

A Study of the clinical and audiological profile of ossicular status in Attico-Antral type of chronic suppurative otitis media: A prospective observational study

Dr. Shriya Basti^{1*}, Dr. Shweta Sawant², Dr. Pooja N³

¹ Assistant Professor, Karwar Institute of Medical Sciences, Karwar, Karnataka, India.

² Associate Professor, Navodaya Medical College Hospital and Research Centre, Raichur, Karnataka, India.

Email: Shwetasaavant708@gmail.com

³ Assistant Professor, Navodaya Medical College Hospital and Research Centre, Raichur, Karnataka, India.

Page | 1

Abstract

Background

Cholesteatoma has long been a formidable enemy to the otologic surgeon. It is characterized by chronic inflammation of the middle ear cleft. Ossicular necrosis and erosion are commonly associated with it. Preoperative knowledge of ossicular necrosis helps the surgeon to be better prepared for the surgery and ossicular reconstruction if required. It also allows the surgeon to discuss with the patient the possible outcomes of the surgery with respect to hearing improvement. Hence, this study is intended to identify the occurrence of ossicular chain defects in COM and its impact on hearing at the earliest and manage it accordingly.

Objectives: To study the correlation between clinical and audiological evaluation and ossicular defects.

Methods

This is a Prospective study of Ossicular defects in Chronic otitis media- atticoantral type conducted on 50 patients presenting to the Department of Otorhinolaryngology, Navodaya Medical College, Raichur. Since it is a time-bound study, it will be undertaken over a period of 18months.

Results

Otorrhea was the most frequently presenting symptom, being found in 92% of the study population, while hearing difficulty was found in 64% of the study population. On Otoscopic examination, Cholesteatoma was noted in 42% of the patients, while Granulation tissue/polyp was present in 12% of the patients. Hearing impairment was diagnosed in 64% of the patients. Pure tone audiometry revealed that 80% of the study population suffered from Conductive hearing loss, while 20% had mixed hearing loss. This implies that conductive hearing impairment was the most common audiological abnormality associated with attico-antral chronic suppurative otitis media. The results emphasize the importance of detailed otological and audiological evaluation.

Conclusion

In COM, Otorrhea was the most common presenting symptom in our study, followed by hearing loss.

Recommendation

Further studies on a large number of patients with a long follow-up are recommended.

Keywords: Chronic Suppurative Otitis Media; Attico-Antral Disease; Cholesteatoma; Ossicular Status; Conductive Hearing Loss.

Submitted: August 12, 2026 **Accepted:** September 17, 2026 **Published:** September 30, 2026

Corresponding Author: Dr. Shriya Basti*

Email: shrishriyabasti@gmail.com

Assistant Professor, Karwar Institute of Medical Sciences, Karwar, Karnataka, India.

Introduction

Chronic otitis media (COM) is defined as the chronic infection of the middle ear cleft, including the middle ear, mastoid air cell system, and the eustachian tube, in the presence of persistent tympanic membrane perforation.^{1,2} Disorders affecting hearing can be congenital or acquired. Yet, it is a preventable and correctable condition in the above-mentioned categories, which demand attention. The leading cause of hearing loss in acquired disorders, being Chronic otitis media, is both preventable and correctable to a certain extent as well.

The research on COM becomes increasingly important owing to the large number of individuals in the population who are affected by it, along with the means available to prevent its complications and also to restore the hearing process. The relevance of studies on defects of the ossicular chain lies in the fact that it helps to decide what kind of treatment needs to be done to restore hearing back to normal. Continuous activity of COM is likely to result in increasing damage to the ossicular chain and potentially to the inner ear.³ Hence, it was important to identify the occurrence of ossicular chain defects in COM and its impact on hearing at the earliest and manage it accordingly with various methods prescribed in the literature.

Cruveilhier first described aural cholesteatoma as a “pearly tumor” of the temporal bone.⁴

Abramson et al.⁵ have given a thorough definition of cholesteatoma

“Cholesteatoma represents an epidermoid and connective tissue growth, generally in the form of a sac, that tends to follow the contours of the middle ear spaces, attics and mastoid. It tends to progress with loss of underlying bone and recurrence when removed¹¹.

Pathology of ossicular necrosis

Two major pathophysiological processes have been suggested as a cause of osteolysis in the case of middle ear cholesteatoma. These include osteolysis due to pressure-induced bone resorption and osteolysis due to enzymatic bone breakdown via cytokine-driven inflammation. Pressure-induced bone necrosis first noted by Steinbrugge in 1879 and Walsh in 1951, and bone resorption as suggested by Chole et al. in 1985 have been proposed as possible causes of bone destruction. Matrix metalloproteinases (MMPs), a family of zinc metalloenzymes that degrade unmineralized extracellular matrix, are present in the cholesteatoma. MMP-2 and MMP-9 were expressed in suprabasal epithelial layers of cholesteatoma. Schmidt and co-workers analysed the in vivo significance of MMP-9 activity in relation to the production of cytokines interleukin (IL)-1a, IL-1b, TNF-a, transforming growth factor (TGF)-b, and epidermal growth factor (EGF) in tissue homogenates of cholesteatoma and nine external ear skin specimens. IL-1a production was found to be

significantly elevated; however, no correlation was found between MMP-9 activity and cytokine production.

IL-1 and IL-8, important intercellular mediators of osteoclastic activities, have been shown to increase in cultured cholesteatoma cells compared with normal external auditory canal skin.

The role of another important cytokine, TNF-a, has also been found. Yan and co-authors found that by in vitro stimulating monocytes, they were able to produce multinucleated cells with osteoclast-like activity that produced acid phosphatase-induced bone demineralization. The amount of osteolysis was increased by adding osteoblasts to the TNF-a-treated osteoclasts-containing medium, suggesting a cell-to-cell interaction mediated by TNF-a. In addition, the latter enhanced the production of collagenases by macrophages and osteoblasts.⁶

Jung and coworkers⁷ showed the possible role of nitric oxide as an important mediator of osteoclast function. Using in vivo analysis of a minute model of cholesteatoma-induced bone resorption and in vitro analysis of osteoclast culture, the investigators studied the gene expression of nitric oxide synthase (NOS) and the effect of aminoguanidine (an inhibitor of cytokine mediated nitrite production). They showed a selective upregulation of the inducible NOS, or NOS II, compared with NOS I and NOS III. In vitro, only interferon (IFN)-g was able to generate nitrite. This nitrite production was blocked in vitro by the addition of aminoguanidine and was synergistically enhanced in the presence of IFN-g, IL-1β, and TNF-a.

These findings indicate a role for nitric oxide in the osteoclast-mediated bone resorption in cholesteatoma and suggest the implication of additional cytokines in the in vivo osteoclastogenesis and bone resorption.

Clinical presentation

Studies specific to COM with cholesteatoma reveal an annual incidence ranging between 6 and 12 per 100,000.

The current literature suggests that 10% of cholesteatomas are bilateral.⁷ History in the case of cholesteatoma is often non-specific. The accumulation of keratin is the cause of infection, otorrhea, bone destruction, hearing loss, facial nerve paralysis, a labyrinthine fistula, and intracranial complications such as epidural and subdural abscesses, parenchymal brain abscess, meningitis, and thrombophlebitis of the dural venous sinuses.⁵

The hallmark of cholesteatoma is retention of keratin debris. A cholesteatoma can be filled with keratin and be dry or be associated with active bacterial infection leading to malodorous otorrhea.

Classically, active squamous chronic otitis media presents with foul-smelling otorrhea and hearing impairment. However, many patients complain only of hearing impairment and are unaware of any discharge from their ear,

as the quantities of pus are small and these dry up and form crusts. Sometimes, the disease may be obscured as the pars tensa appears normal, but a small crust obscures the attic. The crust can be mistaken for wax, though wax can only occur in that site if the patient pushes it there with a cotton bud.

Enquiry should be made as to any previous surgery and about recent topical aural medications and how effectively they were used.

Physical examination 8 evaluated for signs of secondary otitis externa as well as scarring, which again, would suggest prior surgery. The presence and location of aural polyps and granulation tissue should be noted. Attention is then turned to the TM. The size and location of any perforation should be described in detail in the medical record, usually either as a diagram or photograph.

Chronic otitis media in the absence of cholesteatoma is usually associated with a central perforation, whereas cholesteatomas are commonly observed in the setting of defects in the pars flaccida or marginal perforations of the TM.

Depending on the size of the perforation, as well as the presence of granulation tissue and polyps, the middle ear mucosa and structures can often be examined. The physical examination should also include a fistula test if the patient reports vestibular symptoms, inspection of the nasopharynx, including the eustachian tube orifices, and gross assessment of hearing with a tuning fork.

Audiometric evaluation 9

Every case of COM evaluation should include audiometric testing with air and bone pure-tone thresholds. Appropriate clinical masking is imperative as patients often have bilateral involvement and mixed hearing loss. The degree of hearing loss is often helpful in determining the extent of the middle ear disease. Perforations of the TM will lead to 15 to 20 dB of conductive hearing loss. When perforations are accompanied by ossicular chain damage, the hearing loss is between 30 and 50 dB. Finally, ossicular chain disruption with an intact drumhead accounts for 55 to 65 dB of conductive hearing loss.

Speech discrimination testing is also useful. Specifically, speech reception thresholds can help determine whether a patient is a candidate for middle ear reconstructive surgery. Usually, the speech discrimination and hearing loss correlate, but a small percentage of patients have an unexpectedly low speech reception threshold and thus may benefit less from surgical intervention.

Alireza KY et al. 10 found the SRT and ABG are more impressive from CSOM than SDS and suggests a higher value of SRT and ABG in diagnosis of CSOM. The existence of cholesteatoma significantly increased the ABG. Ossicular defects increased both SRT and ABG

significantly.

Accordingly, the objective of this study was to assess the clinical and audiologic profile of ossicular status in patients with attico-antral chronic suppurative otitis media.

Materials and methodology

Study design

This is a prospective observational study that was carried out on patients having attico-antral chronic otitis media.

Study setting

The study was done in the Department of Otorhinolaryngology of Navodaya Medical College, Raichur, Karnataka, between December 2022 and May 2023. The department takes care of the assessment and treatment of patients having disorders of the ears, nose, and throat. Patients with attico-antral chronic otitis media coming to the OPD were assessed clinically and by relevant audiometric and radiological studies.

Participants

Fifty participants who were diagnosed with attico-antral chronic otitis media with cholesteatoma were recruited. Individuals of all ages and both genders could participate in the study if they gave their consent. Individuals with middle-ear malignancy, otitis externa, or those who underwent any form of surgery in the past on the ear were not recruited in the study. Selection of participants was done in the Otorhinolaryngology department.

Bias

Possible selection bias could be avoided by applying predetermined inclusion and exclusion criteria to all participants. Standardized clinical examination, tuning fork test, pure tone audiometry, and radiologic tests were done to ensure uniformity in data gathering. A similar procedure was used on all the participants.

Study size

There were 50 participants in this study. There are no available study documents that show there was a formal sample size calculation, statistical assumption, effect size, or provision for non-response. Hence, the rationale behind having 50 participants needs to be shown if stated in the original study protocol.

Data collection

Data were collected with the aid of a structured case proforma. Comprehensive history taking and examination were done. The tuning fork test was done at frequencies of 256, 512, and 1024 Hz. Investigations included bilateral Schüller's view mastoid X-ray and pure-tone audiometry.

The variables included demographic features, clinical features, presence of cholesteatoma, and audiological features.

Statistical analysis

Frequency and percentage were used to describe qualitative variables, whereas quantitative variables were described using means and standard deviations. Paired t-test was used for comparing quantitative data within a group, while unpaired t-test was used for between-group comparisons provided that the normality test was satisfied. The chi-square test was applied wherever applicable. A P-value of <0.05 was taken as statistically significant. Analysis was done using IBM SPSS Statistics for Windows, version 22. This methodology doesn't include any measure for confounder control or management of missing data (11).

Ethical consideration

This research was carried out with the approval of the relevant Institutional Ethics Committee. However, there is no information about the name of the Institutional Ethics Committee, the date of approval, and the ethical approval number. This information should be included where available.

Informed consent

Written informed consent was obtained from all participants before their inclusion in the study.

Results

Ear discharge was present in 92% of the study population. 54.3% of patients had intermittent ear discharge. 65.2% of patients had scanty ear discharge. All patients in the study population had foul-smelling ear discharge. The quality of ear discharge was mucopurulent in most patients, accounting for 58% of the study population.

The duration of ear discharge was 6.04 ± 3.48 (Mean $\pm$ SD). 66% of patients had retraction of the tympanic membrane. Pars flaccida (57.57%) was the most common site of retraction, followed by marginal perforations involving the postero-superior portion of the pars tensa in 42.85%. Central perforation was noted in 28.57% of the study population. In 6%, both the pars tensa and flaccida were involved.

On otoscopic examination, in 42% patient's cholesteatoma was visualized, 12% had granulation tissue polyp, 8% had cholesteatoma and granulation tissue and 2% had only granulation tissue.

Hard of hearing was noted in 64% of the study population. 88% of the study population had severe, and 10% had moderate hearing loss as determined by Rinne's test. 1 patient had mild hearing loss. Weber's test was lateralized to right side in 54%, 38% in left side n centralized in 8%. Absolute bone conduction test was the same as examined in 94% and reduced in 6%.

80% of the study population had conductive hearing loss, and 20% had mixed hearing loss as determined by pure tone audiometry.

Table 1: Distribution of study subjects based on ear discharge

Ear discharge	Frequency (n=50)	Percentage (%)
Present	46	92
Absent	4	8

Table 2: Distribution of study subjects based on ear discharge characteristics

EAR DISCHARGE	FREQUENCY (N=46)	PERCENTAGE (%)
DURATION	Mean $\pm$ SD	6.04 $\pm$ 3.48
TYPE	Continuous	21 (45.6)
	Intermittent	25 (54.3)
QUANTITY	Scanty	30 (65.2)
	Profuse	16 (34.7)
ODOUR	Foul smelling	46 (100)
	Non-foul smelling	0 (0)
QUALITY	Mucoid	0 (0)
	Muco-purulent	29 (58)
	Purulent	14 (28)
	Blood stained	3 (6)

Table 3: Distribution of study subjects based on hard of hearing

HARD OF HEARING	FREQUENCY (N=50)	PERCENTAGE (%)
PRESENT	32	64
ABSENT	18	36

Table 4: Distribution of study based on other ear complaints

Other complaints	Frequency (n=26)	Percentage (%)
Ear ache	13	48.18
Swelling around ear	1	3.7
Headache	0	0
Dizziness	5	18.51
Facial nerve palsy	3	11.11
Fever	0	0
Others	5	18.5

Table 5: Distribution of study subjects based on site of perforation noted on Otoscopy and Otomicroscopy

Examination		Otoscopy		Otomicroscopy	
		Frequency (n=44)	Percentage (%)	Frequency (n=50)	Percentage (%)
Tympanic Membrane	Perforation(P)	12	27.27	14	28
	Retraction(R)	31	70.45	33	66
	Both	1	2.27	3	6
	perforation and retraction				
	Pars flaccida	18	58.06	19	57.57
	retraction				
	Pars tensa	13	41.93	14	42.42
	retraction				
	Pars flaccida	3	25	4	28.57
	perforation				
Site	Pars tensa	3	25	6	42.85
	Marginal (Tm)				
	perforation				
	Pars tensa	6	50	4	28.57
	Central (Tc)				
Size	perforation				
	TmP FR	1		2	
	TR FP	0	0	1	
	Small	4	33.33	2	14.28
	Large	8	66.66	12	85.71

Table 6: Distribution of study subjects based on middle ear pathology noted on otoscopy

Middle ear pathology	Frequency (n=50)	Percentage (%)
Cholesteatoma only	21	42
Granulation tissue only	1	2
Cholesteatoma & granulation Tissue	4	8
Granulation polyp	6	12
None	18	36

Table7: Distribution of study subjects' deafness based on Tuning fork test

Tuning fork tests	Frequency (n=50)	Percentage (%)
Rinne Test	Mild (256Hz)	1
	Moderate (512Hz)	5
	Severe(1024Hz)	44
	Right	27
	Left	19
Weber (512)	Centralized	4
	Same	47
ABC	Reduced	3
		6

Table 8: Distribution of study subjects' deafness based on pure-tone audiometry

Type of deafness	Frequency (n= 50)	Percentage (%)
Conductive	40	80
Mixed	10	20

The total number of participants with attico-antral chronic otitis media was 50. Nonetheless, there is no record available regarding the number of patients who were potentially eligible, screened, excluded, or assessed prior to

being enrolled. It is important to note that reasons for non-participation and drop-outs have not been recorded as well. Hence, it would be wise to get these figures from the actual recruitment documents first.

Table 9: Participant flow

Study stage	Number (n)	Reason/details
Potentially eligible patients	Not documented	Patients presenting to the Department of Otorhinolaryngology with suspected attico-antral chronic otitis media
Patients examined for eligibility	Not documented	Assessed through clinical examination and relevant investigations
Confirmed eligible patients	Not documented	Met the predefined inclusion criteria
Excluded patients	Not documented	Middle-ear malignancy, otitis externa, previous ear surgery, or unwillingness to provide consent
Patients included in the study.	50	Eligible patients who provided written informed consent
Patients analysed	50	Final study sample reported in the available methodology
Dropouts/loss to follow-up	Not documented	No dropout information was provided

Statistical analysis of quantitative findings

Quantitative variable	Analysis	Statistical test	p-value	Interpretation
Duration of ear discharge	6.04 ± 3.48 years	Paired t-test	Not reported	Statistical significance cannot be determined from available data
Within-group quantitative comparison	Not reported	Paired t-test	Not reported	Patient-level paired data unavailable
Between-group quantitative comparison	Not reported	Unpaired t-test	Not reported	Group-level comparative data unavailable

If the p-value <0.05, it means that there is statistical significance. The available manuscript does not contain the quantifiable data that could help in obtaining the p-values.

Discussion

Otorrhea was the most common presenting symptom in our

study, noted in 92% of patients, followed by hearing loss seen in 64% of the study population. Earache was seen in

48.18% of patients, and 18.51% presented with dizziness. The ear discharge was more frequently found to be foul-smelling (100%), intermittent (54.3%), scanty (65.2%), and mucopurulent (58%) in character. It was occasionally blood-stained (6%).

Otoscopic and Otomicroscopic findings

The most common pathology noted in the tympanic membrane on otomicroscopy was retraction (66%). Pars flaccida was the most common site of retraction noted in 57.57% of the study population, followed by marginal perforation involving the postero-superior portion of the pars tensa in 42.85%. Central perforation was noted in 28.57% of the study population. 6% of the patients had both perforation and retraction. The perforation in the pars tensa was graded as large when it involved more than one quadrant, and perforation in the pars flaccida was graded large when it involved more than 50% of the pars flaccida. 85.71% of the study population had large perforation and 14.28% had small perforation. 4% of patients having tympanic membrane retractions with or without perforation were falsely identified as having tympanic membrane perforations on otoscopy.

Cholesteatoma was noted in 42% of patients on otoscopy.

Preoperative pure tone audiometry was performed in all patients, and pure tone averages for air conduction and bone conduction were calculated for 0.5, 1, and 2 kHz, and the air-bone gap were determined.

Audiological evaluation of patients revealed that 80% of the study population had conductive hearing loss and 20% of patients had mixed hearing loss.

Kotzias SA et al.,¹¹ found most common diagnosis was primary chronic otitis media with cholesteatoma (58.4%), followed by COM without cholesteatoma in 41.6% and in this last group 20.8% of the patients presented suppurative disease. Overall, otorrhea was found in 64% of the ears.

Doddamani et al.,¹² Found for Malleus ossicle defect, Air conduction threshold was 54.97dB and ABG was 35.34dB. For Incus defect, Air conduction threshold was 54.78 dB, and ABG was 32.50dB. For stapes defects, air conduction defect was 57.05 dB, and ABG was 35.79dB.

Carrillo RJ,¹³ in their study found the ABG of 20 dB or less at 500 Hz and 30 dB or less at 1kHz decreased probability of Ossicular discontinuity from 33 to 5.6% and 15.5% respectively. Air-bone gap levels of greater than 30 dB at 2 kHz and greater than 40 dB at 4 kHz increased the probability of Ossicular discontinuity from 33 to 51% to 89%. In the presence of cholesteatoma, the chance of Ossicular discontinuity was 88% irrespective of ABG.

Srinivas C et al.¹⁴ noted that there was a statistically significant difference between ossicular defects and intact ossicles with respect to pure tone audiometry and ABG scores ($P = 0.001$).

Interpretation

Otorrhea was the most common symptom seen in 92% of the patients, and hearing loss was found in 64% of the cases. Foul-smelling discharge was seen in all cases with ear discharge, and mucopurulent discharge was the most common type. Cholesteatoma was seen in 42% of the patients on otoscopy. Conductive hearing loss was seen in 80% by pure-tone audiometry and mixed hearing loss in 20%. This study shows that ear discharge and conductive hearing loss are two major clinical features of attico-antral chronic suppurative otitis media. Results from the current study support the results of Kotzias et al., who found that cholesteatoma was commonly diagnosed and otorrhea was present in 64% of affected ears. Similarly, a significant association between ossicular defect and pure-tone audiometry and air-bone gap has been found by Srinivas et al. ($P = 0.001$).

Generalizability

The results of the study could be generalized to other patients suffering from chronic suppurative otitis media attico-antral type attending such tertiary care departments of otorhinolaryngology. But this generalizability could be restricted by the fact that the study was done in a single center with only 50 patients.

Conclusion

In COM, Otorrhea was the most common presenting symptom in our study, followed by hard of hearing.

Preoperative PTA can give a clue regarding the presence or absence of ossicular discontinuity, but it is difficult to narrow down individual ossicular erosions with just Pure Tone Average.

Limitations

The number of patients in the study (50) was a limitation for drawing conclusions.

The follow-up of patients is not included in the study. Owing to the chronic nature of the disease and its recurrence, conclusions are difficult to make.

Recommendations

Further studies on a large number of patients with a long follow-up are recommended.

Acknowledgment

The authors wish to acknowledge the Department of Otorhinolaryngology, Navodaya Medical College, Raichur, and the clinical team that helped us in performing patient evaluation, investigations, and data acquisition. The authors also wish to thank all subjects for their co-operation and participation in the study.

List of abbreviations

CSOM	Chronic Suppurative Otitis Media
COM	Chronic Otitis Media
PTA	Pure Tone Audiometry
ABG	Air-Bone Gap
SRT	Speech Reception Threshold
SDS	Speech Discrimination Score
TM	Tympanic Membrane
ENT	Ear, Nose and Throat
OPD	Outpatient Department
SPSS	Statistical Package for the Social Sciences
ABC	Absolute Bone Conduction

Funding sources

This research study was not supported by any kind of external funding provided by any institution or any organization or agency.

Conflict of interest

The authors declare that there is no conflict of interest regarding this study.

Author contributions

All authors contributed to the design and conception of the study, patient recruitment, clinical evaluation, data collection, interpretation of results, and preparation of the manuscript. All authors critically revised the manuscript, approved the final version of the manuscript, and take full responsibility for the manuscript.

Data availability

Data used to support the findings of this study are available from the corresponding author upon request.

Author biography

Dr. Shriya Basti is an Assistant Professor at the Karwar Institute of Medical Sciences, Karwar, Karnataka, India. She holds ORCID: 0000-0002-4680-1853 and contributed to the clinical and academic aspects of the study.

Dr. Shweta Sawant is an Associate Professor at Navodaya Medical College Hospital and Research Centre, Raichur, Karnataka, India. She holds ORCID: 0000000206040412 and contributed to the clinical assessment, data collection, and interpretation of the study findings.

Dr. Pooja N is an Assistant Professor at Navodaya Medical College Hospital and Research Centre, Raichur, Karnataka, India. She holds ORCID: 0000-0002-4496-7147 and contributed to the clinical assessment, data analysis, and manuscript preparation.

Bibliographical references

- Slattery WH. Pathology and clinical course of inflammatory diseases of the middle ear. In: Glasscock ME, Gulya AJ, editors. Glasscock-Shambaugh surgery of the ear. 5th ed. New Delhi: Reed Elsevier India Pvt Ltd; 2003. p428-429.
- Mills RP. Management of chronic suppurative otitis media. In: Booth JB, Kerr AG, editors. Scott-Brown's otolaryngology, vol. 3. 6th ed. London: Reed educational and professional publishing limited; 1997. p1-11.
- Browning GG, Merchant SN, Kelly G, Swan LRC, Canter R, McKerrow WS. Chronic otitis media. In: Gleeson M, Browning GG, Burton MJ, Clarke R, Hibbert J, Jones NS, et al., editors. Scott-Brown's otorhinolaryngology head and neck surgery, vol. 3. 7th ed. Great Britain: Hodder Arnold; 2008. p3397-3431. <https://doi.org/10.1201/b15118-279>
- Chole RA, Sudhoff HH. Chronic Otitis Media, Mastoiditis, and Petrositis. In: Niparko JK, editors. Cummings Otolaryngology Head and Neck Surgery. 5th ed. Elsevier Mosby; 2010. p1963-78. <https://doi.org/10.1016/B978-0-323-05283-2.00140-3>
- Abramson M et al. Cholesteatoma pathogenesis: evidence for the migration theory. In: McCabe B, Sade J, Abramson M, editors. Cholesteatoma. First International Conference. Aesculap: Birmingham; 1977. p176-86.
- Maroun T, Semaan, Cliff A. Megerian. The pathophysiology of cholesteatoma. Otolaryngol Clin N Am. 2006;39:1143-1159. <https://doi.org/10.1016/j.otc.2006.08.003> PMID:17097438
- Jung JY, Pashia ME, Nishimoto YS, Faddis BT, Chole RA. A possible role for nitric oxide in osteoclastogenesis associated with cholesteatoma. Otolaryngology & Neurotology. 2004;25(5):661-668. <https://doi.org/10.1097/00129492-200409000-00003> PMID:15353992
- Kemppainen HO, Puhakka HJ, Laippala PJ, et al. Epidemiology and aetiology of middle ear cholesteatoma. Acta Otolaryngol(stockh) 1999;119:568-72. <https://doi.org/10.1080/00016489950180801> PMID:10478597
- Telian AS, Schmalbach CE. Chronic otitis media. In: Snow Jr JB, Ballenger JJ, editors. Ballenger's Otorhinolaryngology Head and Neck Surgery. 16th ed. Hamilton, Ontario: BC Decker; 2003. p261-90.
- Alireza Karimi-Yazdi, Babak Saedi, Mojtaba Fayeziadeh, Hamidreza Seifmanesh. Association

Original Article

between audiometric profile and intraoperative findings in patients with chronic suppurative otitis media. Iranian Journal of Otorhinolaryngology. 2011;23(2):37-42.

11. Kotzias SA, Seerig MM, Mello MF, Chueiri L, Jacques J, Silva MB, Zatt DB. Ossicular chain reconstruction in chronic otitis media: hearing results and analysis of prognostic factors. Brazilian journal of otorhinolaryngology. 2020 Mar 30;86(1):49-55.
<https://doi.org/10.1016/j.bjorl.2018.09.005>
PMid:30545783 PMCID:PMC9422474
12. Doddamani SS, Yasha C. Hearing loss and ossicular status in cholesteatoma. Int J

Otorhinolaryngol Head Neck Surg. 2018 Jul;4:1072-5. <https://doi.org/10.18203/issn.2454-5929.ijohns20182716>

13. Carrillo RJ, Yang NW, Abes GT. Probabilities of ossicular discontinuity in chronic suppurative otitis media using pure-tone audiometry. Otolaryngology & Neurotology. 2007 Dec 1;28(8):1034-7.
<https://doi.org/10.1097/MAO.0b013e31815882a6>
PMid:17921908
14. Srinivas C et al. Factors influencing ossicular status in mucosal chronic otitis media – An observational study. Indian journal of otology. 2014;20(1):16-19. <https://doi.org/10.4103/0971-7749.129800>

PUBLISHER DETAILS

Student's Journal of Health Research (SJHR)

(ISSN 2709-9997) Online

(ISSN 3006-1059) Print

Category: Non-Governmental & Non-profit Organization

Email: studentsjournal2020@gmail.com

WhatsApp: +256 775 434 261

**Location: Scholar's Summit Nakigalala, P. O. Box 701432,
Entebbe Uganda, East Africa**

