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International Journal of Recent Surgical and Medical Sciences

Original Article

A Cross-Sectional Study on the Status of Contralateral Ear in Cases with Otitis Media Attending a Tertiary Care Center

Raghavan V.K.[1], Prabakaran S.[1], Namasivaya Navin R.B.[1], Rajasekaran S.[1]

[1]Department of ENT, Chettinad Academy of Research and Education, Chettinad Hospital and Research Institute, Kelambakkam, Tamil Nadu, India.

***Corresponding author:**
Namasivaya Navin R. B., MBBS, MS, Department of ENT, Chettinad Academy of Research and Education, Chettinad Hospital and Research Institute, Kelambakkam, Tamil Nadu, India.

navin.rajasekar@gmail.com

EPub Ahead of Print:
17 January 2023

Published: 22 August 2023

DOI
10.1055/s-0042-1758521

ABSTRACT

Background: As the aeration and drainage entrances in both ears are the same, the factors that produce otitis media in one ear may also affect the other. Also, the unsolved debate is that long-standing otitis media turns into chronic otitis media (COM). Hence, this study was conducted with the objective of assessing the incidence of abnormal findings in the contralateral ear (CLE) and to find the association between the type of COM of diseased ear with the findings of CLE.

Materials and Methods: A hospital-based cross-sectional study was conducted among cases with unilateral COM who visited the outpatient department of otorhinolaryngology at Chettinad Hospital and Research Institute in Chennai between November 2021 and February 2022. The study comprised 200 COM cases in all. The medical history, otoscopic examination, pure-tone audiometry, and tympanometric findings of the patient were all documented. SPSS version 20 was used to conduct the analysis.

Results: About 80% of the individuals with COM in one ear exhibited some abnormalities in the CLE. The type of COM in the afflicted ear is not linked with the otoscopic findings, type of hearing loss, tympanometric findings, or overall abnormalities in the CLE. This study's findings are comparable to those of several others.

Conclusion: Though there is no association between type of COM and the pathological findings in the CLE, considering the huge burden of pathological findings noted in the CLE, all cases of unilateral COM should be screened for aberrant findings in the CLE.

Keywords: COM, Contralateral ear, Hearing loss, PTA

INTRODUCTION

Chronic otitis media (COM) is one of the oldest ear diseases, and it is unquestionably the most popular topic in modern otology.[1] Persistent inflammation of part or all of the mucoperiosteal lining of the middle ear cleft is known as COM. Tubotympanic (mucosal type) and attico-antral (squamous type) COM are the two categories.[2] Many variables contribute to the development of COM. Tonsils, adenoids, nasal and sinus disorders, crooked nasal septum, allergic rhinitis, low socioeconomic status, mastoid air cell size, genetic determination, and middle ear infection are all factors to consider.[2] One of the most important aspects of COM is its pathogenesis.[1] Because Eustachian tube dysfunction is the most common cause of COM, a person with COM is likely to have a condition in the contralateral ear (CLE).[3]

Acute otitis media, negative middle ear pressure, and otitis media with effusion (OME) are the most common causes of COM. Rupture of the ear drum and/or disruption of the ossicles

are linked to hearing loss.[4] A patient with COM-related unilateral discharge is likely to have a problem in the CLE as well.[5] Asymptomatic ear or, in cases of bilateral symptoms, the ear with clearly less symptoms based on hearing loss, otorrhea, and overall discomfort is described as CLE.[6] The fact that COM is rarely an isolated disease has become common knowledge. Because both ears share aeration and drainage entrance, the conditions that cause COM in one ear may also affect the CLE. Unresolved OME evolves into COM, according to the continuum hypothesis. The cause and progression of disease in the worse ear may be revealed by evaluating clinicopathological features. The damaged ear could be a sign of the CLE's impending pathological endpoint.[1,7] The research of the CLE may reveal information on the pathophysiology of full-blown ear disease, tubal function, and therapeutic planning.[6]

COM does not appear to be a one-time occurrence in a single patient. It appears to be the result of a set of experiences that are unique to each individual. Because the ear with confirmed COM can be a useful guide for the likely evaluation in the CLE, the exact and critical examination of both ears is crucial in the prognosis evaluation of the patient.[8]

The progression of COM pathology from simple abnormalities to severe changes, as in the following sequences: tympanic membrane (TM) retraction, middle ear effusion, or even perforation, or even formation of cholesteatoma, thus representing various pathological phases but of the same disease, and this transformation concept of the continuum theory could even be detected in the CLE.[9]

However, it was also stated that, if the pathological process of COM was developed based on this continuum hypothesis, the question of why only a small percentage of OME will progress to COM is raised, as well as another question of why, given the high prevalence of bilateral OME, there was not a similar high prevalence of COM.[10]

With these questions in mind, this study was conducted with the objective of assessing the incidence of abnormal findings in the CLE and to find the association between the type of COM of diseased ear with the findings of CLE.

MATERIALS AND METHODS

During the months of September 2021 to March 2022, a hospital-based cross-sectional study was done among cases with unilateral COM who visited the outpatient department of otorhinolaryngology at Chettinad Hospital and Research Institute in Chennai. The study did not include patients under the age of 10. According to a study conducted by Rosito *et al*.,[11] the incidence of anomalies in CLE among individuals with COM was 93%, and the sample size was determined as 200 with 99% confidence and 5% relative precision, therefore the same number of cases were included in the study. The Institutional Ethics Committee approved this study. Before starting the study, the subjects gave their written informed consent.

The patient's medical history was gathered, and the principal investigator evaluated them clinically. Following that, each case received an otoscopic examination, pure-tone audiometry (PTA), and tympanometric findings were recorded. When necessary, X-rays and computed tomography (CT) scans were performed. The primary aim was to determine the frequency of abnormal CLE findings, and the secondary outcome was to determine the relationship between the type of COM of the diseased ear and the CLE results. All of the information was entered into a pro forma.

Statistical analysis

The data from the MS Excel spreadsheet was transferred to SPSS version 20 for analysis. The chi-square test was used to determine the relationship between two variables. Statistical significance was defined as a *p*-value of less than 0.05.

RESULTS

In this study, majority (34%) of cases belongs to age group of 11 to 20 years followed by 21 to 30 years (24.5%), 31 to 40 years (22.5%), and more than 40 years (19%). Also, this study showed a female predominance (65.5%) compared with males (34.5%). However, in this study, 69 and 31% of diseased ears had mucosal and squamous type, respectively. Also in the CLE, otoscopy of 77.5% of cases had abnormal findings, hearing loss was noted in 62% of cases, and overall abnormalities in the CLE was noted in 80.5% of cases [Table 1].

On assessing the association between the type of COM in the diseased ear and overall abnormalities in the CLE, there was no significant association reported. Similarly, on comparing

Table 1: Type of COM in diseased ear and findings in CLE.

Variables	Frequency	Percentage
Type of COM in diseased ear		
Mucosal	138	69
Squamous	62	31
Otoscopic findings in CLE		
Abnormal	155	77.5
Normal	45	22.5
Hearing loss in CLE		
Present	124	62
Absent	76	38
Overall abnormalities in CLE		
Present	161	80.5
Absent	39	19.5

Abbreviations: CLE, contralateral ear; COM, chronic otitis media.

Table 2: Association between type of COM and findings in CLE.

Type of COM	Overall abnormalities in CLE (*N* = 200)			*p*-Value
	Present	Absent	Total	
Mucosal	107 (53.5)	31 (15.5)	138 (69)	0.1144
Squamous	54 (27)	08 (4)	62 (31)	
Type of CSOM	**Otoscopic findings in CLE (*N* = 155)**			***p*-Value**
	Retracted TM	**Tympanosclerotic patches**	**Effusion**	
Mucosal	39 (25.2)	43 (27.7)	23 (14.8)	0.6610
Squamous	22 (14.2)	17 (11)	11 (7.1)	
Type of CSOM	**Type of hearing loss in CLE (*N* = 124)**			***p*-Value**
	Conductive HL	**Sensorineural HL**	**Mixed HL**	
Mucosal	43 (34.7)	16 (12.9)	20 (16.1)	0.7051
Squamous	22 (17.7)	12 (9.7)	11 (8.9)	
Type of CSOM	**Tympanometric findings in CLE (*N* = 200)**			***p*-Value**
	Type A	**Type B**	**Type C**	
Mucosal	39 (19.5)	75 (37.5)	24 (12)	0.8607
Squamous	19 (9.5)	34 (17)	09 (4.5)	

Abbreviations: CLE, contralateral ear; COM, chronic otitis media; CSOM, chronic suppurative otitis media; HL, hearing loss; TM, tympanic membrane.

Table 3: Association between PTA of CLE and type of COM in diseased ear.

Pure-tone audiometry in CLE	Type of COM in diseased ear			*p*-value
	Mucosal type	Squamous type	Total	
< 25 dB	59 (29.5)	17 (8.5)	76 (38)	0.1143
26–40 dB	68 (34)	38 (19)	106 (53)	
41–55 dB	11 (5.5)	07 (3.5)	18 (9)	
56–70 dB	00	00	00	

Abbreviations: CLE, contralateral ear; COM, chronic otitis media; PTA, pure-tone audiometry.

with the type of COM and otoscopic findings, type of hearing loss, and tympanometric findings, there were no significant associations reported [Table 2].

On assessing the association between PTA in the CLE and the type of COM in the diseased ear, there was no significant association reported [Table 3].

DISCUSSION

In this study, it is clear that among the cases with COM in one ear, approximately 80% of the cases had some abnormalities in the CLE. However, the otoscopic findings, type of hearing loss, tympanometric findings, and overall abnormalities in the CLE is not associated with the type of COM in the diseased ear. The findings of this are comparable with several studies. Khan[12] did a study and found that 90% of the cases of COM were tubotympanic type and only 10% were attico-antral type. Retraction of the TM, tympanosclerosis, and thin membrane were all CLE findings in tubotympanic disease (TTD) type COM. Retraction of the TM and granulation tissue were found on the attico-antral disease type of COM CLE. In the CLE, the patient experienced conductive hearing loss. The CLE had radiological indications of illness as well. They noted that COM should not be thought of as an illness that only affects one ear because it can affect both ears in many cases.

According to a study conducted by Scheibe *et al.*,[13] 59.2% of all cases had COM with cholesteatoma and 40.8% had COM without cholesteatoma. The CLE was found to be abnormal in 46.3% of patients. In the group of patients with cholesteatoma, 57% had an abnormal CLE, while in the other group, 39% had an abnormal CLE. Retraction of the eardrum was the most common defect seen in both groups. They found that those with COM are more likely to have bilateral illness, which supports the theory that COM is a constitutional condition that affects both ears. Also, Jadia *et al.*[5] stated that 72.9% of cases in their study had unilateral COM with a mean age of 24.3 years, with 51.4% of females and 48.6% of males. Mucosal disease was found in 68.2% of cases with unilateral COM, squamous disease in 31.8%, and aberrant findings in 30.9% of total CLE. The pre- and postoperative data were compared, and there was a statistically significant difference in pre- and postoperative PTA as well. They may also reveal a substantial improvement in the CLE following surgery for a damaged ear. According to Bhandari *et al*'s[14] study, postoperative cases of

mucosal diseases with abnormalities in the CLE decreased to 30.3%, while normal cases climbed to 69.7%. In postoperative squamous disease, the proportion of cases with abnormalities in the CLE decreased to 64.7%, while the proportion of normal cases climbed to 35.3%. In addition, 28% of cases had poor hearing in the CLE, while 72% of cases had normal hearing.

In a study, Selaimen da Costa *et al*.[1] observed that the CLE was found to have structural abnormalities in 75.2% of the cases; 60.4% of the individuals presented with COM without cholesteatoma, and in this group, 69.9% had an abnormal CLE. The CLE was reported to be abnormal in 83.3% of patients with cholesteatoma. Retraction of the TM was the most common finding in both groups. They came to the conclusion that those who have COM in one ear are more likely to have illness in the other ear. In another study, the incidence of CLEs with changes was 92.8%, according to Rosito *et al*.[11] Granulation tissue (81%), effusion (58%), and TM retractions were the most common changes (35%). The degree of granulation tissue in the more injured ear and the CLE had a direct and relatively strong connection. The amount of cholesteatoma in the more injured ear and the CLE showed a substantial connection. They discovered that alterations in the CLE were common. The extent of both granulation tissue and cholesteatoma between both the ears had a clear association, suggesting that the more widespread the expression of these pathologies in the more injured ear, the larger the CLE.

According to Silva *et al*.,[9] the study included 50.6% males with an average age of 36 years. We discovered that COM was linked to 54.7% of alterations in the CLE. The predominance of radiographic abnormalities in the CLEs of COM patients supports clinical, histological, and functional findings developed by the same group, indicating that this condition is bilateral. In their study, Pardhi *et al*.[15] found that otoscopic findings revealed anomalies in CLE in 76.36% of mucosal patients and 88% of squamosal cases. In CLE, 75% of cases suffered hearing loss, according to PTA. In CLE, 46.25% of people have conductive hearing loss, 11.3% have sensorineural hearing loss, and 17.5% have mixed hearing loss. Hearing impairment was seen in 76% of squamosal COM cases compared with 74.54% of mucosal COM cases. In tympanometry findings, type B curves were seen in 58.75% of patients. Sclerotic mastoid air cells were found in 32% of squamosal and 9.09% of mucosal CLE cases. They found that in around 80% of patients with unilateral COM, CLE findings are abnormal. Squamosal unilateral COM had a higher risk of CLE anomalies.

Perforation (30.6%) was the most often found pathology in the CLE, according to Bayir *et al*'s[10] investigation. The number of surgeries, presence of ossicular damage, facial canal dehiscence, lateral semicircular defect, and dural defect and CLE condition had no statistically significant relationship. Preoperative diagnosis, kind of surgery, middle ear mucosal state, presence of cholesteatoma, postoperative condition, and CLE condition all had a significant relationship. In another study, only 37% of cases exhibited normal findings in the CLE, according to Vartiainen *et al*.,[8] with pars tensa atrophy and tympanosclerosis being the most common aberrant findings, followed by pars tensa and attic retractions. The CLE had also been operated on in 18% of patients. The hearing function of cases with cholesteatoma was worse than that of other cases with COM, with only 64% of cases having normal hearing levels and 21% having hearing levels > 30 dB. Even the superior hearing ear had a hearing level of > 60 dB in 3% of cases, including one patient who was completely deaf in both ears.

According to Damghani and Barazin,[3] 60% of cases had CLE problems, as determined by otoscopy, PTA, tympanometry, and graphical analysis. According to otoscopy research, 54% of cases had a CLE condition, with perforation of the ear drum being the most prevalent. CLE issues were found in 48% of PTA participants. Note that 73.2% of conductive hearing loss patients experienced difficulty at all frequencies, while half of sensorineural hearing impairment cases had problems at frequencies greater than 1,000 Hz. Tympanometry revealed that 38% of cases had an issue in the opposite ear. CLE abnormalities were found in 31.5 and 36% of high-resolution CT (HRCT) and Schuller graphical studies, respectively. Also, the frequency of otoscopic CLEs structural anomalies was 47.9%, according to Dawood.[16] The most common otoscopic structural abnormalities of CLEs were TM retraction in the squamous type and thinning TM in the mucosal type; also, radiological and audiological abnormalities of the CLEs were more common in the squamous type of chronic suppurative otitis media than in the mucosal type.

Kayhan *et al*.[17] investigated CLEs in COM patients. They discovered that in the group with cholesteatoma-COM, stage 1–2 and stage 3–4 pars tensa retraction, stage 1–2 and stage 3–4 pars flaccida retraction, and the presence of cholesteatoma were statistically significantly high. In the group lacking cholesteatoma-COM, however, perforation of the CLE ear was statistically significantly higher. Soft tissue in the tympanic cavity, soft tissue in the mastoid cavity, ossicular chain defect, and scutum erosion were found to be statistically significantly higher in the group with cholesteatoma-COM when CT data were compared. Poor mastoid pneumatization did not differ between the groups, while normal CLE results were significantly higher in the cholesteatoma-COM group. In their study, Thampi *et al*.[18] observed that 70% of cases had

variations in the CLE after accounting for all changes such as TM, X-ray mastoid, hearing assessment, and tympanometry.

According to Hooda *et al*.,[19] the most common aberrant finding in the CLE on otoscopy in both unilateral mucosal and squamosal COM patients is grade 1 pars tensa retraction. Note that 71.4% of squamosal COM cases had aberrant TMs on otoscopy of the CLE. Hearing loss was observed in 25.7% of mucosal COM patients and 22.9% of squamosal COM patients. On HRCT temporal bone, 17.1% of mucosal COM cases and 20% of squamosal COM cases have mastoid sclerosis of the CLE. The majority of patients of unilateral COM have pathophysiology of COM in the CLE. These findings in the CLE are more common in squamosal COM cases than in mucosal COM cases.

CONCLUSION

We conclude that almost 80% of the subjects with COM in one ear also exhibited abnormalities in the CLE. The kind of COM in the afflicted ear is not linked with the otoscopic findings, type of hearing loss, tympanometric findings, or overall abnormalities in the CLE. Hence, it is important to screen all the cases with unilateral COM for the abnormal findings in the CLE.

Conflict of interest

None declared.

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How to cite this article: Raghavan VK, Prabakaran S, Namasivaya RB, Rajasekaran S. A cross-sectional study on the status of contralateral ear in cases with otitis media attending a tertiary care center. Int J Recent Sur Med Sci 2023;9:*S68-S72*.