

## STUDY ON STATUS OF CONTRALATERAL EAR IN UNILATERAL CHRONIC OTITIS MEDIA

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### Abstract

**Background:** Chronic otitis media (COM) is a permanent abnormality of the pars tensa or flaccida, mostly as a result of sequelae caused by eustachian tube dysfunction. Inherently, the anatomical structures of both sides are similar, predisposing both ears to similar environment, and hence the question arises for the involvement of contralateral ear in unilateral COM. The objective of this study was to assess the status of contralateral ear in unilateral chronic otitis media clinically, audiological and radiologically. **Materials and Methods:** This was a prospective descriptive observational study carried out at department of Otolaryngology & Head and Neck Surgery at Rajendra Institute of Medical Sciences, Ranchi from May 2023 to April 2024 selecting 100 patients for the study fulfilling the inclusion criteria. Patients aged 10 to 70 years with unilateral COM were included. The contralateral TM was observed otoscopically. Audiological and radiological investigations were performed. **Result:** The study found that COM is more prevalent in younger populations, with a male-to-female ratio of 1:1. The majority of patients were aged 21-30, with COM more prevalent in lower socio-economic classes. The most common abnormality was tympanic membrane retractions found in 37% of cases. Contralateral impedance audiometry showed abnormalities, with Ad curve being the most common. Contralateral mastoids were found to be pneumatized in 48% of cases, followed by diploic and sclerotic in 18%. **Conclusion:** The contralateral ear was found to be abnormal in more than one third cases. Significant statistical association was found between tympanic membrane status and contralateral tympanometric findings as well as mastoid pneumatization.

## INTRODUCTION

Chronic otitis media (COM) results from past episodes of acute otitis media (AOM) or otitis media with effusion (OME) due to relative negative middle ear pressure and eustachian tube (ET) dysfunction causing a permanent defect of tympanic membrane (TM) involving either pars tensa or pars flaccida. COM can be classified as active or inactive for both mucosal and squamous diseases as well as healed otitis media. Granulation tissues, cholesteatoma formation or cholesterol granulomas are commonly encountered in histopathology of COM.<sup>[1]</sup> Characteristically, COM presents with otorrhoea or persistent ear discharge for over 2 to 6 weeks through the perforated tympanic membrane.<sup>[2]</sup>

In postoperative cholesteatomatous cases, Chao et al. found that ET dysfunction was a common finding suggesting its causative role in pathophysiology of COM.<sup>[3]</sup> ET dysfunction, a common coexisting

factor in COM leads to middle ear pressure disequilibrium causing its decreased aeration, impaired ventilation and drainage mechanisms resulting in the classic suppurative symptoms of COM.<sup>[4]</sup> This results in conductive hearing-loss, characteristically found in patients with COM and may lead to further morbidity, if left untreated.<sup>[5]</sup>

Study by Yoon et al. supports the continuum theory, according to which if otitis media with effusion (OME) fails to get resolved, it will lead to a number of sequels eventually and, in the worst case, chronic otitis media.<sup>[6]</sup> The tympanic membrane (TM) also undergoes changes, like minor retraction progresses to higher grades causing retraction pockets, and cholesteatoma. Although just few cases of OME progresses to COM, considering the prevalence of bilateral middle ear effusion to be high as reported by researchers like Casselbrant et al., the involvement of the contralateral ear is questionable.<sup>[7]</sup>

Inherently, structures of middle ear, eustachian tubes and nasopharynx of both sides are similar, predisposing both ears to similar environment. So, understanding the anatomy, genetics and cellular events are important for anticipation of potential bilateral involvement of ears.

The objective of this study was to assess the status of contralateral ear in unilateral chronic otitis media clinically, audiological and radiologically. The secondary objective was to study the demographic distribution.

## MATERIALS AND METHODS

This study was carried out at Rajendra Institute of Medical Sciences (RIMS) Ranchi in department of Otorhinolaryngology and Head and Neck Surgery. The institute-associated ethical clearance was obtained to conduct the study (Ref no.: 120 IEC RIMS dated 14/04/2023). This prospective observational study was conducted over the course of one year, from May 2023 to April 2024.

The study sample size consisted of 100 patients. Patients aged 10 to 70 years, clinically identified as having a unilateral chronic otitis media while the opposite ear being apparently normal were included for the study. The research excluded patients with established bilateral COM, having previous history of contralateral ear discharge or perforation and ear surgery. Patients with active hepatitis, HIV, tuberculosis infection or with any carcinoma and those not giving consent for the study were excluded.

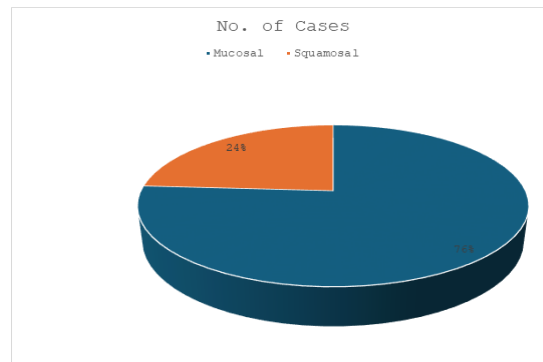
A thorough history and demographic data were obtained using a predesigned proforma. Otoscopic or otoendoscopic ear examination were performed on each patient. The retraction of TM was noted and graded as per Sades and Tos classification. The rest of the anatomical features was also thoroughly examined. Pure tone audiometry and tympanometry was performed for contralateral ear in all the patients. Hearing loss was classified according to the ASHA (American Speech-Language-Hearing Association) grading. Degree of hearing loss (dB HL) ranges are as follows: Normal (-10 to 15), Slight (16 to 25), Mild (26 to 40), Moderate (41 to 55), Moderately-severe (56 to 70), Severe (71 to 90) and Profound (>91) Radiography included x-ray mastoids schuller's view and high resolution computed tomography (HRCT) temporal bone wherever required. Contralateral mastoids were categorised as pneumatized, diploic and sclerotic respectively.

The acquired data was entered into a template created by Microsoft Excel 2010 (Microsoft Corporation, Redmond, USA). Using IBM SPSS Statistics for Windows, Version 20 (Released 2011; IBM Corp., Armonk, New York, United States), data analysis was carried out following data cleaning and coding. Quantitative data were expressed as mean and standard deviations, whereas qualitative data were expressed as frequency and percentages. Frequency tables were produced and descriptive statistics

examined. Statistical significance was defined as a P-value <0.05.

## RESULTS

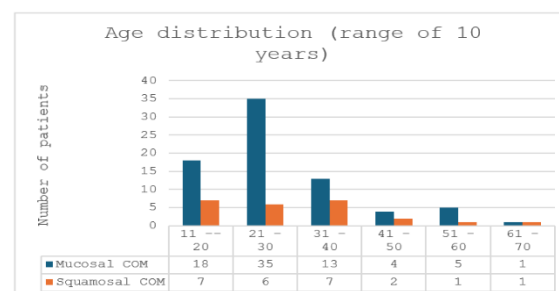
Out of 100 cases 76% were mucosal disease and 24% were squamosal disease.



**Figure 1: Pie chart showing distribution of mucosal and squamosal COM. (n=100)**

Male is to female ratio was found to be 1:1 for both mucosal and squamosal COM respectively.

Maximum patients of diseased ear were found to be in the age group of 21 to 30 years which was 41%.



**Figure 2: Comparative bar chart showing distribution of patients to different age groups for mucosal and squamosal COM. (n=100)**

In this study maximum patients belonged to upper lower class amounting to 44% followed by lower middle class which was 38% according to modified Kuppuswamy scale.

While contralateral tympanic membrane was within normal limits for 38% of cases, absence of cone of light was found in another 37% of contra lateral ears (CLEs).

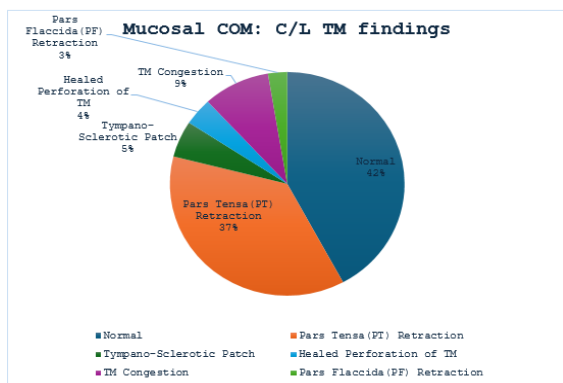


Figure 3: Pie chart showing contralateral TM status of mucosal COM. (n=100)

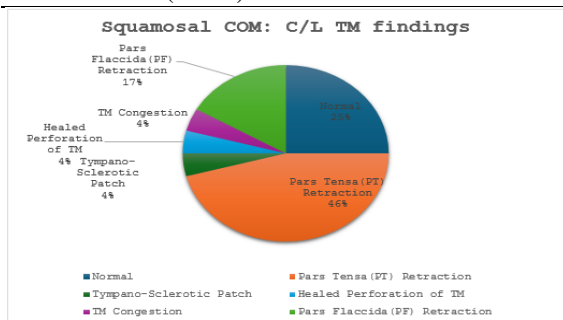


Figure 4: Pie chart showing contralateral TM status of squamosal diseases. (n=100)

While, 75% of the contralateral ears had hearing within normal thresholds, 15% showed mild hearing loss.

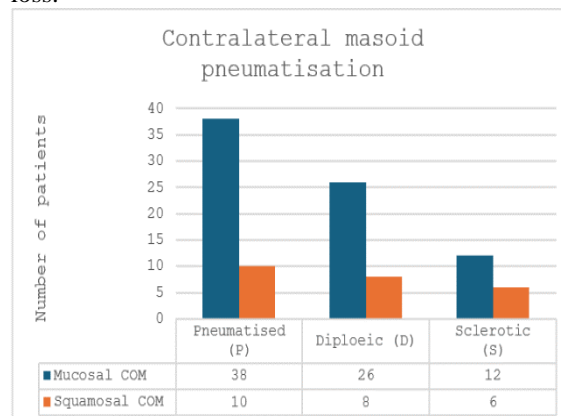


Figure 5: Comparative bar chart showing pneumatisation status of contralateral mastoid of mucosal and squamosal COM respectively. (n=100)

Table 1: Degree of hearing loss in contralateral ear (n=100).

CLE Hearing loss	Mucosal	Squamosal	Total/(%)
Normal	34 (44.8%)	11 (45.8%)	45
Minimal	21 (27.6%)	9 (37.5%)	30
Mild	12 (15.8%)	3 (12.5%)	15
Moderate	4 (5.3%)	1 (4.2%)	5
Moderately-Severe	2 (2.6%)	0	2
Severe	2 (2.6%)	0	2
Profound	1 (1.3%)	0	1
n=100/(%)	76	24	100

Most common type of hearing loss in the contralateral ear was conductive hearing loss followed by mixed hearing loss.

Table 2: Type of hearing loss in contralateral ear (n=100).

Type of hearing loss in CLE	Mucosal	Squamosal	Total/(%)
CHL	8 (10.5%)	3 (12.5%)	11
SNHL	9 (11.8%)	1 (4.2%)	10
MHL	4 (5.3%)	0	4
Normal	55 (72.4%)	20 (84.3%)	75
n=100/(%)	76	24	100

While 65% of contralateral ears showed A type of curve in tympanometry, Ad curve was the most common abnormality detected.

Table 3: Contralateral ear impedance (n=100)

Impedance (C/L)	Mucosal	Squamosal	Total/(%)
A	45 (16%)	20 (83.33%)	65
Ad	16 (21%)	0	16
As	6 (8%)	1 (4.17%)	7
C	2 (2.6%)	1 (4.17%)	3
Cd	1 (1.3%)	0	1
Cs	1 (1.3%)	1 (4.17%)	2
B	5 (6.5%)	1 (4.17%)	6
n=100/(%)	76	24	100

Contralateral mastoids were found to be pneumatized in 48% of cases followed by diploic mastoids in 34% cases on radiography.

## DISCUSSION

In our study of 100 unilateral COM, mucosal and squamous types were 76% and 24% respectively. These findings were similar to studies of Kutty et al,<sup>[8]</sup> (mucosal: 73.75%, squamous: 26.25%) in 2016 and Jambunathan et al,<sup>[9]</sup> (mucosal: 87%, squamous: 13%) in 2020 respectively. This makes clear that prevalence of mucosal COM is more than squamous disease. In this study, we found majority of patients (41%) belonged to age group 21 – 30 years, which is in accordance to the study done by Chandrashekarayya et al,<sup>[10]</sup> in which majority of the patients belonged from third and fourth decade. The mean age of our patients was 29.24 years for a range of patients ageing 13 to 69 years included in our study, which is similar to studies by Khan et al,<sup>[11]</sup> 2018 (28.47 years); da Costa et al,<sup>[12]</sup> 1999 (26.3 years); and Damghani et al,<sup>[13]</sup> 2013 (23.03 years). This makes evident that COM is more prevalent in younger age groups with mean age falling in third decade. In my study male to female ratio was 1:1 for both mucosal and squamous disease coincidentally, close to a study by Chavan et al,<sup>[14]</sup> the ratio being (1.1:1). Socio-economically according to modified kuppuswamy scale, most cases belonged to upper lower (44 %) followed by lower middle (38%) class together accounting for 82% cases, similar to findings of Chandrashekarayya et al,<sup>[10]</sup> who found 77.6% belonging to low and rural socioeconomic status. Chadha et al,<sup>[15]</sup> also found that lower socioeconomic class patients had higher prevalence of OME. 32 patients (32%) had normal tympanic membranes otoscopically and a total of 62(%) patients {mucosal: 44 patients (57.89%) and squamous:18 patients (75%)} were found to have some abnormalities in the contralateral TM, out of total 100 cases studied. Kutty et al,<sup>[8]</sup> also had similar findings with abnormal contralateral ears (mucosal-66.10% and squamous76.20%). Abnormalities in the contralateral ear were found to be 80% and 60% by Orji et al,<sup>[16]</sup> 2007 and Damghani et al,<sup>[13]</sup> 2012, in their respective studies. In our study, most common contralateral ear (CLE) abnormalities encountered were TM retractions- 45(%) cases out of which 39(%) had pars tensa (PT) and 6(%) had pars flaccida (PF) retractions. Vartiainen et al,<sup>[17]</sup> in 1996, described contralateral ears in a series of 493 patients undergoing ear surgery for chronic otitis media and found that 63% of the CLEs had some kind of abnormalities (perforations, severe retractions, or cholesteatoma), concluding TM retraction to be the most frequent finding. In our study, out of the total retractions of CLE's tympanic membranes, pars tensa retractions were (grade one: 82.22%, grade two: 2.22% and grade three: 2.22%) and pars flaccida were (grade one: 11.11%, and grade three: 2.22%) according to Sades

and Tos classification respectively. Luntz et al,<sup>[18]</sup> in 1997 found pars tensa retractions (grade one- 52.9%, grade two- 30.8%, grade four- 1.4) and pars flaccida retractions (grade one- 13.2% and grade two- 1.4%) in the CLEs. Nagle et al,<sup>[19]</sup> in 2009 also found pars tensa retractions as follows: (grade one- 35.2%, grade two- 8.9% and grade three- 11.8%). In our study, squamous COM (PT- 46%, PF- 17%) had a greater number of TM retractions as compared to mucosal COM (PT-37%, PF- 3%) in CLEs. Tympanosclerotic (TS) patches were found to be 5% in the contralateral TM overall (mucosal- 5% and squamous- 4%). Jambunathan P et al,<sup>[9]</sup> found the incidence of TS patches to be 9.4% in the CLEs. 75% patients had normal hearing thresholds in the contralateral ear in our study. Remaining 25% showed some degree of hearing loss audiologically (15% - mild; 5% - moderate) respectively. Of these 25% CLEs with hearing impairment; 44% had conductive type of hearing loss (CHL), 40% had sensory neural hearing loss (SNHL) and remaining 16% had mixed hearing loss (MHL). Ho Chung et al,<sup>[20]</sup> in 2014 noted 60% of Contralateral cholesteatomatous ears had normal hearing thresholds, while rest 40% had air-bone gap upto 44 dB. Niyatharuni R et al,<sup>[21]</sup> in a study of 75 patients in 2023, found 33.33% patients having hearing loss most common type being SNHL (26.66%), followed by MHL (5.33%) and CHL respectively. Damghani et al,<sup>[13]</sup> also found 48% of CLEs having hearing loss (CHL- 85%; SNHL- 12.5%; and MHL- 1.2%). Mucosal COM patients had more percentage of hearing losses in the contralateral ears – 26.63% as compared to squamous COM – 16.67%. Out of 100 cases, 65(%) cases had normal 'A' type of curve in tympanometry performed in the contralateral ear. Remaining 35(%) showed abnormal impedance in CLEs, out of which maximum 16(%) cases had 'Ad' curve all found in mucosal COM; 7% showed 'As' type curve and 6% showed 'B' type and 'C' type curve each respectively. Significant statistical association was found between tympanic membrane status and contralateral tympanometric findings (p value = 0.001) as well as mastoid pneumatization (p value = 0.04). Niyatharuni R et al,<sup>[21]</sup> found slightly more normal tympanometric curve: A type (82.66%) in CLEs. Abnormal types found by them were As curve (10.66%) followed by Ad (4%) in decreasing order. Pardhi et al,<sup>[22]</sup> in their study in 2019, found quite higher number of patients (58.75%) to show type B curve in tympanometry. In our present evaluation of 100 contralateral mastoids, 48(%) had normal pneumatization(P). Diploic(D) mastoids were found in 34 (%) whereas remaining 18 (%) had sclerotic(S) CLE mastoids. Roy et al,<sup>[23]</sup> 2015 found similar data in their study whose results were as follows: 42.6% - pneumatized(P); 31.4% - diploic(D) and 25.7% - sclerosed(S) in contralateral mastoids. Jambunathan P et al,<sup>[9]</sup> also had similar findings of the contralateral ears: 38.20%-

pneumatized(P); 40% diploic(D) and 22.8% sclerosed(S) in their study. Squamousal COM (24 patients) were found to have more abnormalities {42% (ten cases)- P, 33% (eight cases)D and 25% (six cases)- S} as compared to mucosal COM (76 patients) {50% (38 cases)- P, 34% (26cases)- D and 16% (12cases)- S} in contralateral mastoids. In contrast, Kutty et al,<sup>[8]</sup> found that patients with mucosal COM (42.4%- pneumatized, 37.3%- diploic, and 20.3%- sclerotic) had more abnormalities than squamousal COM, (47.6%- pneumatized, 38.1%- sclerotic, and 14.3%- diploic) in the contralateral mastoids. In a study by Gupta DK et al,<sup>[24]</sup> in 2022, contralateral ears of squamousal COM, predominantly showed pneumatic mastoids (64.3%), followed by diploic in (33.9%) and remaining 1.8% being sclerotic.

Diagnostic challenges in unilateral otitis media require sophisticated methods and bilateral examinations for contralateral ear evaluation. Long-term follow-up is crucial to determine long-term effects and prognostic indicators, which was not possible in this study. Understanding the innate course of the disease helps design measures to avoid problems and enhance ear well-being. Other challenges include participant variability, data collection limitations, and dynamic otitis media. These are the limitations of the study.

## CONCLUSION

More than one third of contralateral ears were found to be abnormal either audiological, radiologically or clinically. This suggests that the underlying pathology behind COM has a tendency to involve both ears over time although not simultaneous, as evident from other studies as well. So, the CLE might develop symptoms similar to diseased ear over time. Diseased ear might be the future of contralateral ear. Therefore, thorough evaluation of both the ears are necessary not only prognostically but also for early detection of disease in contralateral ear.

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