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Research Article

A HOSPITAL BASED STUDY OF PREOPERATIVE INDICATORS OF OSSICULAR DEFECT IN MUCOSAL TYPE OF CHRONIC SUPPURATIVE OTITIS MEDIA

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Abstract

Introduction: Chronic Suppurative Otitis Media (CSOM), a common condition in otorhinolaryngology, is characterized by chronic, intermittent or persistent discharge through a perforated tympanic membrane. It leads to a wide range of pathologies in the middle ear that include irreversible mucosal changes, granulation tissue formation, cholesteatoma, tympanosclerosis and ossicular destruction.

Materials and methods: This was a Cross Sectional Analytical study conducted in the Department of ENT, Great Eastern Medical School and Hospital, Srikakulam, AP from October 2022 to September 2023. As it was a time bound study, every consecutive patient of mucosal type of Chronic Suppurative Otitis Media (CSOM) fulfilling inclusion criteria were selected for the study.

Results: A total of 90 patients with inactive mucosal type of Chronic Suppurative Otitis Media were included in the study with the mean age of 28.59±10.08 years with male to female ratio of 1:1.8. Out of 90 patients, 21 (23.33%) had ossicular necrosis detected under operating microscope during surgery.

Conclusion: The risk of ossicular erosion in mucosal type of CSOM is higher, if the disease persists for >10 years, if the margin of the perforation is adherent to the promontory and if the air bone Gap is >40 dB. This can help the surgeon to plan for ossicular reconstruction preoperatively.

Key Words: Chronic Suppurative Otitis Media, otorhinolaryngology, ossicular erosion.

INTRODUCTION

Chronic Suppurative Otitis Media (CSOM), a common condition in otorhinolaryngology, is characterized by chronic, intermittent or persistent discharge through a perforated tympanic membrane. It leads to a wide range

of pathologies in the middle ear that include irreversible mucosal changes, granulation tissue formation, cholesteatoma, tympanosclerosis and ossicular destruction.[1]
Ossicular chain involvement is found in both mucosal and squamosal type of disease. Ossicular erosion due to mucosal CSOM may be due to an increased osteoclastic activity or avascular necrosis by means of overproduction of cytokines-tumor necrosis factor (TNF) alpha, interleukin-2, fibroblast growth factor, and platelet derived growth factor. Thomsen et at stated that, hyperaemia associated with mucosal inflammation rather than avascular necrosis causes osteoclasis resulting in bony erosion.1 According to Schachern P et al, granulation tissue in nondraining spaces of middle ear cleft could result in significant bony erosion over a period of time.[2]
Malleus, incus and stapes along with tympanic membrane are vital for impedance matching mechanism of the middle ear. Necrosis of long process of the incus, Superstructure of stapes, body of incus and manubrium occur in decreasing order of frequency in Chronic Otitis Media. Complete disruption of the ossicular chain can result up to 60 dB hearing loss. Erosion or
Discontinuity of the ossicular chain is confirmed only during surgery. Preoperative HighResolution Computed Tomography (HRCT) Scan of Temporal bone can give a clue of ossicular integrity. But it's high cost and degree of Radiation exposure limits its use in developing countries like India specially in cases of mucosal type of CSOM.[3, 4,5]
Preoperative knowledge of ossicular discontinuity is important because it enables the surgeon to discuss with the patient the possible outcome of surgery and take the consent accordingly. Surgeon can also plan for ossicular reconstruction operation with respect to arrangement of specific instruments, consumables, prosthesis etc.

MATERIALS AND METHODS

This was a Cross Sectional Analytical study conducted in the Department of ENT, Great Eastern Medical School and Hospital, Srikakulam, AP from October 2022 to September 2023. As it was a time bound study, every consecutive patient of mucosal type of Chronic Suppurative Otitis Media (CSOM) fulfilling inclusion criteria were selected for the study.
Approval from Institutional Ethics Committee was achieved before starting the study. Patients of either sex and age above 15 years to 60 years having inactive mucosal type of Chronic Suppurative Otitis Media with pure conductive hearing loss and functioning Eustachian tube posted for Tympanoplasty were included in the study. Whereas the patients who were with squamosal type of CSOM and previous history of ear surgery in the same ear were excluded from the study. An informed written consent was taken before the conduct of the study.
The selected patients underwent a detailed clinical examination which included otoscopic and microscopic examination and all findings were recorded. On microscopic examination, when there is permanent central perforation in Pars tensa but no inflammation of middle ear mucosa and no production of pus in the middle ear and mastoid it was

diagnosed as Inactive mucosal type of Chronic Suppurative Otitis Media. Perforation of size of a single, two, three or more quadrants of Pars Tensa were classified into small, medium and large perforation respectively and if the entire Pars Tensa involved with intact annulus was considered as subtotal perforation. Preoperative Pure Tone Audiometry was done a day prior to surgery to assess the type and degree of hearing loss using "Elkon EDA Giga 3" Pure Tone Audiometer. The air and bone conduction threshold averages were calculated by taking the average of 0.5-2k Hz frequencies. The Air Bone Gap (ABG) was calculated by taking difference between air conduction and bone conduction thresholds. In Pure conductive hearing loss, Bone conduction threshold remains normal (-10 dbB to 20 dB), Air conduction threshold is more than 20 dB with Air- Bone Gap of > 20 dB. The mean Auditory Threshold was classified into <40 dB and >40 dB. Eustachian Tube Function was assessed by Toynbee's test using Impedance Audiometer "Interacoustics AT 235". In this test, if the increased or decreased middle ear pressure built up by the impedance audiometer is neutralized in 5 swallows in a step ladder pattern then the eustachian tube is labelled as normally functioning. X-Ray both Mastoids Schuller's view was done to know the status of mastoid air cell system.

Pre-anaesthetic evaluation was done to achieve fitness for the surgery. Tympanoplasty was done by post aural approach under Local Anaesthesia with IV sedation or General Anaesthesia whichever was required. Intra-operative middle ear findings including status of middle ear mucosa, ossicular chain status, erosion of the individual ossicle and continuity of the malleoincudal and incudostapaedial joint were noted.

Temporalis fascia was used as graft material for repair of tympanic membrane perforation. Ossicular reconstruction was done in patients with ossicular chain defects by re-sculpturing the autologous ossicules or by using autologous tragal cartilage graft depending on the defect.

Statistical Analysis

Data was entered in Microsoft Office Excel 2010 and was analysed using Epi Info version 7. Frequencies and percentages of categorical variables were calculated. Association between categorical variables was assessed by the $\chi 2$ (chi- square) test. Association between audiogram and ossicular necrosis was analyzed using independent 't' test. P value ≤ 0.05 was considered statistically significant.

RESULTS

A total of 90 patients with inactive mucosal type of Chronic Suppurative Otitis Media were included in the study with the mean age of 28.59±10.08 years with male to female ratio of 1:1.8. Out of 90 patients, 21 (23.33%) had ossicular necrosis detected under operating microscope during surgery.

Preoperative factors		Normal Ossicles (N=69) Frequency (%)	Ossicular Necrosis (N=21) Frequency (%)	Total Patients (n=90)	P Value
Age	<30 years	46 (66.67%)	8 (38.10%)	54	0.019
	>30 years	23 (33.33%)	13 (61.90%)	36	
Gender	Male	25 (36.23%)	9 (42.86%)	34	0.61
	Female	44 (63.77%)	12 (57.14%)	56	
Duration of disease	<10 years	57 (82.61%)	10 (47.62%)	67	0.003
	>10 years	**12 (17.39%)**	**11 (52.24%)**	**23**	

Table 1: Association of Baseline Characters of Patients with Ossicular Necrosis (n=90)

Preoperative factors		Normal Ossicles (N=69) Frequenc	Ossicular Necrosis (N=21) Frequency	p value
Size of perforation	Small & Moderate	48 (69.57%)	5 (23.80%	0.001
	Large & Subtotal	21 (30.43%)	16 (76.19%)	
Round Window Exposure	Yes	33 (47.83%)	14 (66.67%	0.001
	No	36 (52.17%)	7 (33.33%	
TM edge adhesion	Yes	30 (43.47%)	15 (71.43%)	0.001
	No	39 (56.52%)	6 (28.57%)	
IS joint area exposure	Yes	23 (33.33%)	14 (66.67%)	0.001
	No	46 (66.67%)	7 (33.33%)	
Air- Bone Gap (ABG)	< 40 dB	62 (89.86%)	4 (19.05%)	0.001
	> 40 dB	7 (10.14%)	7 (10.14%)	

Table 2: Association of Preoperative Clinical Parameters with Ossicular Necrosis (n=90)

	Normal Ossicles (N=69)	Ossicular Necrosis (N= 21)	p value
Mean ABG	**37 + 3.76 dB**	**52.32 + 4.50 dB**	**0.001**

Table 3: Comparison of Mean Air-Bone Gap (ABG) with Ossicular Status (n=90)

DISCUSSION

Defects of the ossicular chain may occur in all chronic middle ear diseases. Although it is most commonly seen in squamosal type of CSOM, it has been well established that it can also be seen in mucosal type of CSOM.3,4 Ossicular erosion in mucosal type of Otitis media is due to hyper vascularization,

osteoclast activation, and bone resorption by means of overproduction of cytokines like Tumour Necrosis Factor (TNF)- alpha, Interleukin 2, Fibroblast Growth Factor and Platelet Derived Growth factor.[6,7]

CSOM is thus an inflammatory process with a defective wound healing mechanism.5 It is more harmful when it stays for longer duration and when it is nearer to the ossicular chain.6 Ossicular necrosis more commonly occurs in finely constructed parts of the chain, mainly long process of incus and stapes superstructure where osteoclastic activity is abundant as compared to weak osteoblastic activity.

The ability to predict the presence of ossicular discontinuity in such patient using certain preoperative factors, would be of benefit in allowing the surgeon to plan ahead with regard to the need for an ossiculoplasty and also to give the patient a realistic explanation of the expected outcome. There have been limitations of the microscope during visualization of the posterosuperior area of tympanic cavity and blind niches.[8] Rigid endoscope can be employed to visualize and evaluate the extent of middle ear disease, assess ossicular integrity and explore the hidden niches of the middle ear and provides the surgeon with better control over the pathology and therefore achieves enhanced eradication of disease.8 In the present study, ossicular necrosis in inactive mucosal type of CSOM was seen in 23.33% cases (21 out of 90). Isolated Long process of incus was predominantly affected, i.e. in 11 out of total 21 cases of ossicular necrosis.[9]

In our study, sex of patients and round window area exposure were also analyzed but were not found to statistically significantly associated with ossicular necrosis and the finding is consistent with other studies. Menon AG et al found that, visualization of the handle of malleus, long process of incus, incudostapedial joint, stapes supra structure, Eustachian tube opening and the hypotympanum is statistically significantly better with the 300 and 700 endoscopes as compared to the microscope and should be incorporated in evaluation of middle ear in cases of CSOM.[10]

CONCLUSION

The risk of ossicular erosion in mucosal type of CSOM is higher, if the disease persists for >10 years, if the margin of the perforation is adherent to the promontory and if the air bone Gap is >40 dB. This can help the surgeon to plan for ossicular reconstruction preoperatively.

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