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Fate of asymptomatic contralateral ear at the time of presentation among patients presenting with the unilateral squamosal disease: A clinicoradiological study

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Abstract

Background: In cases of chronic otitis media (COM) presenting with unilateral squamosal disease, there may be the possibility of a potential disease in the opposite ear, which may lead to future complications. Therefore, it needs to be known whether there is any silent pathological process in the contralateral ear (CLE) that is currently asymptomatic but likely to be diseased in the near future. Therefore, this study was undertaken to analyze the fate of the contralateral asymptomatic ear in patients with unilateral squamosal disease.

Results: A total of 32 patients with COM squamosal disease were included. All the patients were subjected to clinical examination and a high-resolution computed tomography (CT) scan of bilateral temporal bones. The mean duration of age at presentation was 20.4 years. The male-to-female ratio was 1.28. Out of 32 patients, 11 (34%) showed either clinical or radiological findings in the asymptomatic CLE, out of which 7 showed both abnormal clinical and radiological findings, 3 demonstrated only abnormal clinical findings, and 1 showed only abnormal CT changes without obvious clinical findings in the CLE. In the CLE, 7 (21%) patients had mild conductive hearing loss. There was no statistically significant association of clinical findings or radiological findings in CLE to that of the unilateral squamosal diseased ear.

Conclusion: In cases with unilateral squamosal disease, an asymptomatic CLE can undergo subclinical changes and conductive hearing loss. Patients can also have silent radiological changes in the CLE detected on the CT scan, which are significant but remain undetected. No statistical significance could be reported in this study, yet other studies with even larger samples are required to show a causal relation between unilateral squamosal disease and a quiescent process in the asymptomatic CLE.

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Highlights

What is current knowledge?

In the unilateral squamosal type of chronic suppurative otitis media, the diseased ear shows signs of ossicular destruction and chances of complications.

What is new here?

In unilateral squamosal disease the asymptomatic contralateral ear may also show subclinical and radiological changes.

Introduction

Chronic otitis media (COM) is the chronic inflammation of the mucosa of the middle ear cleft, which is characterized by chronic, intermittent, or persistent discharge through a permanent tympanic membrane perforation. It may lead to granulation tissue formation, irreversible mucosal changes, ossicular necrosis, tympanosclerosis, fibrosis, and cholesteatoma formation. In addition, it may cause impairment in hearing, which may affect the quality of life of the patient (1).

Chronic otitis media squamosal disease poses a significant health problem due to its prevalence and in relation to economics. The sequelae of the disease present with problems that are difficult to manage. Cholesteatoma is an inflammatory disease of the temporal bone that progresses over time and causes destructive changes. Clinical presentations may vary from early asymptomatic to subsequent life-threatening complications (2, 3). Complications of COM can be further subdivided based on the extent of infection. The infection spreads from the middle ear and mastoid to adjacent sites, causing complications. This spread can be intratemporal or extratemporal or may even extend to intracranial structures. Intracranial complications are treated as emergencies as they are life-threatening (4). Besides managing the sequelae and complications of COM, due attention must be paid to hearing loss management.

With the advent of high-resolution computed tomography (HRCT) of the temporal bone, the extent of the disease can be studied in detail. The extent and type of the disease, sequelae, and complications of cholesteatoma (e.g., the opacification of the middle ear cavity, homogenous soft tissue mass with bone erosion, and erosion of the scutum, ossicles, etc.) and the formation of a cavity in the mastoid, can be seen on imaging (5-7). Many studies have been conducted in which the squamosal diseased ear was studied in detail, and the clinical findings were correlated with computed tomography (CT) scan findings. These studies mainly focused on the diseased ear. They concluded that CT scans will not only give an idea about the extent of the disease, pneumatization, and damage due to the disease but also show any complications arising from the disease. This will further help the clinician to plan the treatment and reduce the complications during surgery (8-10).

Disease in one ear, especially the squamous type, needs a close follow-up of the other ear. Unilateral COM should not be considered an isolated entity but a quiescent process in the contralateral ear (CLE), too. In the CLE, there may be a likelihood of hearing loss, cholesteatoma, and bony erosion of ossicles with or without tympanic membrane perforation (11, 12). However, very few studies have focused on the asymptomatic CLE in patients with unilateral presentation. If one ear has squamosal disease, there may be the possibility of a potential disease in the opposite ear, which may lead to future complications. Therefore, it needs to be known whether there is any silent pathological process in the CLE, which is currently asymptomatic but likely to be diseased in the near future (13, 14). Thus, this study was undertaken to analyze the fate of the contralateral asymptomatic ear in patients with unilateral squamosal disease. The goal was to assess clinical and radiological findings in the contralateral asymptomatic ear in cases of unilateral squamosal ear disease and to compare the clinical and radiological findings of the CLE with the diseased ear.

Methods

This prospective observational study was conducted from September 2020 to June 2022 at a tertiary care teaching center in Hospital. This study included all the cases presented to the Otorhinolaryngology Department who were older than 5 years of age and presented with unilateral squamosal disease with asymptomatic CLE. Patients with congenital cholesteatoma or intracranial complications and those with a history of ear surgery were excluded.

The patients provided written informed consent. Then, a detailed history and clinical examination, including otoscopy, microscopic examination, and tuning fork tests, were performed. All the cases had undergone routine preoperative pathological investigations, audiological assessment, and HRCT of the temporal bone. The clinical and radiological details of both the diseased and CLE were assessed separately and compared with each other by tabulating the data in

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Microsoft Excel and analyzed by Fisher's exact test in the Statistical Package for Social Sciences (SPSS Statistics 2019 v26) software (IBM Corp., Armonk, NY, USA).

Results

A total of 32 patients with COM squamosal disease were enrolled based on the inclusion and exclusion criteria. Most of the patients were 11 to 15 years old (28.12%), and the fewest number of patients were 5 to 10 years old (6.25%). The mean age of presentation was 20.4 years. Clinically and radiologically, it was found that 2 pediatric patients and 9 adult patients had a disease in CLE. There was no statistically significant difference between the ages of presentation of the diseased ear with CLE. There were 18 male (56.25%) and 14 female patients (43.75%). The male-to-female ratio was 1.28:1. Among the 18 men with unilateral squamosal ear disease, 7 had a disease in CLE, whereas among the 14 women, 4 had a disease in CLE. There was no statistically significant difference for sex and the unilateral squamosal diseased ear with CLE.

The right ear was involved in 43.75%, and the left ear in 56.25% of the patients. Among the 14 patients with right ear unilateral disease, 7 had a disease in CLE, whereas among the 18 patients with left ear unilateral disease, 4 had a disease in CLE. The association of right and left diseased ears with CLE was not statistically significant. The most common complaint in this study was otorrhea, seen in all 32 patients (100%), followed by diminished hearing in 25 patients (78.12%). The maximum duration of otorrhea was observed in the range of 5-10 years (40.62%). The mean duration of discharge was 8.9 years. The discharge was mostly scanty (78.12%), purulent (62.5%), bloodstained (53.25%), and foul-smelling (84.37%).

Four patients had a disease in CLE with a duration of discharge of less than or equal to 5 years. However, 7 patients had a disease in CLE who had discharge in the diseased ear more than 5 years. The association of the duration of discharge of the unilateral squamosal diseased ear with CLE was statistically nonsignificant (P=0.40; Table 1).

Table 1. Association of the duration of discharge of the unilateral diseased ear with contralateral ear (CLE)

	Disease in CLE	No disease in CLE	Fisher's exact test
Duration of discharge <5 y	4	4	P=0.40
Duration of discharge >5 y	7	17	

All the patients with the unilateral diseased ear had a negative Rinne test for 256 and 512 Hz. Among them, 11 patients had a negative Rinne test for 1024 Hz. Weber was lateralized to 30 patients with a unilateral diseased ear and centralized to 2 patients. In CLE, 14 patients had a negative Rinne test for 256 Hz, 4 patients had a negative Rinne test for 512 Hz, and the remaining 18 patients had a positive Rinne test. In the Pure Tone Audiometry (PTA) examination, it was observed that among the unilateral diseased ear patients, 3 patients had normal hearing, 17 had mild conductive hearing loss, 8 had moderate conductive hearing loss, and 4 had moderately severe conductive hearing loss. In CLE, 25 patients had normal hearing, and 7 patients had mild conductive hearing loss. There was no association between the hearing loss of unilateral squamosal disease and hearing status in CLE (P=1.0; Table 2).

Table 2. Association of hearing loss in the diseased ear with the hearing status in the contralateral ear (CLE)

	Hearing loss in CLE	No hearing loss in CLE	Fisher's exact test
Normal hearing in the diseased ear	0	3	P = 1
Hearing loss in the diseased ear	7	22	

In the diseased ear itself, out of 32 patients, 3 patients had tympanic membrane (TM) perforation, 15 patients had pars tensa retraction, 1 patient had pars flaccida retraction, 5 patients had both pars tensa and flaccida retraction, and the remaining 8 patients had both retractions and perforations in the diseased ear. Nevertheless, in CLE, 22 patients had normal TM, and 10 patients showed pars tensa retraction.

The HRCT temporal bone findings of the 32 patients with unilateral squamosal diseased ear (Figure 1) showed 27 cases with ossicular destruction and 29 with scutum erosion, while all 32 cases demonstrated soft tissue opacification in the tympanic cavity and mastoid cavity and poor mastoid pneumatization. In the CLE, out of 11 patients, 8 patients showed HRCT changes. Among those 8 patients, 5 patients had soft tissue opacification in the mastoid and tympanic cavity, and 3 patients had ossicular destruction. Moreover, 4 out of 8 patients showed scutum erosion, while 8 patients had CT findings of poor pneumatization of mastoid air cells (Figure 2).

There were 21 patients out of 32 patients of CLE who had normal clinical and radiological findings. Among the 11 patients who showed abnormal clinical and/or radiological findings, 7 had both abnormal clinical and radiological findings, 3 had abnormal clinical findings, but no CT scan changes were seen, and 1 patient had normal clinical findings but showed abnormal CT changes in the CLE.

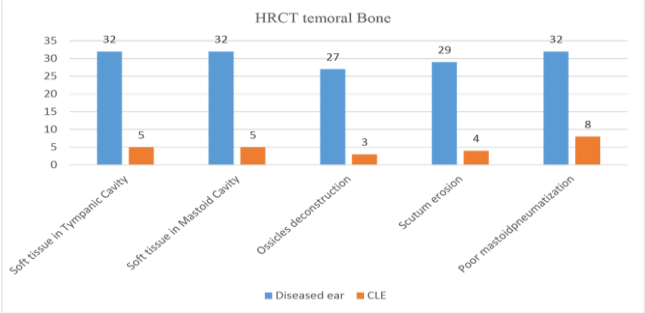

Figure 1. Findings of high-resolution computed tomography (HRCT) of the temporal bone in the diseased and contralateral ear

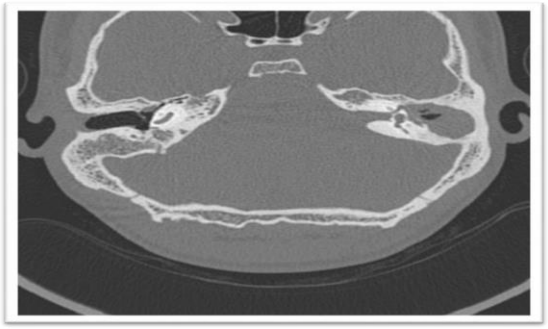

Figure 2. Axial section showing poor mastoid pneumatization in the contralateral ear

Discussion

Cholesteatoma causes aggressive destruction of the middle ear and mastoid and can cause serious complications. Even when symptoms are apparently mild, the clinician should have a high index of suspicion. In the early detection of cholesteatoma, wherein there is limited tissue destruction, less invasive surgical methods can be used with better hearing preservation. Moreover, life-threatening complications can be avoided. Cholesteatoma diagnosis is made clinically based on otoscopic examination. In cases in which the diagnosis is not clearly obvious, HRCT may be needed to confirm the presence of cholesteatoma. Temporal HRCT may demonstrate a soft tissue mass with characteristic ossicular destruction and bone erosion. The HRCT produces an accurate picture of both the anatomy and the disease of the middle ear and mastoid air cells (15).

The condition of CLE in patients with unilateral cholesteatoma is a subject that needs to be explored. The chances of CLE following the same fate of the unilateral diseased ear have to be researched thoroughly. As such, this study was undertaken to assess the clinical and radiological findings in the case of asymptomatic CLE in the unilateral squamosal disease ear. A total of 32 patients with unilateral COM squamosal disease were selected, and their clinical profile, audiological examination, and HRCT findings were studied. The purpose was to compare the clinical and radiological findings of the asymptomatic CLE with the diseased ear.

The study showed that there was a 34.38% involvement of CLE based on clinical and radiological findings, and the remaining 65.62% had a healthy normal ear. A similar study by Khalil et al. showed that only 28% of the CLE were apparently healthy (16). In a study conducted by Jothiramalingam SB. et al., the most common age group presenting with the COM squamosal disease was 16-25 years, which is similar to our study showing that the second decade is the most common age group involved (17). A study by Thampi et al. showed that the mean duration of symptoms was 4.27 years, whereas in our study, the mean duration of manifested symptoms was 20.4 years (18). Clinically and radiologically, it was found that 2 patients in the pediatric age group had a disease in CLE, and 9 patients in the adult age group had a disease in CLE. The association of the age and the unilateral squamosal diseased ear with CLE showed no statistical significance. In this observational study, there were 18 men and 14 women, and the male-to-female ratio was 1.28:1. In a review article by Pardhi et al., more men were involved as compared to women, which is similar to our study (19). Among the 18 male patients with unilateral squamosal ear disease, 7 had a disease in CLE, whereas in the 14 females, 4 had a disease in CLE. The

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association of sex and the unilateral squamosal diseased ear with CLE showed no statistical significance.

In our study, the majority of the patients (56.25%) had involvement in the left ear, whereas a study by Thampi et al. showed more right ear involvement (18). Among the 14 patients with right ear unilateral disease, 7 had a disease in CLE, while among 18 patients with left ear unilateral disease, 4 had a disease in CLE. The association between the variable of ear involvement and unilateral squamosal disease with CLE showed no statistical significance. The most commonly presenting symptom in this study was otorrhea, seen in all 32 patients (100%), followed by complaints of diminished hearing in 25 patients (78.12%); this result was in accordance with a retrospective study conducted in Brazil by de Aquino et al. on 1146 cases of cholesteatoma, which showed the most common presentation was otorrhea (66.5%), followed by hearing loss (23.3%) (20). The nature of the otorrhea is helpful in describing the specific type of COM. Profuse and intermittent mucoid discharge is commonly seen in chronic suppurative otitis media without cholesteatoma. Malodorous otorrhea is rare in this setting.

Conversely, patients with COM squamosal disease often describe scanty but persistent, purulent, and foul-smelling otorrhea (20). When an infected cholesteatoma is present or there is bone destruction, the purulent discharge tends to be thick, scanty, and sometimes foul-smelling (21). Our study showed that the discharge was mostly scanty (78.12%), purulent (62.5%), bloodstained (53.25%), and foul-smelling (84.37%). None of the symptoms showed the aggression of the disease in the ear and could represent the presence of a disease in CLE. As shown in Table 1, it was found that 4 patients had a disease in CLE with a duration of discharge of less than or equal to 5 years. Nevertheless, 7 patients had a disease in CLE who had discharge in the diseased ear for more than 5 years. The association of the duration of discharge of the unilateral squamosal diseased ear with CLE was statistically not significant (P=0.40).

All the patients had a negative Rinne test in the unilateral diseased ear, while in CLE, it was negative in 14 patients. The Weber test was lateralized to the unilateral diseased ear in 30 patients and centralized in 2 patients. In the PTA examination, among the unilateral diseased ear cases, 3 (9.37%) patients had normal hearing, 17(53.13%) had mild conductive hearing loss, 8(25%) had moderate conductive hearing loss, and 4 (12.5%) had moderately severe conductive hearing loss. A study by Chung et al. showed moderate or moderate to severe hearing loss in 56% of the patients. In CLE, 25 (78.13%) patients had normal hearing, and 7 (21.87%) patients had mild conductive hearing loss. Nevertheless, a study by Chung et al. showed normal hearing in 66% of the CLE (22). As shown in Table 2, there was no statistically significant association between the hearing loss of the unilateral diseased ear with the CLE.

In our study, in the diseased ear itself, out of 32 patients, 3 patients had TM perforation, 15 patients had pars tensa retraction, 1 patient had pars flaccida retraction, 5 patients had both pars tensa and flaccida retraction, and the remaining 8 patients had both retractions and perforations in the diseased ear. Deguine (1990) conducted a study on the CLE in patients with unilateral cholesteatoma. The cited study reported that the ear drum was normal in only about 1/3 of the cases (23). However, in our study, it was normal in almost 2/3 of the cases, i.e., In CLE, 22 patients had normal tympanic membrane, and 10 patients had pars tensa retraction. A study by Chung et al. showed a 28% change in the tympanic membrane integrity of CLE, which was almost similar to our study, i.e., 31.25%. In our study, the most common presentation of changes in the integrity of the TM was pars tensa retraction, which was similar to the study by Chung et al., where Grade 1 retraction in pars tensa was the common finding in CLE (22).

The HRCT provides a precise definition of the anatomic extent of the disease of the middle ear and the relationship between cholesteatoma masses and the contiguous structures. Comparison with the normal side is useful in doubtful cases. The distinctive features of cholesteatoma are the presence of soft tissue density in the middle ear cavity, ossicular erosions, erosion of the mucosa, borders of the middle ear cavity, and adjacent structures. These changes, when associated with bony expansion of the middle ear cavity, are highly suggestive of cholesteatoma. However, these changes are not specific; ectopic meningioma may simulate this finding and cannot be differentiated from cholesteatoma (21-24). Key HRCT features noted in the COM squamosal disease are soft tissue opacification in the attic and aditus that can reach mastoid air cells, blunting/erosion of the scutum, ossicular erosions, and complications. The classical features of cholesteatoma are present in only about 50% of the cases (25). In this study, among 32 patients with unilateral squamosal diseased ears, 27 showed ossicular destruction, 29 demonstrated scutum erosion, and 32 had soft tissue opacification in the tympanic cavity and mastoid cavity, as well as poor mastoid pneumatization.

In a study of 50 cases of squamosal COM by Sharma V.K. et al., the HRCT temporal bone revealed ossicular erosion in 90% and scutum erosion in 84% as the most common bony erosion (26). Our study found ossicular destruction in 27 (84.37%) patients and scutum erosion in 29 (90.62%) patients in the diseased ear. In CLE, 8 patients demonstrated radiological changes; all 8 patients (25%) showed poor pneumatization, 5 (15.62%) showed soft tissue opacification in the tympanic and mastoid cavity, 3 (9.37%) had ossicular destruction, and 4 (12.5%) showed scutum erosion. A study by Khan et al. reported that 60% had poor mastoid pneumatization, 30% showed ossicular destruction, 20% had soft tissue in the tympanic cavity, and 10% showed scutum erosion (27).

Our study revealed that there were 21 (65.62%) patients with CLE who had both normal clinical and radiological findings; however, among the 11 patients with abnormal clinical and/or radiological findings, 7 (21.8%) patients showed both clinical and radiological changes, 3 (9.37%) patients had abnormal clinical findings but no CT changes, and 1 (3.12%) patient had normal clinical findings but showed abnormal CT changes.

This study suggests that clinical and radiological examination of the CLE can be of value. In cases of unilateral squamosal COM, there is the likelihood of silent clinical, audiological, or radiological changes in the CLE. Early detection of the disease in CLE will enable timely intervention, which, in turn, will reduce the burden of the disease in CLE.

Conclusion

This study concluded that an asymptomatic CLE can undergo subclinical changes, such as retraction of the TM and conductive hearing loss. Patients can also have silent radiological changes in CLE detected on the CT scan, which are significant but remain undetected in the case of unilateral squamosal disease. The patient may not be aware of these subclinical changes in an otherwise asymptomatic CLE. This subclinical disease may progress to a clinical disease because of underlying pathological changes. Thus, such patients should be counseled regarding the underlying pathology in CLE and the importance of follow-up visits. The treating physician should also be aware of the importance of a detailed clinical examination of CLE during follow-up visits. This would be an important step to prevent further deterioration of the CLE in terms of disease progression audiological progression in CLE, and thus preventing the development of complications in squamosal COM. This study found no statistical significance, but other studies with larger samples are required to show a causal relation between unilateral squamosal disease and a quiescent process in the asymptomatic CLE.

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Ethical statement

The study protocol was approved by the Ethical Committee of the Government Medical College, Nalhar, Nuh, Haryana, India.

Conflicts of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

Author contributions

SM, JM, and SN conceived and designed the experimental design. SM and NS were involved in patient recruitment and follow-up. SM, JM, MY, and SN contributed to drafting and revising the manuscript. All the authors read and approved the final version of the manuscript.

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