



ORIGINAL ARTICLE

Intra-Operative Findings in Middle Ear Cleft in Cases of Chronic Inactive Mucosal Otitis Media

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Abstract

Aim: To assess intra-operative findings of mastoid bone; their prevalence in patients with chronic otitis media (inactive mucosal) and their correlation with age, sex of the patient, duration of complaint and degree of hearing impairment; to establish the prevalence of aditus block.

Material and method: In this study 100 patients, ranged from 11 to 74 years, with inactive mucosal chronic otitis media were subjected to type I tympanoplasty with cortical mastoidectomy. All the Intraoperative findings of middle ear & mastoid bone, namely tympanosclerosis, polypoidal or oedematous mucosa, granulations and cholesteatoma, the patency of aditus, integrity and mobility of ossicular chain, and presence of round window reflex of each patient was recorded.

Results: Aditus blockage present in 72%, granulations in the middle ear cleft were found in 27%, edematous mucosa and tympanosclerosis each were present in 17% and 22% respectively. None had any cholesteatoma, ossicular chain destruction or fixity. In all cases round window reflex was present. The incidence of aditus blockage, granulations and tympanosclerosis increases with duration of symptom. The pathology of chronic otitis media has no relation with sex of the patient. Degree of hearing impairment (conductive loss) increases as the incidence of tympanosclerosis in the middle ear cleft increases.

Conclusion: In cases of chronic inactive otitis media, aditus blockage is very prevalent and its incidence increases with duration of symptom, so is granulations and tympanosclerosis in middle ear cleft. Tympanosclerosis bears positive correlation with degree of hearing impairment.

Keywords

Chronic otitis media, Cortical mastoidectomy, Aditus block, Tympanosclerosis, Granulations

Introduction

Chronic otitis media is a chronic inflammation of middle ear cleft with pathological tympanic membrane and discharge (i.e., lasting > 6-12 wk) [1,2]. *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Proteus species*, *Klebsiella pneumoniae*, and diphtheroids are most common bacteria isolated [3,4]. The yearly incidence of COM (chronic otitis media) is around 39 cases per 100,000 persons in children and adolescents aged 15 years and younger [5]. Its incidence in the Western world is less than 1%, but is more common in developing countries [6]. Chronic otitis media has been classified as Healed COM, Inactive (mucosal) COM, Inactive (squamous) COM, Active (mucosal) COM, and Active (squamous) COM [7]. Otorrhoea may be persistent or intermittent. If infection in the middle ear cleft persists, mucosal edema and exudation increase as the mucosal glands proliferate. This edema in middle ear spaces and aditus ad antrum hinders aeration, decreases oxygenation and vascularity in epitympanum and antrum. Drugs too fail to reach the attic and mastoid.

Infection from susceptible microorganisms takes place in the mucosa of the ear [8]. Bone formation sets in early. Metaplastic changes ensue, leading to a columnar respiratory epithelium or stratified squamous epithelium forms that progresses to aural cholesteatoma in time. Hyperplastic mucosal and osteoplastic processes are the outcome of otitis [8]. Radiographically, the mastoid air cell system is partly or completely opaque, reflecting the loss of aeration.

Table 1: Inclusion & exclusion criteria.

Inclusion criteria
1. Patients with history of grade 1 or 2 otorrhea (Merchant classification) but now dry for 6 weeks.
2. Patients with non-traumatic tympanic membrane perforation.
Exclusion criteria
1. History of previous middle ear & mastoid surgery
2. History of current or previous squamous disease in middle ear & mastoid
3. Age younger than 8 years or older than 75 years.
4. Refusal to give consent to participate in the study.
5. The only hearing ear.

Table 2: Distribution of intra operative findings.

Findings	Frequency	Percentage
Tympanosclerosis	22	22
Edematous/Polypoidal mucosa	17	17
Granulations	27	27
Cholesteatoma	0	0
Aditus blockage	72	72
Ossicular chain fixation	0	0
Ossicular chain destruction	0	0
Absent round window reflex	0	0
Tympanic membrane perforation	99	99

Standard treatments for COM include regular ear toilet, otological therapy, and dry ear precautions. In unresponsive cases surgical intervention is considered [6]. In this context cortical mastoidectomy (Also known as Schwartze procedure) seems to be an integral part of every tympanoplasty [9]. The complete (or simple) mastoidectomy refers to a canal-wall-up (CWU) mastoidectomy, with complete removal of disease from the temporal bone lateral to the otic capsule [10]. But it is still controversial that for good surgical outcomes in chronic inactive mucosal otitis media, mastoidectomy should be done or not.

An attempt was made in this study to evaluate the findings of middle ear cleft with special emphasis on mastoid bone in cases of chronic inactive mucosal otitis media and their correlation with various confounding factors like age, sex, duration of symptom, degree of hearing loss.

Materials and Methods

This was a prospective study, undertaken in the Department of Oto-rhino-laryngology at Sir Ganga Ram Hospital, Delhi from November 2013 till 100 willing patients were recruited, after taking ethical clearance. The study sample consisted of 100 patients with chronic otitis media without cholesteatoma subjected to surgical treatment. The inclusion and exclusion criteria are

tabulated in Table 1.

In all patients audiological work up, X-Ray mastoid (lateral oblique view), and pre-anesthetic checkup (with routine investigations) was done. Informed consent for the procedure, and patient's willingness to participate in the study were taken. Also they were briefed up about the study & were given "patient information sheet". In all patients undergoing surgery, temporalis fascia graft was used for repair of tympanic membrane perforation and cortical mastoidectomy was done. The demography, symptoms of all patients, their duration and the intraoperative findings of middle ear & mastoid bone, namely tympanosclerosis, polypoid/edematous mucosa, granulations and cholesteatoma, the patency of aditus, ossicular chain intactness and mobility and presence of round window reflex of each patient was recorded in Microsoft Excel Spreadsheet. The study was conducted according to the ethical guidelines laid down by declaration of Helsinki (Table 2).

Results

The age of the patients ranged from 11 to 74 years. There were 60 females and 40 males (1:1.5 ratio). The maximum number of patients was in the age group of 36-45 years (23%), followed by age group 16-25 and 26-35 years each of which had 22% patients. 15% patients belonged to age 46-55 years and 14% were above 55 years. Only 4% patients were in age group 6-15 years. The mean age was 37.16 ± 14.97 years. Overall 54% patients were affected on left side while right side was affected in 46% patients. It was clear from the p values calculated that there is no left or right side dominance of any symptom.

Maximum patients presented with complaints of otorrhoea (82%). About 65% complained of hearing impairment, followed by otalgia (8%), tinnitus (5%). None of the patient had any complaints of mastoid swelling, vertigo, or headache. Most of the patients had moderate (41 to 55 dB HL) to moderately severe (56 to 70 dB HL) hearing impairment of the ear undergoing operative intervention. 6 patients had mixed hearing loss. Among them 4 patients had mild while 2 had moderate sensorineural loss. 94 patients had pure conductive hearing loss.

The maximum number of patients i.e. 59% presenting to OPD had duration of the chief symptom of 0-6 months, followed by 15% patients with a duration of 1-3 years. 13% patients had symptom duration of 6-12 months. Number of patients in the duration categories of more than 5 years, 3-5 years is 10.0% and 2% respectively. Mean duration of symptom before presenting is 36.28 months. Minimum and maximum duration of presentation are 1 month and 40 years. 99% patients had pars tensa perforation. Only one patient had an intact tympanic membrane. Intra-operatively antral patency had to be established in 72%, because of aditus block-

Table 3: Distribution of intra operative findings in relation to site.

Findings	Frequency		
	Middle ear cavity	Mastoid Antrum	Cortical cells
Tympanosclerosis	18	10	2
Edematous/Polypoidal mucosa	12	16	4
Granulations	15	21	11
Cholesteatoma	0	0	0

Table 4: Distribution of Intra operative findings in relation to duration of Symptoms.

Findings	Duration of symptom										p value
	0-6 months		> 6-12 months		> 1-3 years		> 3-5 years		> 5 years		
	Fre- quency	Per- centage	Fre- quency	Per- centage	Fre- quency	Per- centage	Fre- quency	Per- centage	Fre- quency	Percent- age	
Tympanosclerosis	9	40.9	2	9.1	3	13.6	2	9.1	6	27.2	0.016
Edematous/ Polypoidal mu- cosa	7	41.2	1	5.9	4	23.5	1	5.9	4	23.5	0.074
Granulations	12	44.4	2	7.4	7	25.9	0	0	6	22.2	0.036
Cholesteatoma	0	0	0	0	0	0	0	0	0	0	-
Aditus blockage	39	55.7	12	17.1	11	15.7	0	0	8	11.4	0.033
Ossicular chain fixation	0	0	0	0	0	0	0	0	0	0	-
Ossicular chain destruction	0	0	0	0	0	0	0	0	0	0	-
Absent round window reflex	0	0	0	0	0	0	0	0	0	0	-

Table 5: Distribution of intra operative findings in relation to hearing impairment.

Findings	Hearing loss						p value
	Normal (n = 9) -10 to 25 dB HL	Mild (n = 30) 26 to 40 dB HL	Moderate (n = 18) 41 to 55 dB HL	Moderately severe (n = 1) 56 to 70 dB HL	Severe (n = 1) 71 to 90 dB HL	Profound (n = 1) > 90 dB HL	
Tympanosclerosis	3	5	11	1	1	1	0.024
Edematous/Polypoidal mucosa	4	3	7	1	1	1	0.406
Granulations	9	5	11	0	1	1	0.932
Cholesteatoma	0	0	0	0	0	0	-
Aditus blockage	21	22	25	1	0	1	0.197
Ossicular chain fixation	0	0	0	0	0	0	-
Ossicular chain destruction	0	0	0	0	0	0	-
Absent round window reflex	0	0	0	0	0	0	-

age. Granulations in the middle ear cleft were found in 27%, edematous mucosa and tympanosclerosis each were present in 17 and 22% respectively. None had any cholesteatoma, ossicular chain destruction or fixity. In all cases round window reflex was present (Table 3).

A direct correlation was found between tympanosclerosis and duration of primary symptom, with a p

value of 0.016 (calculated using Pearson Chi-Square test), i.e. as duration of symptom increases incidence of tympanosclerosis increases. A positive correlation is also present between granulations in middle ear cleft and duration of symptom, with a p value of 0.036, which is significant, as also with aditus blockage, with a p value of 0.033 (Table 4). A positive correlation was found

between degrees of hearing impairment with tympanosclerosis, with p value of 0.024 (calculated using Pearson Chi-Square test) (Table 5).

No correlation could be derived in between any findings in the middle ear cleft with sex of the patient (Table 6). It signifies that pathology of chronic otitis media has no relation with sex of the patient. However from the table it may be commented that males had relatively lesser incidences of the findings, though not statistically significant. No correlation was derived between ages of patient with any of the findings in middle ear cleft (Table 7).

Discussion

Kakkar, et al. [11] found that 33 patients (82%) had hearing loss. Patients with small, medium and large perforation were 5, 21 and 14 respectively. 85% patients had conductive hearing loss while 15% had mixed hearing loss. Average hearing loss was 41.62 dB while average AB gap was 38.62 dB. 30% cases had mucoid discharge. Antrum was involved in 17, aditus in 11 and middle ear in 8 patients. Antral mucosa hypertrophy was in all patients (100%) with mucoid discharge but only in 18% cases with dry ear. Aditus blockage was in 75% patients with middle ear mucoid discharge but only in 7% with dry. Middle ear mucosal hypertrophy was present in 58% with mucoid discharge while in 3.5% in

dry ear cases. Ossicular chain disruption was present in 75% cases with mucoid discharge as compared to 7% in dry ears.

Rickers J, et al. [6] performed tympanoplasty with cortical mastoidectomy in 47 children with CSOM. 51% patients had ear discharge for 3 months while 49% had a history of 12 month discharge. Tympanic membrane perforation was present in 77%, granulation tissue in 21% and polyps in 6%. 74% patients had mastoid inflammation and 28% had fluid in the mastoid cells. Edema of the middle ear mucosa in 36% and granulation tissue 57%. In 11% the middle ear mucosa appeared unaffected. They reported fixation of the ossicular chain in 11%, destruction of the ossicular chain in 11% and undetermined status in 23%.

Sady S, et al. [12] studied one hundred forty-four human temporal bones with chronic otitis media. Among the 28 perforated tympanic membranes cases findings were middle ear effusion (93%), cholesterol granuloma (21%), cholesteatoma (36%) and tympanosclerosis (43%). The most prominent pathological feature was granulation tissue (96%), and ossicular bony changes in (96%).

Sady S da Costa and colleagues [12] found tympanosclerosis in 20%, cholesteatoma in 4.3%, and cholesterol granuloma in 12% of the human temporal bones

Table 6: Distribution of Intra operative findings in relation to Sex.

Findings	Female		Male		p value
	Frequency	Percentage	Frequency	Percentage	
Tympanosclerosis	10	45.5	12	54.5	0.115
Edematous/Polypoidal mucosa	12	70.6	5	29.4	0.328
Granulations	20	74.1	7	25.9	0.081
Cholesteatoma	0	0	0	0	-
Aditus blockage	43	61.4	27	38.6	0.656
Ossicular chain fixation	0	0	0	0	-
Ossicular chain destruction	0	0	0	0	-
Absent round window reflex	0	0	0	0	-

Table 7: Distribution of Intra operative findings in relation to Age.

Findings	Frequency						p value
	6-15 (in yrs)	16-25 (in yrs)	26-35 (in yrs)	36-45 (in yrs)	46-55 (in yrs)	> 55 (in yrs)	
Tympanosclerosis	1 (4.5%)	6 (27.3%)	6 (27.3%)	4 (18.2%)	2 (9.1%)	3 (13.6%)	0.920
Edematous/Polypoidal mucosa	0 (0%)	4 (23.5%)	3 (17.6%)	6 (35.3%)	2 (11.8%)	2 (11.8%)	0.736
Granulations	1 (3.7%)	6 (22.2%)	3 (11.1%)	6 (22.2%)	8 (29.6%)	3 (11.1%)	0.254
Cholesteatoma	0	0	0	0	0	0	-
Aditus blockage	2 (2.9%)	17 (24.3%)	16 (22.9%)	15 (21.4%)	11 (15.7%)	6 (12.9%)	0.641
Ossicular chain fixation	0	0	0	0	0	0	-
Ossicular chain destruction	0	0	0	0	0	0	-
Absent round window reflex	0	0	0	0	0	0	-

Table 8: Comparison of findings between other previous studies.

Author	Findings in middle ear cleft (in inactive Otitis media cases only) in percentage					
	Aditus blockage	Mucosal edema/hypertrophy	Granulation tissue	Polyp	Tympanosclerosis	Ossicular involvement
Kakkar, et al. [11]	7	18	-	-	-	7
Rickers, et al. [6]	-	36	57	4	-	22
Sady, et al. [12]	-	-	96	-	43	96
Da costa, et al. [12]	-	-	97	-	20	90
Krishnan, et al. [9]	-	-	42	53	37	-
Meyerhoff, et al. [3]	-	-	48	0	26	-
Bhagat [17]	10	-	-	-	-	-
Current study	72	17	27	-	22	0

of patients with chronic otitis media with a perforated tympanic membrane. The epitympanum and round window niche were the most frequent areas of involvement in temporal bone studies. They found granulation tissue in 97% of the human temporal bones of patients with chronic otitis media with a perforated tympanic membrane. They found ossicular changes in 90% of the human temporal bones of patients with chronic otitis media with a perforated tympanic membrane.

Meyerhoff, et al. [3] studied 27 temporal bone with inactive COM and reported fibrosis of mucoperiosteum in 70%, granulation tissue in 48%, osteitis in 78%, subepithelial glands in 22%, tympanosclerosis in 26%, cholesterol granuloma in 4%, perforation in 7%, ossicular involvement in 81% of specimens, with the incus most commonly involved (81%), followed by the stapes (57%), and malleus (43%).

Krishnan, et al. [9] divided a total of 120 patients with COM without cholesteatoma into two groups, one undergoing tympanoplasty alone and the other, combined with cortical mastoidectomy. They reported that 58% of the patients who had normal middle ear mucosa had polypoidal changes in the antrum.

Prasansuk and Hinchcliffe [13] identified quantifiable clinical descriptions of perforated tympanic membranes that correlated with air conduction hearing threshold levels, in their study on 15 patients with active bilateral chronic suppurative otitis media. They were able to predict, by a mathematical formula, the threshold of hearing from the duration of the aural discharge. Paparella, et al. [14] reported significant sensorineural hearing loss particularly at higher frequencies both in unilateral and bilateral disease on the decade-audiograms in 279 years out of more than 500 studied.

Walby, et al. [15], in a retrospective study of 37 patients with uncomplicated and unilateral chronic suppurative otitis media, confirmed the evidence of increased bone conduction thresholds at 0.5, 1, 2, and 4 kHz on the diseased side when compared with normal opposite ear. Also, there was a greater loss in bone conduction with a longer duration of the disease.

Bhagat [16] reported that 10% of 50 cases of tubotympanic CSOM without evidence of cholesteatoma had blocked aditus ad antrum. They reported statistically significant relation between blocked aditus with age of patient, duration of discharge, site of tympanic membrane perforation and with myringosclerosis.

In our study 99% patients had pars tensa perforation, while aditus blockage was present in 72%, granulations in the middle ear cleft in 27%, edematous mucosa in 17% and tympanosclerosis in 22%. None of the patient had any ossicular involvement. However, X-ray findings were not recorded. A positive correlation was found between degrees of hearing impairment with tympanosclerosis. This signifies that degree of hearing impairment (conductive loss) increases as the incidence of tympanosclerosis in the middle ear cleft increases. However, confounding factors like site, size of tympanic membrane perforation was not taken into account. Whether the hearing impairment was sensorineural, mixed or conductive was not calculated individually. And moreover, the exact site of tympanosclerosis and its extent was not taken into account. No correlation was present between degree of hearing impairment with edematous mucosa, granulations, aditus block, ossicular chain fixity or necrosis. It may also be argued that as the degree of hearing impairment increases, number of patients in the group sample decreases significantly leading to false p values. The incidence of aditus blockage, tympanosclerosis and granulation had a statistically significant relation with the duration of symptom. It signifies that as duration of symptom increases, incidence of tympanosclerosis, aditus blockage and granulation also increases. However, neither the extent nor the distribution of tympanosclerosis and granulations was taken into account. The pathology of chronic otitis media has no relation with sex of the patient. Incidence of granulation tissue formation in the middle ear cleft is higher in the older age group. Thus, it may be concluded that these correlations are in concordance with the previous studies (Table 8).

Conclusion

In cases of chronic inactive mucosal otitis media, in-

idence of tympanic membrane perforation and aditus blockage is extremely high. However, granulations, polyp/ edematous mucosa and tympanosclerosis are also common middle ear cleft. Ossicular involvement is rarely seen. As the duration of symptoms increases, the incidence of aditus blockage, tympanosclerosis and granulations in the middle ear cleft also increases proportionately. The incidence of tympanosclerosis in middle ear cleft also has similar significant positive correlation with degree of hearing loss.

Conflict of Interest

Both the authors declare that they have no conflict of interest.

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