reported on all scans. On an HRCT scan, out of the total 40 patients, the malleus was found to be eroded in 10 (25%) patients and intact in 30 (75%) patients. Incus was found to be eroded in 24 (60%) patients and intact in 16 (40%) patients. Stapes were found to be eroded in 20 (50%) patients and intact in 20 (50%) patients.

CONCLUSION

Intraoperatively, the ossicular findings were 25% of the patients showed an intact ossicular chain, while 75% showed ossicular erosion, isolated incus erosion was found in 40% of patients incus + stapes erosion in 15% of patients, incus + malleus erosion in 7.5% patients, all three ossicles (malleus + incus + stapes) erosion in 12.5% of patients. The individual ossicle status found was incus to be intact was seen in 35%, absent in 15%, isolated long process erosion in 10%, long process + lenticular process erosion in 35%, and body of incus + long process erosion in 5% of patients; stapes was found to be intact in 65%, suprastucture was eroded in 32.5%, and both the suprastructure and footplate were eroded in 2.5% of patients. Malleus was found to be intact in 80%, absent in only 2.5%, head of the malleus eroded in 5%, handle eroded in 10% and both (head + handle) eroded in 2.5% of patients.

As per the radiological findings (HRCT temporal bone), 60% of patients showed incus erosion, 50% showed stape erosion, and 25% showed malleus erosion. In the present study, 22.5% of patients showed normal hearing, while the majority of patients, i.e., 62.5%, showed moderate hearing loss (41–50 dB).

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ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 1, 2024

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