

# The intraoperative pathological findings in cases of chronic suppurative otitis media with central perforation of tympanic membrane at a tertiary care centre in Eastern Nepal



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## ABSTRACT

**Background:** Chronic suppurative otitis media (CSOM) is the chronic inflammation of the middle ear cleft. The atticointral type is called unsafe type because of the associated complications due to granulations and cholesteatoma which may be life-threatening. CSOM with central perforation (tubotympanic type) is usually not associated with major complications such as cholesteatoma formation. **Aims and Objectives:** To find out the intraoperative pathological findings in cases of CSOM with central perforation (tubotympanic type). **Materials and Methods:** This descriptive, cross sectional study has been conducted in the Department of Ear, Biratnagar Eye Hospital in Nepal over 2 years. Study group includes 172 patients having CSOM with central perforations in the tympanic membranes who underwent different types of procedures. Preoperatively, all the patients were evaluated with otoscopy, microscopy, pure-tone audiometry, and some patients with computed tomography scan. The pathological findings were confirmed with biopsy. The findings were tabulated and analysed. **Results:** Twenty-one (12.2%) patients were having dry central perforation with normal Eustachian tube function. Ninety-five patients, i.e., 55.23% were having granulations in attic, aditus, antrum. 25 (14.53%) cases were having ossicular erosion. 5 (2.9%) cases had tympanosclerosis in middle ear. 1 (0.58%) case had facial nerve dehiscence. 16 (9.3%) cases had oedema of middle ear mucosa/aural polyp from middle ear. Surprisingly 9 patients, i.e., 5.23% were having cholesteatoma which was confirmed by histopathological study. **Conclusion:** This study shows that cholesteatoma can be found in tubotympanic type of CSOM, along with other pathological findings. Hence it is on the part of the surgeon to be careful while planning surgery on their patients with CSOM (tubotympanic type), remembering that all safe CSOM might not always be safe.

**Key words:** Central perforation, Cholesteatoma, Chronic Suppurative Otitis Media, Mastoidectomy, Safe ear

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## INTRODUCTION

Chronic suppurative otitis media (CSOM) is the chronic inflammation of the middle ear cleft which is composed of Eustachian tube, hypotympanum, mesotympanum,

epitympanum, aditus and mastoid air cells which presents with recurrent ear discharge through tympanic membrane perforation.<sup>1</sup> Continuing mucosal infection of the middle ear by resistant organisms, continuing infection of the nasopharynx with secondary infection of the middle

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ear cleft and changes in the mucosa of the middle ear secondary to eustachian tube dysfunction may all contribute to the development of chronic otitis media.<sup>2</sup>

Clinically CSOM is of two types- tubotympanic type (safe) and atticofurrow type (unsafe) depending on the likelihood of developing complications, occasionally that can be life threatening.<sup>3</sup>

These complications are mainly due to the granulation tissue and cholesteatoma causing bone erosion and necrosis which may involve the vital structures such as facial nerve, inner ear, and intracranial components. These also erode the ossicles causing hearing loss. The tubotympanic types are mainly complicated with hearing loss which may be due to perforation in the tympanic membrane or ossicular chain erosion/fixation. Mechanism of ossicular erosion in non-cholesteatomatous middle ear disease is overproduction of cytokines—TNF alpha, interleukin-2, fibroblast growth factor, and platelet derived growth factor which promotes hypervascularization, osteoclast activation, and bone resorption causing ossicular damage.<sup>4</sup> In tubotympanic disease, marginal perforations are more sinister, because it sometimes is associated with cholesteatoma formation.<sup>5</sup>

Central perforations are considered safe as cholesteatoma is usually not associated with them. Central perforations may be anterior, posterior, inferior (in respect to handle of malleus), and subtotal. Again central perforation may be dry or active, giving history of intermittent profuse mucoid discharge. Rarely, the discharge is continuous and malodorous. Discharge is precipitated by passage of water through perforation and upper respiratory tract infection.<sup>6</sup>

The diseases usually found in active central perforations are granulation tissue and polyp formation. Ossicular chain fixation or erosion may be found in both active and dry central perforations.

In spite of tubotympanic type of CSOM considered safe and not associated with cholesteatoma, there have been reports of cholesteatoma being found in case of central perforations, although the prevalence is very low.

In a study done by Rout and colleagues, the prevalence of cholesteatoma in chronic suppurative otitis media with central perforation was found in 3.4% of the study sample.<sup>7</sup> In a study done by Sandeep and colleagues, intraoperative finding showed around 66% cases with granulation in attic, aditus and antrum. Surprisingly 2% cases had cholesteatoma sac and histopathological finding of the specimens taken showed cholesteatoma in 8% of cases.<sup>8</sup> Similarly, in a Japanese study, 28 of 2948 ears with central perforation of the Tympanic membrane had cholesteatoma.<sup>9</sup>

Hence considering the above facts, this study was undertaken to find out the intraoperative findings in cases of CSOM with central perforation (tubotympanic type) who underwent surgery at Biratnagar Eye Hospital in the Department of Otolaryngology.

## MATERIALS AND METHODS

This descriptive, cross sectional study has been conducted over a period of 2 years in the Department of Otolaryngology, Biratnagar Eye Hospital, Biratnagar, Nepal. Total patients studied during the period were 172.

### Inclusion criteria

1. Patient of CSOM with central perforation which may be active or dry.
2. Patient willing for surgery and giving consent for the study.
3. Patient willing to come for regular follow up and follow the medical advice.

### Exclusion criteria

1. Patient not willing and not giving consent for the study.
2. Patient of CSOM with other types of perforations except central type.
3. History of previous surgery.

The patients considered for the study were evaluated properly with detailed history taking, thorough clinical examination by otoscopy, examination under microscope, hearing assessment by pure-tone audiometry, x-rays of mastoid region, tests for Eustachian tubes function, and culture and sensitivity test whenever required. Eustachian tube function test was done by valsalva test, or simply by putting ear drops in the ear and asking for bitter tests in the throat. Computed tomography (CT) scan was done in some cases to exclude middle ear and mastoid pathology to assess the ossicular chain status and status of the facial canal and semicircular canals. Routine blood investigations were done.

Patients with dry central perforations of tympanic membrane for more than 6 months, with normal Eustachian tube function, were offered only tympanoplasty despite the status of mastoid air cell system on X-ray.

Rest of the patients underwent cortical mastoidectomy with tympanoplasty except in patients with extensive diseases of middle ear and mastoid, i.e., cholesteatoma and granulation. Since the complete eradication of the disease was not possible, we preferred modified radical mastoidectomy with or without tympanoplasty in those cases.

All the patients were evaluated under microscope during surgery and biopsy was done to confirm the pathological findings. The results were tabulated and expressed in number and percentage.

## RESULTS

Out of 172 patients we studied, 104 (60.47) were males and 68 (39.53) were females, as shown in Table 1. The mean age was 28.68 years. The minimum age was 14 and maximum age was 75 years.

Most of our patients were of younger age group with maximum in the range of 21-30 years i.e. 33.7%, as shown in Table 2.

One-hundred eleven (64.53%) cases had unilateral disease of ear with right ear affected in 72 (41.86%) cases & left ear affected in 39 (22.67%) cases, while 61 (35.47%) cases had bilateral diseased ear. The mean duration of disease in the ear was 8.61 years. 23.8% were smokers. 66.3% of the patients had history of bathing in pond with no precautions to restriction of water entry in ears, as shown in Table 3.

All those patients came with various symptoms and the chief complaint was as shown in the Table 4.

Eighteen (10.46%) cases had no complaint. However, 74 (43.02%) patients had history of recurrent mucopurulent discharge of ears. The second commonest chief complaint was earache in 32 (18.6%) cases. Other symptoms like decreased hearing (28 i.e. 16.27% cases), tinnitus (12 i.e. 6.97% cases) and transient vertigo (2 i.e. 1.16% cases) were also found. Interestingly, 6 (3.48%) patients complained of intermittent foul smelling discharge.

On otoscopic examination of the ears posted for surgery, 86 (50%) cases had large central perforation, 75 (43.6%) cases had subtotal and 11 (6.39%) cases had small perforation, as shown in Table 5.

On estimating the hearing loss, no hearing loss was found in 9 (5.23%) cases. Conductive hearing loss was found in 149 (86.63%) cases, while, mixed hearing loss was found in 14 (8.14%) cases, as shown in Table 6.

After preoperative evaluation, these cases underwent following procedures as shown in Table 7. Maximum number of cases had cortical mastoidectomy with tympanoplasty i.e. 104 (60.46%) cases. Only tympanoplasty was offered in 21 (12.2%) cases. However, 47 (27.32%) cases underwent modified radical mastoidectomy with tympanoplasty (outside in approach) due to extensive

**Table 1: Mean and range of age distribution**

Total number of cases	172
Mean age	28.68
Minimum age	14
Maximum age	75

**Table 2: Age distribution**

Age group in years	Male	Female	Percentage
<= 20	35	15	29
21-30	28	30	33.7
31-40	28	14	24.4
41-50	9	9	10.5
51-60	1	0	0.6
61-70	2	0	1.2
>70	1	0	0.6

**Table 3: Associated factors**

The mean duration of disease in the ear	8.61 years
Diseased contralateral Ear	61 (35.46%)
Smokers	41 (23.8%)
Bathing in ponds/no precautions to entry of water in diseased ears	114 (66.3%)

**Table 4: Chief complaint (n=172)**

Chief complaint	Number of patients	Percentage
No complaints	18	10.46
Decreased hearing	28	16.27
Discharging ears (continuous, intermittent)	74	43.02
Tinnitus	12	6.97
Ear pain	32	18.6
Intermittent foul smelling discharge	6	3.48
Transient vertigo	2	1.16

**Table 5: Type of perforation**

Type of perforation	Number	Percentage
Small	11	6.39
Large	86	50
Subtotal	75	43.6

**Table 6: Type of hearing loss**

Type of hearing loss	No hearing loss	Conductive	Mixed
Number	9	149	14
Percentage	5.23	86.63	8.14

**Table 7: Type of surgery done**

Type of surgery done	Number	Percentage
Only tympanoplasty	21	12.2
Cortical mastoidectomy with tympanoplasty	104	60.46
Modified radical mastoidectomy with tympanoplasty	47	27.32

disease of middle ear and mastoid. The aditus was patent in only 27 (17.88%) cases, while it was blocked in 124 (82.12%) cases, as shown in Table 8.

After proper evaluation using different methods of investigations combined with biopsy of the suspected lesions following predominant pathological findings were found, as shown in Table 9. Twenty-one(12.2%) patients were having dry central perforation with normal Eustachian tube function. Ninety-five patients, i.e., 55.23% were having granulations in attic, aditus, antrum. Twenty-five (14.53%) cases were having ossicular erosion.<sup>5</sup> (2.9%) cases had tympanosclerosis in middle ear. 1 (0.58%) case had facial nerve dehiscence. 16 (9.3%) cases had oedema of middle ear mucosa/aural polyp from middle ear. Surprisingly 9 patients, i.e., 5.23% were having cholesteatoma which was confirmed by histopathological study.

## DISCUSSION

Chronic suppurative otitis media is a disease of young adults and about 33.7% of the patients were between the ages of 21-30 years, which is comparable to the study done by group of workers in cases of tubotympanic type of CSOM.<sup>8,10</sup> The ratio of male to female patients was 1.53:1, showing male predominance; similar findings have been reported by several other authors.<sup>8,11-13</sup> One-hundred -eleven (64.53%) cases had unilateral disease of ear with right ear affected in 72 (41.86%) cases and left ear affected in 39 (22.67%) cases, while 61 (35.47%) cases had bilateral diseased ear. The mean duration of disease in the ear was 8.61 years. There was more laterality to right ear (41.86%) in our study, similar to a study done in India.<sup>8</sup>

Twenty-three point eight percent were smokers in our study. Sixty-six percent of the patients had history of bathing in

pond with no precautions to restriction of water entry in ears. Albu et al in 2012, in a study of 320 cases, found that three factors were significant in predicting success rate, that is, healthy opposite ear, a long dry period preceding the operation, and non-smoker status. The only factor attaining significance in the multivariate analysis was a dry period longer than 3 months.<sup>14</sup>

On otoscopic examination of the ears posted for surgery, 86 (50%) cases had large central perforation, 75 (43.6%) cases had subtotal and 11 (6.39%) cases had small perforation. In the study by Sandeep and colleagues large central and subtotal perforation were common, similar to our study.<sup>8</sup>

Among the pattern of hearing loss, this series showed that 86.63% patients had conductive type of hearing loss, 8.14% had mixed type. Conductive type of hearing loss was the most common type and this was consistent with other study.<sup>8,15</sup>

The goal of tympanic membrane repair in tubotympanic type of CSOM is to close the perforation, remove the disease and improve hearing of the patient. Tympanoplasty is an established procedure for tympanic membrane perforation repair. But, now the quest is on to improve the results further by studying the different influencing factors. Recently many studies have been undertaken to evaluate the role of cortical mastoidectomy to improve the results of tympanoplasty.<sup>16,17</sup> Mastoid factors include the extent of mastoid pneumatization and the presence of inflammatory disease in the mastoid. Holmquist and Bergstrom first suggested that mastoidectomy improves the chance of successful tympanoplasty for patients with noncholesteatomatous chronic otitis media. They maintained that creation of an aerated mastoid enhances success in patients with poor tubal function or a small mastoid air cell system.<sup>18</sup>

Thus, simple closure of a perforation in active mucosal chronic otitis media without surgical removal of infected mucosa and granulation tissue from the mastoid is fraught with failure to control the disease.<sup>19</sup> Mastoidectomy impacted the clinical course in patients by reducing the number of patients requiring future procedures and by decreasing disease progression.<sup>20</sup> Sheehy in 1985 recommended performing simple cortical mastoidectomy routinely for all tympanoplasties because it is “good practice” and because “it’s better to be safe than sorry.”<sup>21</sup>

Out of the predominant pathological findings preoperatively, 21(12.2%) patients were having dry central perforation with normal Eustachian tube function and all of them underwent only tympanoplasty. In the study by Rout and colleagues, 48.6% had above finding.<sup>7</sup>

**Table 8: Status of patency of aditus**

Status of patency of aditus	Number	Percentage
Patent	27	17.88
Blocked	124	82.12

**Table 9: Intraoperative findings**

Type of pathology (predominantly)	Number	Percentage
Dry central perforation with normal Eustachian tube function and no other pathology	21	12.2
Granulation in attic, aditus, antrum	95	55.23
Ossicular erosion	25	14.53
Tympanosclerosis in middle ear	5	2.9
Facial nerve dehiscence	1	0.58
Oedema of Middle ear mucosa/Aural polyp of middle ear	16	9.3
Cholesteatoma	9	5.23

Rest of the cases underwent mastoidectomy. One hundred twenty-four (82.12%) cases had blocked aditus that was cleared. Ninety-five patients, i.e., 55.23% were having granulations in attic, aditus, antrum. In the study by Sandeep and colleagues, 66% had granulation.<sup>8</sup> However, only, 20 cases (9.5%) in the study by Rout and colleagues had granulation.<sup>8</sup>

Twenty-five (14.53%) cases were having ossicular erosion, 5 (2.9%) cases had tympanosclerosis in middle ear and 1 (0.58%) case had facial nerve dehiscence in our study. Eleven (11%) cases had ossicular erosion, 6 (6%) cases had tympanosclerosis and 1 (1%) case had facial nerve dehiscence in study by Sandeep and colleagues.<sup>8</sup>

Sixteen (9.3%) cases had oedema of middle ear mucosa/aural polyp from middle ear. Thirteen (13%) cases in study by Sandeep and colleagues had edema of middle ear mucosa. However, only 11 (5.3%) cases in the study by Rout and colleagues.<sup>7</sup>

Surprisingly nine patients, i.e., 5.23% were having cholesteatoma which was confirmed by histopathological study. Cholesteatoma was reported in the order of 8% by Sandeep and colleagues, while, Rout and colleagues reported cholesteatoma in 3.4% cases.

In a series of 1024 cholesteatoma patients described by Charles D. Bluestone, Jerome O. Klein 2007, a cholesteatoma was found in 42% in the attic in 31% in posterior superior quadrant, in 18% when it was a total perforation, in 6% when there was a central perforation and in 3% when there was no perforation.<sup>22</sup> In a study of 1146 cases of cholesteatoma, it is described that the perforation site on the TM is rarely central; this occurred in 13.3% of the sample. Perforation was marginal and attic in 73.6% of cases. Sadé *et al* found marginal and attic perforation in 84.0% of their cases.<sup>23</sup>

Cholesteatoma is a sac containing central keratin debris surrounded by keratinized squamous epithelium in the fibrous tissue matrix and which has got bone eroding property. Cholesteatoma can be classified as congenital and acquired, and acquired can be primary and secondary. Secondary cholesteatoma is commonest and is found in case of CSOM with attic and marginal perforations. Cholesteatoma formation in CSOM with central perforation is very rare. Most common sites of origin of cholesteatoma are posterior epitympanum, posterior mesotympanum, and anterior epitympanum in the order.

Tos (1988) classified cholesteatoma otoscopically which was later on modified by Mills and Padgham (1991). According to them, cholesteatoma can be of four types, i.e., attic, pars tensa I (marginal), pars tensa II (central), and behind intact tympanic membrane.<sup>5</sup>

Although a central perforation of the tympanic membrane is the typical finding of chronic otitis media without cholesteatoma, a keratinizing squamous epithelium on the tympanic side of the tympanic membrane or in the tympanic cavity is occasionally found during surgery. This finding were observed in 28 of 2948 cases with central perforation of the tympanic membrane without any other pathology indicating the possibility of cholesteatoma such as a retraction, an adhesion, or a debris accumulation around the perforation margin or in the tympanic cavity. The characteristic finding in this disease is an irregular margin of the perforation with a whitish remnant tympanic membrane. This finding was observed in 82% of these cases. If discovered preoperatively, a careful observation of the tympanic side of the tympanic membrane is necessary during surgery.<sup>9</sup>

Sudhoff *et al* expressed their view in that most operations can be completed in one stage by removing the cholesteatoma and then reconstructing the ossicular chain at the same time. A two-stage procedure is indicated only in special situations. When the surgeon has doubts over removal of cholesteatoma completely or, in rare cases, when it is not possible to remove all the squamous epithelium from the oval window or between the crura of the stapes, a second-look operation is recommended 1 (in children) or 2 years later.<sup>24</sup>

Hence, in surgical treatment of CSOM, it might not be possible to eliminate cholesteatoma and infections by preserving normal anatomic structures and to regain hearing function in each and every patient. Although restoration of the hearing loss and the preservation of anatomy are important aspects, eradication of the disease should be the main principle in the surgical procedures.<sup>25,26</sup>

In our series, we also followed the same principle in restoring the anatomy by performing in maximum patients the cortical mastoidectomy and tympanoplasty. But in cases of extensive disease, we gave preference to eradication of the disease by doing modified radical mastoidectomy and tympanoplasty.

#### Limitation of the study

This study has not been able to depict the possible causative factors responsible for these type of pathological findings in cases of CSOM with central perforation.

#### Recommendation

A long term prospective study is recommended to find out the causative factors responsible for the underlying pathological changes in CSOM with central perforation that would guide the surgeon to plan the surgery accordingly beforehand. Also the long term results in terms of graft

uptake, hearing improvement and recurrence of disease must be explored.

## CONCLUSION

This study describes the different types of underlying pathological findings in cases of safe type of chronic suppurative otitis media. This study also shows that cholesteatoma can be found in tubotympanic type of CSOM. Hence it is on the part of surgeon to be careful while planning surgery on their patients with CSOM (tubotympanic type), remembering that all safe CSOM might not always be safe. It is advisable to open the mastoid antrum and to do complete eradication of disease whenever clinical features are suggestive of extensive disease of middle ear cleft. This ensures prevention of further complication and helps to provide a safe ear and better hearing.

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**SKT** - Concept and design of the study, reviewed the literature, manuscript preparation and critical revision of the manuscript; **NG** - Concept, literature search, statistical analysis and helped in preparing first draft of manuscript; **RA** - Conceptualized study, collected data and review of literature and interpreted, and critical revision of the manuscript; **SKS** - Concept of study, literature review and review of study; **AA** - Concept of study, statistical analysis, manuscript draft.

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