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Pre-operative predictors of ossicular necrosis in chronic otitis media-mucosal type

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ABSTRACT

Background: Chronic suppurative otitis media can cause a wide range of pathologies in the middle ear that include irreversible mucosal changes, granulation tissue formation, cholesteatoma, tympanosclerosis, and destruction of ossicles. Knowledge regarding ossicular discontinuity before surgery enables the surgeon to be prepared for ossiculoplasty. Objective was to study the pre-operative clinical, audiological and microscopic findings in chronic otitis media mucosal type and correlate preoperative findings with intra-operative ossicular necrosis.
Methods: Study design was observational, descriptive and cross sectional study. All patients were subjected to detailed clinical, otoscopic and microscopic examination to assess the size and site of perforation, presence or absence of ear discharge, granulation tissue, tympanosclerosis in the middle ear, exposure of incudostapedeal joint and condition of middle ear mucosa. Pure tone audiogram was also done. All patients underwent tympanoplasty±cortical mastoidectomy and the intraoperative findings of ossicular necrosis were noted.
Results: Of the 105 patients, 18(17.1%) had ossicular necrosis. Bivariate analysis showed positive correlation for long standing disease (p=0.004), presence of discharging ear (p=0.014), polypoidal middle ear mucosa (p=0.000) granulations in middle ear (p=0.000) and also when incudostapedeal joint was exposed (p=0.005). Mean Air bone gap was higher with 35 dB in ossicular necrosis and 22.7 dB in intact ossicular chain was also statistically significant (p=0.0001).
Conclusions: Ossicular necrosis was best indicated by the presence of polypoidal mucosa, granulation in the middle ear and higher air-bone gap on audiometry. However longer duration of disease, persistent active stage of disease and exposure of incudostapedeal joint were also found to be significant.

Keywords: Chronic otitis media, Ossicular necrosis, Mucosal disease

INTRODUCTION

Chronic otitis media describes chronic middle ear disease and is defined as 'chronic inflammation of the middle ear and mastoid cavity, which presents with recurrent ear discharge or otorrhea through a tympanic membrane perforation.[1] There is increased vascularity along with mucosal and submucosal inflammation and thereby increased inflammatory cells within the lamina propria that traverse through the broken basement membrane and enter middle ear lumen.[2] This will lead to osteitis with bone destruction in and around middle ear cleft. Presence of osteitis will in turn result in formation of granulations as well. Although ossicular erosion can be seen in both types of chronic otitis media, its incidence is comparatively low in mucosal type. The use of high resolution CT scan of temporal bone is valuable for detection of early erosive changes in the ossicles, particularly in the smaller parts such as the

incudostapedeal junction.[3] But this is not done routinely in mucosal type of COM. Hence it is necessary to correlate clinical and audiological data so as to suspect ossicular damage This knowledge of ossicular necrosis before surgery can useful in pre-operative counselling, necessary preparation for anaesthetist for a longer duration of surgery and adequate preparation to address the ossicular damage. The study aims in identifying predictive factors of ossicular necrosis by preoperative clinical findings and audiology with intra operative evidence of ossicular necrosis.

METHODS

The study was undertaken at Yenepoya Medical College, Mangalore between June 2017- June 2018 following the approval from Ethical committee of the institution. Written and informed consents were obtained from all participants in the study. 105 patients with mucosal type of otitis media who presented to the department of otorhinolaryngology and were willing for surgery at this institute were enrolled. Study period was 1 year. These patients underwent detailed clinical, otoscopic and microscopic examinations to evaluate the size and site of perforation, presence or absence of ear discharge, presence of granulation tissue in the middle ear, exposure of incudostapedeal joint, tympanosclerosis and condition of middle ear mucosa. Audiological evaluation was done in all cases and air bone gap values calculated for frequencies of 500, 1000 and 2000 Hz respectively. Patients then underwent tympanoplasty or cortical mastoidectomy with tympanoplasty under general anesthesia based on the disease condition. The intraoperative findings of ossicular necrosis were obtained and analyzed. Data was entered in MS Excel 2016 and analysed using EPI Info 6 Software. Chi-square test and Fisher's exact test is the test of significance for association of categorical values. Paired t test was the test of significance for continuous variables. P<0.05 was considered as statistically significant.

RESULTS

The study group consisted of 105 patients with mucosal type chronic otitis media of ages between 15 and 64 years which included 61 males (58.1%) and 44 females (41.9%). Age distribution showed maximum number of patients in age group of 20-30years, 40 patients (38%). Right side disease was more in number with (68) patients. Overall ossicular chain necrosis was noted in 18 patients (17.1%).

71 patients (67.6%) had duration of disease lasting less than 5 years. There were 34 patients with duration of disease more than 5 years of which 11 had incidence of ossicular necrosis (32.34%) which was statistically significant (p=0.004). Ear was dry in 68 patients (64.8%) moist in 29 patients (27.6%) and active discharge in 8 patients (7.6%).

Ossicular necrosis was found in 7 cases of dry ear, 10 with moist ear and 1 with active discharge which was significant (p=0.014). Assessment of size of perforation showed perforation involving 1 quadrant comprised of 17 patients (16.2%), 2 quadrants in 50 patients (47.6%)and 3 quadrants or more in 38 patients (36.2%). Ossicular necrosis was seen in 9 patients with 2 quadrant perforation and 7 patients with 3 quadrant perforation. The findings did not correlate statistically.

Table 1: Patient profile and otomicroscopic findings.

		Intact ossicles	%	Ossicular necrosis	%	P value
Age (in years)	20 and below	16	18.4	0	0	0.034
	21-30	36	41.4	4	22.2	
	31-40	12	13.8	3	16.7	
	41-50	15	17.2	7	38.9	
	Above 50	8	9.2	4	22.2	
Sex	F	39	44.8	5	27.8	
	M	48	55.2	13	72.2	0.18
Duration of disease	1–4	64	73.6	7	38.9	
	5-10	22	25.3	9	50.0	0.004
	Above 10	1	1.1	2	11.1	
Side	Right	55	63.2	12	66.7	0.782
	Left	32	36.8	6	33.3	
Size of perforation	1quadrant	15	17.2	2	11.1	0.81
	2quadrant	41	47.1	9	50.0	
	3quadrant	31	35.6	7	38.9	
Status of ear	Dry	61	70.1	7	38.9	
	Moist	19	21.8	10	55.6	0.014
	Discharge	7	8.0	1	5.6	

Continued

		Intact ossicles	%	Ossicular necrosis	%	P value
Middle ear mucosa	Pale	65	74.7	4	22.2	0.000
	Polypoidal	22	25.3	14	77.8	
Middle ear granulation	Present	1	1.1	5	27.8	0.000
	Absent	86	98.9	13	72.2	
Tympanosclerosis	Present	8	9.2	3	16.7	0.346
	Absent	79	90.8	15	83.3	
Is joint exposure	Present	5	5.7	8	44.4	0.005
	Absent	82	94.3	10	55.6	
Aditus patency	Not checked	66	78.1	8	44.4	
	Patent	20	22.9	5	27.8	0.022
	Blocked	3	3.4	5	27.8	

Middle ear mucosa was pale in 69 patients (65.7%) and polypoidal in 36 patients (34.3%). Ossicular erosion was significantly higher when middle ear mucosa was polypoidal (p=0.000) Presence of granulation in the middle ear noted in 6 patients (5.7%) which was significant for ossicular necrosis (p=0.000). Tympanosclerosis was found in 11 patients (10.4%) but had no relation to ossicular necrosis (p=0.346). Exposed incudostapedeal joint had positive correlation with 8 out of 13 patients having ossicular necrosis (p=0.005). The study also showed mean air bone gap being significantly higher with ossicular necrosis with 35 dB to that of 22.7 dB with intact ossicular chain.

Table 2: Preoperative distribution of degree of hearing loss.

Hearing loss dB	Type of loss	Intact ossicular chain	Ossicular necrosis	P value
<25		60	1	
26-40	Mild	26	14	
41-55	Moderate	1	3	
56-70	Moderate - severe	0	0	0.0001
71-90	Severe	0	0	
>91	Profound	0	0	
Mean AB gap (dB)		35	22.7	

Pure-tone average of 500, 1000, and 2000 Hz.

72 patients (68.5%) underwent tympanoplasty and 33 patients (31.4%) had undergone cortical mastoidectomy along with tympanoplasty. Multiple ossicles were often involved. Most common ossicle found to be involved was the incus (18) with isolated erosion of lenticular process in 6 patients and long process erosion in other 12 patients. Next most involved ossicle was the malleus which was seen in 7 patients. Erosion was noted in the handle of malleus. Stapes involvement was noted in 4 patients and the part involved was the suprastructure. Ossicular chain reconstruction was done in all these patients. Aditus patency was checked in 33 patients who underwent cortical mastoidectomy and was found to be patent in 25 patients (75.5%). 8 patients (24.2%) had aditus blockage where 3 patients had intact ossicular chain and 5 among them had ossicular erosion which was found to be statistically significant (p=0.022).

DISCUSSION

Otitis media refers to any inflammatory process in the middle ear and the etiology of the inflammation can be infectious in nature, but can also involve rare systemic inflammatory diseases. At the onset, there is increased vascularity of the mucosa and submucosa and an increase in inflammatory cells. This increase in chronic inflammatory cells leads to osteitis and mucosal edema with ulceration, which is followed by capillary proliferation, which results in the formation of granulation tissue and polyps, and rarifying osteitis, which ultimately produces new bone formation and fibrosis.[4] Thomsen and colleagues found that, bone erosion in those with chronic otitis media was more prevalent when cholesteatoma was present but still occurred in the absence of cholesteatoma.[5,6]

In the current study, there were about 18 patients with intraoperative findings of ossicular necrosis (17.1%) which were in accordance with available literatures with erosion of long process of incus being the most common finding.[6,7] Lenticular and long process of the incus receives blood supply from submucosal vessels that come from the body of incus and due to the long course, it may get compromised in chronic otitis media due to thrombosis of mucosal vessels supplying them.[8] Resorptive osteitis of the ossicles is a common occurrence and long process of the incus, crura of the stapes, body of the incus, and manubrium are involved, in that order of frequency. Inflammatory process in temporal bone induces the development and activation of osteoclast that are capable of resorbing bone. Resorption of the lenticular process may result in a fibrous union between the long process of the incus and head of the stapes and is characterized functionally by a fluctuating conductive hearing loss.[9,10]

Majority of the patients in the study belonged to younger age group with ossicular erosion noted in longer duration of the disease process. Sadé has reported that ossicular discontinuity is more common among older age groups and longer duration of disease.[11] Those with active ear discharge which did not respond to conservative management and remained active were more prone for ossicular damage when compared to dry ear. This supports to the fact that active inflammation play an important role in accelerating the ossicular erosion even in the absence of cholesteatoma.

In this study, it was noted that size of perforation did not correlate with ossicular necrosis. Presence of polypoidal mucosa and granulations in the middle ear was associated with evidence of ossicular necrosis as seen in the study. Granulation tissue forms secondary to secretion of angiogenic growth factors that incite capillary budding, vascular hyperpermeability, and fibroblast recruitment.[4]

Also in audiological evaluation, a higher air bone gap value was consistent with ossicular necrosis, with average of 35 dB hearing loss which was statistically significant when compared to an average of 22.7 dB hearing loss without ossicular necrosis. Ossicular discontinuity is associated with significantly higher hearing loss as seen in various studies wherein a moderately severe hearing loss (45-60 dB) was associated with ossicular necrosis.[5,12] In this study it was noted to be significantly lesser. Jeng et al similarly found that the air-bone gap was not always a reliable predictor of ossicular necrosis when granulations are present which could bridge the defect between eroded ossicles and thus reduce the air-bone gap.[13]

CONCLUSION

Ossicular necrosis was best indicated by the presence of polypoidal mucosa and granulation in the middle ear and also higher air-bone gap on audiometry. However longer duration of disease and persistent active stage of disease and exposure of incudostapedeal joint also were significant predictors. So necessary preparations for ossicular reconstruction has to be done in such cases.

Assessing these factors, a longer duration of disease, presence of active discharge despite conservative management and with findings of polypoidal mucosa, granulations in middle ear, and the chances of ossicular necrosis is high. Air bone gap were found to be higher in those with ossicular necrosis but was not high in all the cases. Surgical planning and the need for ossiculoplasty has to be thought when addressing such cases.

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