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Disease Extension in Active Chronic Otitis Media

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Abstract:

- ***Background:*** Active chronic otitis media (COM) commonly presents with granulation tissue and cholesteatoma, both of which can originate and extend from similar pathological processes within the attic and mastoid air cell system.
- ***Objectives:*** To evaluate intraoperative findings in the middle ear cleft, particularly within the attic and mastoid air cells, during mastoid exploration procedures.
- ***Material and Method:*** A prospective study conducted at the ENT departments of Kirkuk and Azadi Teaching Hospitals. 20 ears from patients scheduled for mastoid exploration were assessed for the presence and extent of granulation tissue and cholesteatoma.
- ***Results:*** Granulation tissue in the mastoid cavity was observed in 60% of cases, all associated with active mucosal COM. The remaining 40% were diagnosed with active squamous COM, characterized by cholesteatoma and granulation tissue in the mastoid air cell system. Aural polyps were associated with extensive mucosal disease, bone erosion, and cholesteatoma in 50% of these cases.
- ***Conclusion:*** Active mucosal chronic otitis media was more commonly encountered than the squamous type during mastoid exploration in the studied cases.

Keywords: Chronic Otitis Media, cholesteatoma, granulation tissue.

INTRODUCTION

Active chronic otitis media (COM) is characterized by persistent inflammation of the middle ear, typically accompanied by purulent discharge. The diagnosis of an active ear is primarily based on clinical examination, with visualization of inflamed middle ear mucosa and ongoing secretions (1). In cases of active squamous epithelial disease, particularly those associated with cholesteatoma, concurrent mucosal inflammation is nearly always present. This mucosal disease contributes to the production of secretions, which may include squamous epithelial debris. These secretions—especially mucopurulent material—can dry and be misinterpreted as cerumen (earwax); however, upon removal, the underlying disease may remain active or may have transitioned to an inactive state (2).

In **active mucosal COM**, activity is usually indicated by generalized inflammation of the middle ear mucosa. Localized granulation tissue or the formation of polypoidal masses may also be observed. Evaluation of the ossicular chain is crucial in both active and inactive cases, especially when the perforation involves the posterior third of the tympanic membrane (3).

Active squamous COM, or cholesteatoma, represents the advanced stage of squamous epithelial retractions—commonly arising from the pars tensa or pars flaccida—that fail to self-cleanse, leading to retention of keratinizing debris and a secondary inflammatory mucosal response. Otoscopic examination alone is often insufficient to determine the full extent of the

cholesteatoma, as parts of the retraction pocket and retained debris may be hidden from view (4).

The aim of this study is to evaluate intraoperative findings in the middle ear cleft, particularly within the attic and mastoid air cells, during mastoid exploration procedures.

MATERIALS AND METHODS

This prospective study was conducted in the Department of Otolaryngology at Kirkuk and Azadi Teaching Hospitals over a period extending from January 2013 to February 2019. A total of 20 patients (12 females and 8 males), each presenting with active chronic otitis media and requiring mastoid exploration, were included. The patients ranged in age from 5 to 46 years.

All patients underwent detailed clinical evaluation, including otomicroscopic examination. Based on the findings, the affected ears were categorized into two groups. The first group included patients with active mucosal chronic otitis media, characterized by tympanic membrane perforation, persistent otorrhoea, and mucosal changes such as granulation tissue and/or aural polyps. The second group comprised patients with active squamous chronic otitis media (cholesteatoma), identified by features suggestive of keratinizing squamous epithelium involvement.

Both preoperative otomicroscopic findings and intraoperative observations made during mastoid exploration were carefully recorded. Particular attention was given to the presence, location, and extent of granulation tissue and cholesteatoma within the middle ear cleft, attic, and mastoid air cell system.

RESULTS

Twenty patients with active chronic otitis media were included in this study, comprising 12 females (60%) and 8 males (40%), with ages ranging from 5 to 46 years and a mean age of 22.3 years. The mean age for females was 20 years, while for males it was 25.75 years. Based on clinical otomicroscopic examination, the affected ears were classified into two groups: 12 ears (60%) with active mucosal chronic otitis media and 8 ears (40%) with active squamous chronic otitis media (cholesteatoma) (Table 1).

In the active mucosal group, the patients' ages ranged from 5 to 46 years, with a mean age of 26.08 years. Among these, 3 patients (25%) were children aged 15 years or younger. Two ears in this group (17%) presented with aural polyps, corresponding to an overall incidence of 10% across the entire study population. In the active squamous group, patient ages ranged from 5 to 32 years, with a mean of 16.6 years. Four of the eight patients (50%) in this group were in the pediatric age group. Overall, 7 out of the 20 patients (35%) were children aged 15

years or younger. Regarding the laterality of disease, the left ear was affected in 12 cases (60%), while the right ear was involved in 8 cases (40%) (Figure 1, Table 1).

All patients presented with mucopurulent discharge and inflamed middle ear mucosa. In the active mucosal group, granulation tissue was observed in 8 ears (66%), polypoid mucosa in 2 ears (17%), and aural polyp in 2 ears (17%). In the squamous group, 6 ears (75%) exhibited cholesteatoma alone, while 2 ears (25%) showed both cholesteatoma and granulation tissue.

Intraoperative findings revealed mucopurulent discharge in all cases. Examination of the mastoid cortex showed that 7 patients (58%) in the mucosal group had a cellular mastoid, and 5 (42%) had a sclerotic mastoid. In contrast, in the squamous group, 6 patients (75%) had a sclerotic mastoid, and only 2 (25%) had a cellular mastoid. Overall, sclerotic mastoid was found in 11 patients (55%) and cellular mastoid in 9 patients (45%).

Regarding the extension of pathological tissue, granulation tissue was present in the mastoid air cell system in all patients with active mucosal COM, and cholesteatoma was found in 1 of these cases (8.3%), associated with an aural polyp. In the squamous group, all patients had cholesteatoma and granulation tissue within the mastoid air cells. In the fossa incudis, granulation tissue was found in 11 mucosal ears (91.6%), while cholesteatoma was observed in 1 ear (8.3%) with an aural polyp. All squamous ears (100%) had cholesteatoma in the fossa incudis, and 5 of them (62.5%) also had associated granulation tissue.

In the attic region, 11 mucosal ears (91.6%) had granulation tissue, and 1 ear (8.3%) had cholesteatoma, again in association with an aural polyp. All ears in the squamous group showed attic cholesteatoma, with granulation tissue present in 5 of them (62.5%). In the supratubal recess, 3 mucosal ears (25%) showed granulation tissue, and 1 (8.3%) had cholesteatoma. Among the squamous cases, 4 ears (50%) had cholesteatoma in this area. Overall, pathological tissue in the supratubal recess was found in 8 ears (40%).

Granulation tissue was found in the facial recess in 7 ears (58.3%) of the mucosal group and in 5 ears (62.5%) of the squamous group. Cholesteatoma was identified in the facial recess in 1 mucosal case (8.3%) and in all 8 squamous cases (100%). Altogether, granulation tissue was found in the facial recess in 12 ears (60%), while cholesteatoma was found in 9 ears (45%).

In the sinus tympani, cholesteatoma was detected in 1 mucosal ear (8.3%) and in 4 squamous ears (50%), making the overall incidence in this site 25%. Finally, the middle ear cavity showed granulation tissue in all mucosal ears (100%) and cholesteatoma in all squamous ears (100%).

Table 1 Distribution of patients according to otoscopic diagnostic category

Otoscopic diagnostic category	NO.	%
Active mucosal COM	12	60%
Active squamous COM (cholesteatoma)	8	40%
total	20	100%

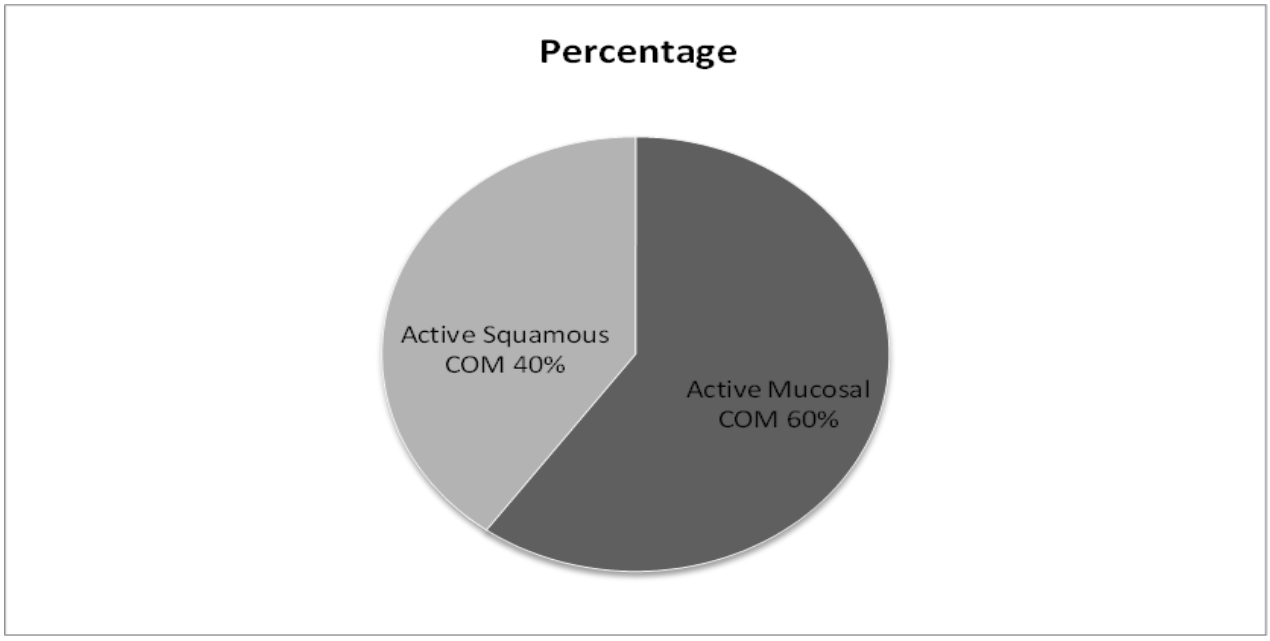

Figure 1 Percentage of Otoscopic diagnostic abnormal results

Table 2: Active mucosal group

Mast. Cortex	Mastoid Antrum	Retrofacial aircells	Attic	Supratubal recess	Middle ear	Sinus tympani
sclerosed	Granulation tissue	gt	gt	-	gt	-
sclerosed	gt	gt	gt	-	Polypoid mucosa	-
Cellular	gt	gt	gt	-	gt	-
sclerosed	gt	gt	gt	-	Polypoid mucosa	-
Cellular	Ch+gt	gt	Ch+gt	Ch	Polyp	Ch
Cellular	gt	gt	gt	-	gt	-
sclerosed	gt	gt	gt	-	gt	-
Cellular	gt	gt	gt	-	gt	-
Cellular	gt	gt	gt	-	gt	-
Cellular	gt	gt	gt	-	gt	-
sclerosed	gt	gt	gt	gt	gt	-
Cellular	gt	gt	gt	gt	gt	-

Table 3 Active squamous group

Mastoid Cortex	Mastoid Antrum	Retrofacial aircells	Attic	Supratubal recess	Middle ear	Sinus tympani
Sclerosed	Ch+gt	Granulation tissue	Ch+gt	-	Ch	-
Sclerosed	Cholesteatoma	Granulation tissue	Ch+gt	Ch	Ch	Ch
Sclerosde	Cholesteatoma	Granulation tissue	gt	Ch	Ch	Ch
Cellular	Cholesteatoma	Granulation tissue	gt	Ch	Ch	Ch
Cellular	Cholesteatoma	Granulation tissue	gt	Ch	Ch	Ch
Sclerosed	Ch+gt	Granulation tissue	Ch+gt	-	Ch	-
Sclerosed	Ch+gt	Granulation tissue	Ch+gt	-	Ch	-
Sclerosed	Ch+gt	Granulation tissue	Ch+gt	-	Ch	-

DISCUSSION

Pathological conditions within the middle ear often have hidden extensions into areas such as the epitympanum and mastoid air cell system. These extensions are not visible through otoscopic examination of the tympanic membrane, making surgical exploration essential for accurate identification and complete removal of disease (5). Clinically, such conditions may present as mucopurulent discharge, granulation tissue, aural polyp, or cholesteatoma. In cases where discharge is observed through a tympanic membrane perforation, the underlying pathology often includes chronic mastoiditis, characterized by extensive inflammation involving the entire middle ear cleft, including the mastoid antrum (6).

Granulation tissue and polyps typically originate in concealed regions such as the anterior or posterior epitympanic recesses, attic, or mastoid air cells (7). Similarly, cholesteatomas seen in the attic or middle ear often extend into or originate from these hidden spaces. These disease processes demand surgical removal not only from visible areas but also from less accessible spaces like the mastoid air cells, attic, epitympanic recesses, facial recess, sinus tympani, and supratubal recess to prevent recurrence or complications (8).

In the present study, 20 ears with active chronic otitis media that necessitated mastoid exploration were classified into two categories: active mucosal chronic otitis media and active squamous chronic otitis media (cholesteatoma). Unfortunately, few studies in the literature

have employed this specific categorization, limiting direct comparison (9). However, selected findings were comparable to results reported in similar research using different terminologies. For instance, the term “active COM” used in this study refers to ears with persistent inflammation and pus. This roughly corresponds to what other authors have described as chronic suppurative otitis media (CSOM) without or with cholesteatoma, or as non-cholesteatomatous COM (NCCOM) and cholesteatomatous COM (COMC) (10).

In this study, active mucosal COM accounted for 60% of the cases, while active squamous COM (cholesteatoma) made up the remaining 40%. These figures align closely with studies by Oswaldo Laercio (11), who reported 49% NCCOM and 51% COMC among 84 ears, and by Al-Badri and Yousif Elamien, who found mucosal disease in 51.9% and cholesteatoma in 48.1%.

With regard to patient demographics, 60% of participants were female and 40% male (12). This finding contrasts with Al-Badri and Ali Kamal’s study (13), which showed a slight male predominance. The mean age of patients in the current study was 22.3 years, closely matching the 23.7 years reported by Elamien. Notably, the mean age in the mucosal COM group was higher (26.08 years) than in the squamous group (16.6 years), with the youngest patients belonging to the squamous group. This difference may be due to the more aggressive symptoms of squamous disease and the presence of thick, deeply seated discharge that is difficult to clean, leading to earlier clinical presentation.

Children aged 15 years or younger represented 35% of the overall study population, a markedly higher proportion than that reported in studies by Elamien (12.5%) and Kamal (14.8%). Interestingly, children comprised 50% of the squamous group and only 25% of the mucosal group, which supports the notion that cholesteatoma tends to present earlier and may be more debilitating in younger patients (14).

Laterality analysis revealed left ear involvement in 60% of cases, consistent with Elamien's study, which reported a 59.3% incidence of left-sided disease. In one patient with bilateral active mucosal disease, the better-hearing ear underwent surgery. The non-operated ear had intermittent discharge with a central perforation and inflamed mucosa, but without granulation tissue or polyp. Audiometric evaluation showed mixed hearing loss, which may be attributed to ototoxic medication or environmental noise exposure.

Pathological examination revealed mucosal changes in all ears with active mucosal disease. Aural polyps were identified in 2 ears (10%) and were associated with extensive granulation tissue, posterior marginal perforation, and bony erosion. These findings correspond with Kamal's study (13), which reported granulation tissue in 95.4% and aural polyps in 8.3% of cases. In the attic region, granulation tissue was observed in 91.6% of mucosal ears, and cholesteatoma in one case. All squamous ears showed attic cholesteatoma, and 62.5% of these also had granulation tissue. By comparison, Elamien reported attic granulation in 21.4% and attic cholesteatoma in 31% of cases.

Granulation tissue was found in the mastoid antrum in all mucosal cases, while all squamous cases exhibited cholesteatoma in this location. In extensive cases, the cholesteatoma sac filled the antrum and granulation tissue extended into the retrofacial and perisinus cells. Kamal reported granulation in 91.6% of mastoid cases (13), and Elamien found extensive mastoid granulation in 57.2% and cholesteatoma in 46.2% of cases (11). The more extensive disease seen in our study may reflect delayed presentation or more advanced pathology (15).

Among the two cases with aural polyp, one (50%) was associated with cholesteatoma. This aligns with the findings of study (16), who described aural polyps as indicative of extensive mucosal disease and found a 35% association with cholesteatoma.

Involvement of the facial recess was observed in 70% of ears, with granulation tissue in 14 cases and cholesteatoma in 9 cases (45%). These figures are significantly higher than those reported by Elamien, who found facial recess granulation in 21.4% and cholesteatoma in 23%. This suggests that the disease in our series may have been more advanced at the time of surgery (17).

Cholesteatoma was found in the sinus tympani in 5 ears (25%)—1 from the mucosal group and 4 from the squamous group. Previous studies have not specifically commented on the incidence of sinus tympani involvement, making our findings a useful contribution to the literature (18).

Pathological tissue in the supratubal recess was observed in 8 ears (40%), including 3 mucosal ears with granulation tissue and one with cholesteatoma, and 4 squamous ears with cholesteatoma. Previous studies considered disease in this region to be a contraindication for canal wall up mastoidectomy (19,20). However, in our study, one five-year-old female patient in the squamous group with supratubal involvement was successfully managed using the canal wall up technique.

In summary, this study emphasizes the necessity of thorough surgical exploration in cases of active chronic otitis media, as hidden disease in the epitympanum, mastoid air cells, and other recesses may be missed during routine examination. Our findings also underscore the clinical relevance of categorizing COM into mucosal and squamous types, which may guide surgical planning and improve disease clearance, particularly in younger patients and in cases with extensive anatomical involvement.

CONCLUSION

Active chronic otitis media frequently involves pathological extension into concealed regions of the middle ear, including the attic, mastoid antrum, and mastoid air cells. Cholesteatoma, when present, is consistently associated with mucosal changes within the middle ear cleft, indicating a combined epithelial and mucosal pathology. In cases of squamous chronic otitis media, granulation tissue is commonly observed in deeper and less accessible areas such as the retrofacial region, perisinus cells, tegmen plate, and mastoid tip cells, reflecting the

extensive nature of the disease. Additionally, the presence of an aural polyp often signifies widespread mucosal inflammation and, in some instances, may be associated with underlying cholesteatoma, highlighting the need for careful surgical exploration and disease clearance.

Recommendation:

A promising recommendation arising from this study is the integration of endoscopic evaluation in both the preoperative and intraoperative assessment of the middle ear cleft. The use of endoscopy is likely to enhance the diagnostic accuracy achieved through conventional otomicroscopic examination and surgical exploration. By allowing better visualization of mucosal compartments and anatomically hidden regions within the middle ear cleft, endoscopy can reveal additional pathological findings that might otherwise remain undetected, thereby supporting more comprehensive disease management and surgical planning.

There is no conflict of interest

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