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St. Paul's Hospital Millennium Medical College

Prevalence of

Cholesteatoma among patients with Chronic Suppurative Otitis Media and its associated factors in St. Pauls Hospital Millennium Medical College, Addis Ababa, Ethiopia 2023.

By: Lidya Zewdie (Otolaryngology and head and neck surgery Resident)

**Thesis report Submitted to Department of Otolaryngology and Head and Neck Surgery in
Partial Fulfillment of the Requirement of Degree in
Otolaryngology and Head and Neck Surgery Specialty**

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ST. PAUL HOSPITAL MILLENNIUM MEDICAL COLLEGE

GRADUATE STUDY PROGRAM

PREVALENCE OF CHOLESTEATOMA AMONG PATIENTS WITH CHRONIC
SUPPURATIVE OTITIS MEDIA AND ITS ASSOCIATED FACTORS IN ST. PAULS
HOSPITAL MILLENNIUM MEDICAL COLLEGE, ADDIS ABABA, ETHIOPIA 2023.

A RESEARCH THESIS

INVESTIGATOR: LIDYA ZEWDIE (MD)

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Abbreviations/Acronyms

CI: Confidence Interval

COM: Chronic Otitis Media

CWD: Canal Wall Down

CWU: Canal Wall Up

CSOM: Chronic Suppurative Otitis Media

ECC: Extra cranial Complications

ENT: Ear, Nose and Throat

ICC: Intracranial Complications

TM: Tympanic Membrane

OPD: Out Patient Department

OR: Odds Ratio

PI: Principal Investigator

SPHMMC: Saint Paul's Hospital Millennium Medical College

SPSS: Statistical Package for Social Sciences

Abstract

Introduction: Chronic suppurative otitis media, also known as chronic otitis media is a recurrent infection of the middle ear and/or mastoid air cells in the presence of a tympanic membrane (TM) perforation. The annual incidence of acquired cholesteatoma ranges from approximately 9 to 12.6 cases per 100,000 adults and from 3 to 15 cases per 100,000 children. In Ethiopian context, ~~despite the fact that~~ there is scarcity of data regarding the exact magnitude and impact of cholesteatoma and its complications, which are often neglected conditions due to insufficient funds, work force, facilities, and knowledge.

Objective: To assess prevalence of Cholesteatoma and its associated factors among chronic suppurative otitis media patients in St. Pauls Hospital Millennium Medical College, Addis Ababa, Ethiopia 2023.

Method: ~~A~~ ~~C~~ross sectional facility based study; design was used in ~~St~~ Saint Paul's ~~Hospital~~ ~~Millennium~~ ~~Medical~~ ~~College~~ and conducted among 329 Chronic suppurative otitis media patients using convenient sampling. Data was collected using ~~a~~ structured checklist. Median with interquartile range was computed. In addition ~~B~~ivariate analysis was used to identify significant variables and then variables with $p < 0.25$ were included into multiple logistic regressions to determine the association between independent and dependent variables. $P < 0.05$ was used to declare significant association.

Results: ~~t~~The prevalence of chole~~a~~steatoma patients among ~~patients with~~ chronic otitis media ~~patient~~ was 10.6%. The likelihood of developing cholesteatoma among ~~patients with~~ COM ~~patients~~ with longer duration of ear discharge (≥ 30 years) was 17.8 times [AOR 17.8 (CI 1.511, 208.7) more likely to develop cholesteatoma compared with their counterpart. In addition the log of developing cholesteatoma was 4% times [AOR 0.004(CI 0.001, 0.018)] less likely to on those who had central perforation than those who had atticointral perforation.

Conclusion and recommendations: This study found that cholesteatoma was prevalent in 10.6% of chronic otitis media patients and was associated with longer duration of ear discharge and marginal perforation of the tympanic membrane. Recommendations include regular follow-up and monitoring, health education for patients, and early evaluation by ENT specialists.

1. INTRODUCTION

1.1 Background

Chronic suppurative otitis media, also known as chronic otitis media is a recurrent infection of the middle ear and/or mastoid air cells in the presence of a tympanic membrane (TM) perforation. Symptoms commonly include hearing loss, aural fullness, otalgia, otorrhea, and occasionally vertigo (1, 2). It is the most common cause of hearing disability in developing countries (3). Chronic suppurative otitis media (CSOM) is a common disease in low socioeconomic stratum and rural areas, with poor hygienic and dietary conditions. The disease is now-a-days less aggressive, due to excessive use of antibiotics, but it's atticoantral type with marginal perforation and cholesteatoma can lead to serious complications (4).

CSOM is usually classified into two main groups: tubotympanic and atticoantral disease. The tubotympanic type is otherwise also called safe type or benign type because it is not associated with any serious complications. The atticoantral type is called unsafe or dangerous type because of the associated complications which may be life-threatening at times. These complications are mainly due to granulation tissue and cholesteatoma causing bone erosion and necrosis which may involve the vital structures such as facial nerve, inner ear, and intracranial components. These also erode the ossicles causing hearing loss (5).

The word "cholesteatoma" was used for the first time by the German anatomist Johannes Mueller, in 1838 (6). The roots of this word mean *cole* - cholesterol; *esteado* - fat; *oma* - tumor, that is, a tumor in which we have fatty tissue and cholesterol crystals. Etymologically, this term is completely incorrect, and it is considered the second wrong term in otology (the first one is acoustic neuroma, given that it is in fact a vestibular nerve Schwannoma) (7). It is a well-demarcated noncancerous cystic lesion derived from an abnormal growth of keratinizing squamous epithelium in the temporal bone (8-10), which is commonly characterized as "skin in the wrong place" (11). Cholesteatoma results from the enzymatic activity of the cholesteatoma matrix. This abnormal growth is locally invasive and capable of causing the destruction of structures in the middle ear cleft. Furthermore, squamous epithelium may be rendered destructive in an environment of chronic infection, thereby enhancing the osteolytic effects of cholesteatoma (12).

Commented [FU2]: I am not sure if this is mixed up. I am pretty sure that the most common cause for hearing loss in developing countries is age. Please look thorough at your reference

Commented [FU3]: Which these? The complications?

There are two main types of cholesteatoma based on the disease pathogenesis: congenital, which is specific to childhood, and acquired, which affects children as well as adults (13). Acquired can be primary and secondary. Primary acquired cholesteatoma occurs as a retraction pocket in which desquamated keratin epithelium accumulates behind an apparently intact eardrum, usually in the region of the pars flaccida. Secondary acquired cholesteatoma appears secondary to epithelial migration into the middle ear through a perforated eardrum, which is in turn caused by infection, trauma, or iatrogenesis. Secondary acquired cholesteatomas are more common and are usually associated with squamous type of chronic otitis media (COM) having attic and marginal perforation(14).

1.2. Statement of the problem

Every year, approximately 31 million people develop CSOM around the world (15). The annual incidence of acquired cholesteatoma ranges from approximately 9 to 12.6 cases per 100,000 adults and from 3 to 15 cases per 100,000 children (16-18). A male predominance of 1.4: 1 in cholesteatoma incidence has been reported (19-21). Among children, a 72% preponderance of boys has been reported with no predilection for either the left or right side (21). The prevalence of cholesteatoma is higher in underdeveloped countries than in developed countries (3).

Cholesteatoma often exist in a nonaggressive state, remaining undetected for years before potentially dangerous presentations manifest (22). The growth of cholesteatoma often progress undiscovered until they have become dangerously large and threatens to invade intratemporal structures. CSOM develops complications in 30% of cases, in comparison with chronic otitis media (COM) without cholesteatoma that can be complicated in 2% of cases (23). There are two groups of complications: Intracranial (meningitis, dural abscesses, cerebral abscess, cerebellar abscess and lateral sinus thrombosis) and extracranial (facial nerve palsy, labyrinthine fistula, petrositis, zygomaticitis, mastoiditis and neck abscesses arising from mastoid tip-Bezold's abscess).

Sometimes, multiple intracranial and concomitant intracranial and extracranial complications (IC/EC) can occur (24). The prevalence rates of extracranial and intracranial complications are reported to range from 0.69% to 5%, and the rate of mortality from intracranial complications are 8% (25).

Patients with cholesteatoma often report experiencing recurrent episodes of foul-smelling otorrhea. This otorrhea is described as a scant, purulent discharge, meaning it is thick and contains pus.

Commented [FU4]: ? This statement is not clear to me CSOM = COM. So why is CSOM developing more complications?

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Hearing loss can be progressive and either conductive, sensorineural or mixed. Conductive hearing loss is due to the impaired movement of ossicles. Damage to the cochlea can cause irreparable sensorineural hearing loss, occasionally complicated by tinnitus. Destruction of the bone which overlies the semicircular canals (particularly the horizontal canal) can trigger vertigo or balance dysfunction. In addition, violation of the facial nerve canal often manifests as temporary or even permanent facial paralysis (26).

In the pediatric population, cholesteatoma accounts for 10% of chronic otitis media cases (27) and it has been proposed that children with craniofacial syndromes are predisposed to develop cholesteatoma. An estimated 0.9–5.9% of children with a cleft palate develop primary acquired cholesteatoma (28).

In many cases, complications are not identified until they have progressed to advanced stages. A failure to early control infection ~~early~~ can lead to fatal complications, such as meningitis, brain abscesses, epidural abscesses, septic cavernous sinus thrombosis and acute mastoiditis with a subperiosteal abscess (29). ~~Therefore, it is important to invest in early detection, diagnosis, and rehabilitation of chronic otitis media so that the right interventions can be carried out before Cholesteatoma develops and needs to be treated at much higher burden — individually and at society at large.~~

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In the Ethiopian context, the scarcity of data regarding the magnitude and impact of cholesteatoma and its complications reflects neglected conditions due to insufficient funds, workforce, facilities, and knowledge. These factors contribute to limited awareness, diagnosis, and management of cholesteatoma in Ethiopia. ~~Hence, there is a dire need to conduct such studies to estimate the magnitude and its contributing factors.~~

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1.3 Significance of the study

The findings of this study ~~was is~~ an input to the country's health sector transformation plan, which aims to improve equity, coverage and utilization of essential health services. Understanding disease prevalence, that is, the proportion of a population with the condition, is critical to anticipating health care needs and allocating appropriate resources. In addition, comparisons of the burden by demographic factors like sex, age and place of residency may yield etiological clues and identify subgroups at particularly high risk for targeted case finding. Moreover, this study is

expected to contribute to the existing body of knowledge regarding cholesteatoma and its associated factors among chronic suppurative otitis media patients attending otolaryngology clinics at the study setting, thereby shedding some light to the potential areas for evidence-based mitigation measures. Furthermore, the findings are expected to be of particular importance to local planners and health-policy makers to design policies that would alleviate this growing health burden among vulnerable age groups. Finally, this study will also serve as a baseline information to other interested investigators in similar research endeavors.

2. Literature review

Prevalence of Cholesteatoma

A study done in Nepal showed that the incidences of the complications from acute otitis media, chronic otitis media without Cholesteatoma, and chronic otitis media with Cholesteatoma were 0.5%, 0.06% and 5.6%, respectively (30). Prevalence of Cholesteatoma on the study conducted in Pakistan, Rawalpindi, among patients with CSOM showed that Cholesteatoma was diagnosed in 10.63% (31). Another study conducted in Donkka medical university, Guinea, showed that prevalence of Cholesteatoma was 1.33% (32) among patients attending ENT clinics. In a study done on management of complication of Cholesteatoma in Republic of Kosovo from a total of 2765 patients suffering from COM, 502 (18.08%) had cholesteatoma (24). Relatively high prevalence of cholesteatoma among COM was recorded in study conducted in Brazil on 419 patients ~~and it was at a rate of~~ 24.5% (33).

Socio-demographic factors

Annual incidence of Cholesteatoma ranges around 3 in 100,000 in children and 9 in 100,00 in adults (34). According to a conducted study, the correlation between cholesteatoma and chronic otitis media was particularly pronounced among individuals below the age of 20 at the time of their initial surgery (OR, 5.2; 95% CI, 3.6-7.6). The risk of having a Cholesteatoma surgery was almost 4 times higher in individuals having a first-degree relative surgically treated for the disease (OR, 3.9; 95% CI, 3.1-4.8). A male predominance of 1.4 : 1 in Cholesteatoma incidence has been reported in Brazil. The study conducted in Brazil revealed that there were no significant associations between the size of the tympanic membrane perforation (gap size) and either patient age or duration of symptoms in relation to the occurrence of cholesteatoma (33).

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Clinical Presentations and Complications

Most of patients with cholesteatoma present with sign and symptom of ear discharge-, hearing loss, headache, facial palsy, ear ache, swelling behind the ear, discharge behind the ear, vertigo/giddiness, vomiting, swelling ~~in~~of the neck, swelling of ~~verhead~~the mastoid region, fever, Kernig's sign + ve, neck rigidity, fistula sign + ve, mastoiditis and cerebellar sign mastoid fistula (35). A study done in the Republic of Kosovo showed that out of [] patients Eighty-two (56.55%) cases had extracranial complications (ECC) and 49 patients (33.79%) intracranial complications (ICC). For the ECC cases, we found that subperiosteal mastoid abscess occurred in 25%, facial nerve palsy was seen in 13% and labyrinthine fistula in 9.6 %. For the ICC cases, meningitis (12%) and perisinus abscess (11%) were the most common complications (24).

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Commented [FU11]: We or they?

Management of cholesteatoma

Treatment of CCOM is essentially surgical. The primary objective is complete eradication of the disease, providing to the patient a dry and complication-free ear. The secondary objective, although not less important, is to preserve or improve the tympano-ossicle system function, whenever possible (10). Surgical Approaches are: Canal Wall Up (CWU) and Canal Wall Down (CWD) Mastoidectomies (36). Medical treatment regimens are unable to provide a complete cure for acquired cholesteatoma; rather, these therapies are used to control preoperative infection or inflammation and to reduce the risk of postoperative complications (37).

Conceptual framework

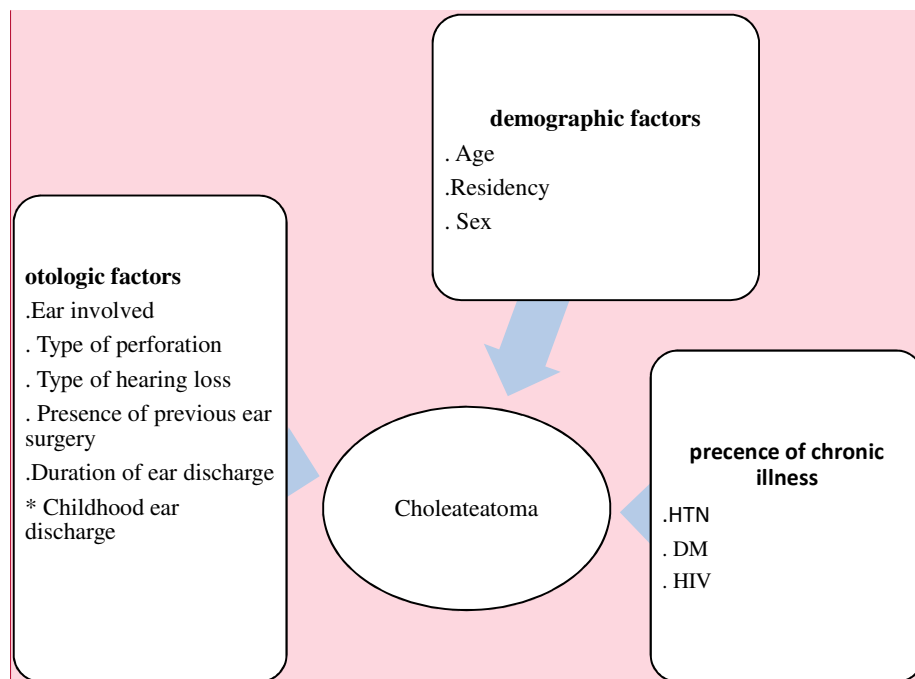


Figure 1: conceptual framework developed after reviewing different literatures

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3. Objective

3.1 General Objective

To assess the prevalence of Cholesteatoma and its associated factors among chronic suppurative otitis media patients in St. Pauls Hospital Millennium Medical College, Addis Ababa, Ethiopia 2023.

3.2 Specific Objective

1. To assess the prevalence of Cholesteatoma among patients with chronic suppurative otitis media in St. Pauls Hospital Millennium Medical College, Addis Ababa, Ethiopia.
2. To determine associated factors of Cholesteatoma among patients with chronic suppurative otitis media in St. Pauls Hospital Millennium Medical College, Addis Ababa, Ethiopia 2023.

4. Methods and Materials

4.1 Study area and period

St. Paul's Hospital Millennium Medical College (SPHMMC) was founded in July 1947 during the reign of Emperor Haile Selassie, and it is the second largest hospital in Ethiopia. The hospital has

more than 2500 clinical, academic and administrative staff. While the inpatient capacity is more than 700 beds, the college sees more than 2000 emergency and outpatient clients daily.

The ENT ~~epd~~-OPD clinic is run five times a week by a team of seniors, residents, nursing and other staff. St. Paul's Hospital Millennium Medical College is selected for presence of organized ENT clinics providing services for a relatively large population size belonging both to pediatric and adult age groups. Data was -collected from November -1st to November 30, 2023.

4.2 Study design

A cross-sectional study design employing retrospective chart review was conducted.

4.3 Source population

All patients with chronic suppurative otitis media at ENT clinic of St. Paul's Hospital Millennium Medical College.

4.4 Study population

Selected patients who were diagnosed with chronic suppurative otitis media at Ear, Nose and Throat clinic of St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia from September 1st, 2021 to August 31st, 2022 and who fulfill the inclusion criteria.

4.5 Eligibility criteria

4.5.1 Inclusion criteria

Patients diagnosed with chronic suppurative otitis media at Ear, Nose and Throat clinic of St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia from September 1st, 2021 to August 31st, 2022.

4.5.2 Exclusion criteria

- Patients who had congenital cholesteatoma
- patients whose charts were lost or incomplete
- age less than seven

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4.6 Sample size determination

The sample size for this study was calculated using a single population proportion formula. Considering the population proportion of estimate proportion of patients with chronic suppurative otitis media who develop Cholesteatoma to be 50% due to absence of previous study done at the current study setting and with the intention of obtaining maximum sample size:

$$n = \frac{z^2 p(1-p)}{e^2}$$

n = the required sample size

p = proportion of patients with COM that develop Cholesteatoma=0.5

$Z_{\alpha/2}$ = the critical value at 95% confidence level = 1.96

e = precision (margin of error) = 5%

Accordingly,

$$n^0 = \frac{(1.96)^2 * 0.5(1 - 0.5)}{0.05^2}$$

$$n^0 = \frac{(1.96)^2 * 0.5(0.5)}{0.05^2}$$

$$n^0 = 384$$

Since source population is less than 10,000 correction formula was applied. Annual patient flow of chronic otitis media was 1720.(HMIS report)

$$n = \frac{n_0}{1 + \frac{n_0 - 1}{N}}$$

$$\text{Where } n_0 = \frac{z^2 pq}{e^2}$$

n = Sample size

N = Population size

This brings the sample size to be 314 and taking 5% contingency the final sample was 329.

4.7 Sampling procedures

The study participants were selected by means of systematic random sampling technique, as the total number of patients was estimated for the study period. The first patient was selected via lottery method, and then every other patient was approached for data collection with estimated 5th interval.

4.8 Data collection tools and procedures

Patients' medical records were retrieved and reviewed. Data was collected from charts using a structured checklist. The data collection format and questions was prepared by reviewing different literatures. Data was gathered from logbook records of ENT patient registry over the period of one year (from September 1st, 2021 to August 31st, 2022). Two professional healthcare workers were recruited and trained on data collection checklist and procedures.

4.9 Study variables

4.9.1 Dependent variable

-Cholesteatoma

4.9.2 Independent variables

- Reduced hearing or hearing loss
- demographic characteristics: Age, Sex, Residence
- Intermittent foul smelling discharge
- Chronic diseases: HIV, DM, HTN
- History of previous surgery: tympanoplasty, gormate insertion,
- History of childhood ear discharge, cleft plate
- History of skull fracture

Commented [FU14]: What is a GORMATE??? At your stage of residency you should know the right spelling!!!

4.10 Operational definition

- Chronic suppurative otitis media (CSOM) is defined as a perforated tympanic membrane with persistent drainage from the middle ear for more than 2-6 weeks.

- Cholesteatoma is operationally defined as a physician-diagnosed condition characterized by persistent ear discharge unresponsive to antibiotics, accompanied by the presence of attic crust in a retraction pocket and visual identification of squamous epithelium in the middle ear.

4.11 Data processing and analysis

Data entering, coding, and cleaning was performed using Epi-info version 7.2.2.2 and **will** then be exported to SPSS version 26 to carry out statistical analysis. Frequency and cross tabulation was computed. Descriptive statistics such as mean, median, percentage, frequencies, interquartile range and standard deviation ~~was-were~~ computed for demographic and clinical characteristics of patients binary logistic regression was run to determine associations between the independent and dependent variables. Those variables with p value of ≤ 0.25 in bivariate logistic regression were included in the multivariable logistic regression model to compute adjusted odds ratio at 95% confidence interval. Hosmer-Lemeshow goodness-of-fit test was run to test the fitness of the model. Variables with p-value ≤ 0.05 were considered as statistically associated with the outcome variable. Finally, the study findings were presented using diagrams, tables and figures.

Commented [FU15]: Is it not done yet?

4.12 Data quality management

To ensure data quality, data collection tool was prepared after thorough review of relevant literatures and related studies. An English version, pretested checklist was used to collect the data. Brief training for the data collectors (two health professionals) about the process of data collection was given before the actual data collection. The data collection procedure was closely supervised, and each day, filled checklists was double-checked manually for consistency and completeness by the principal investigator before proceeding to statistical analysis.

4.13 Ethical consideration

Ethical clearance was obtained from Ethical Review Committee of SPHMMC. Clearance letter was submitted to the medical director before carrying out the actual data collection for the study. This was followed by introduction and familiarization of the data collectors with the study subunits.

During data collection, the information obtained from medical record was kept confidential and anonymous. It will not be used for other purpose.

4.14 Dissemination of the study findings

The finding of this study will be submitted to Department of Otorhinolaryngology, Head and Neck Surgery, St Paul's Hospital Millennium Medical College as a partial fulfillment of the requirements for the specialty certificate in Otorhinolaryngology-Head and Neck Surgery. The outcome of this study will be presented to the higher officials of the college. Additionally, the manuscript will be submitted to a peer-reviewed scientific journal for possible publication.

5. Results

5.1 Demographic characteristics

The total number of study participants ~~on in~~ this study ~~were was~~ 329. The median age of the study participants ~~were was~~ 26 (IQR=19). Around two third of the participants 207(62.9%) were female. ~~almost half 152 (46.2%) of the study participants~~ Regarding the place of study participants residence ~~almost half 152(46.2%) of them were form~~ was from outside Addis Ababa (Table 1).

Table 1: demography characteristics of patients with Chronic Suppurative Otitis Media at SPHMMC, Addis Ababa, Ethiopia 2023(n=329).

Variable	Category	Frequency	Percent
Age	7-15	48	14.6
	15-25	114	34.7
	25-45	129	39.2
	45-65	38	11.6
	Total	329	100.0
Sex	Female	207	62.9
	Male	122	37.1
	Total	329	100
Residence	Addis Ababa	177	53.8
	Other than Addis	152	46.2
	Total	329	100

5.2. Prevalence of cholesteatoma and characteristics of patients with COM

The prevalence of Cholesteatoma among ~~chronic otitis media~~ patients with chronic otitis media was 35 (10.6%). Almost a quarter of the study participants 246 (74.8%) had history of childhood ear discharge. Regarding the duration of the ear discharge, the median of the duration in years was 15 years of discharge (IQR=15). ~~where~~ The majority of the study participants 126 (38.3%) fell in the category between 15 to 30 years.

~~The~~ The majority 301 (91%) of the study participants had a central tympanic membrane perforation.

Just above two third 218 (66.3%) of the study participants had a conductive hearing loss.

More than half 187 (56.8%) of the study participants had a bilateral ear involvement, while among 35 study participants who had cholesteatoma more than three-fourth 27 (77.1%) had unilateral ear involvement. Regarding history of previous ear surgery only 20 (6.1%) of the study participants

Commented [FU16]: What about the rest?

Commented [FU17]: Others? No hearing loss? Mixed? SNHL?

Commented [FU18]: What is a bilaterala ear involvement? Do you want to say they had on both sides a cholesteatoma or both sides CSOM?

Commented [FU19]: As above

had a history of previous ear surgery. This study does did not found participants who had history of cleft palate surgery and history of skull base fracture (**Table 2**).

Table 2: Prevalence of Cholesteatoma and characteristics of patients with chronic suppurative otitis media at SPHMMC, Addis Ababa, Ethiopia 2023(n=329).

Variable	Category	Frequency	Percent
Cholesteatoma	No	294	89.4
	Yes	35	10.6
	Total	329	100
History of child hood ear discharge	No	83	25.2
	Yes	246	74.8
	Total	329	100
Duration of ear discharge in years	<5	60	18.2
	5-15	109	33.1
	15-30	126	38.3
	>=30	34	10.3
	Total	329	100
History of previous ear surgery	No	309	93.9
	Yes	20	6.1
	Total	329	100
History of cleft palate surgery	No	329	100
	Yes	0	0
	Total	329	100
History of skull fracture	No	329	100
	Yes	0	0
	Total	329	100
Type of perforation	Atticoantral	28	8.5
	Central	301	91.5
	Total	329	100
Type of hearing loss	CHL	218	66.3
	Mixed	104	31.6
	SNL	7	2.1
	Total	329	100
Ear involved for chronic otitis media	bilateral	187	56.8
	unilateral	142	43.2
	Total	329	100
Ear involved for Cholesteatoma	Unilateral	27	77.1
	Bilateral	8	22.9
	total	35	100

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Commented [FU21]: ? What do you want to say?

Commented [FU22]: Please format it, that the table looks nice and need. Either all over left or centered data. Also same font for the whole table

5.3 Prevalence Chronic illness among study participants

~~Regarding~~ Only a small proportion of the study participants were suffering from chronic illnesses. ~~chronic illness only~~ 6 (1.8%) of ~~the~~ study participants had DM. Among ~~the~~ study participants 7 (2.1%) ~~of them~~ were carriers of HIV/AIDS. -Another chronic illness observed was HTN ~~where~~ 7 (2.1%) of the patients seen at ENT clinics had HTN (Table 3).

Table 3: Chronic illness with chronic suppurative otitis media at SPHMMC, Addis Ababa, Ethiopia 2023(n=329).

	Category	Frequency	Percent
DM	No	323	98.2
	Yes	6	1.8
	Total	329	100
HIV	No	322	97.9
	Yes	7	2.1
	Total	329	100
HTN	No	322	97.9
	Yes	7	2.1
	Total	329	100

Commented [FU23]: Is it 7 of the patients seen at ENT clinic or 7 of the study participants?

5.4 Chief complaint of study participants

The main chief complaint of study participants was ear discharge. ~~where~~ 287 (87.2%) of the participants visited the clinic due to ear discharge. The following chief complaint ~~of 83 (25.2%) study participants~~ was hearing loss ~~and among the study participants 83(25.2%) had complaint of hearing loss~~. Among ~~the~~ study participants who had cholesteatoma none of them had ~~a~~ complaints of facial paralysis or tinnitus but two and three patients ~~with chronic otitis media~~ respectively presented with chief complaints of facial paralysis and tinnitus among patients ~~with chronic otitis media~~ (Figure 2).

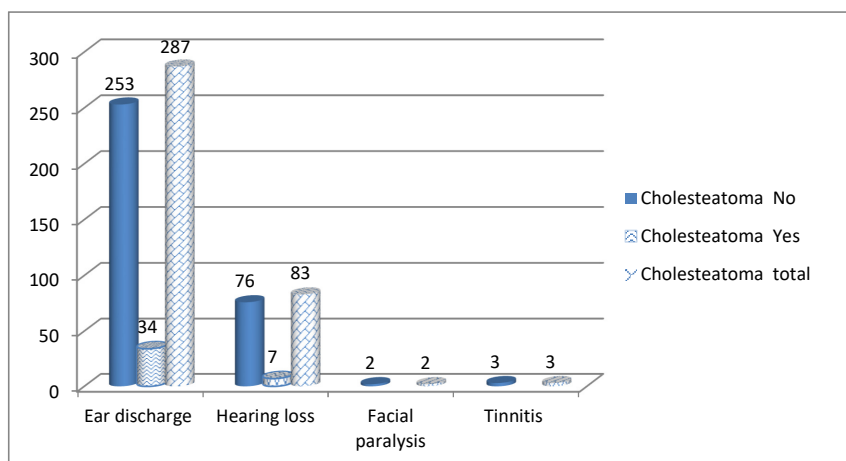


Figure 2: Chief complaints of patients with Chronic Suppurative Otitis Media at SPHMMC, Addis Ababa, Ethiopia 2023(n=329).

Commented [FU24]: The legend does not make sense: Cholesteatoma yes and no is ok, bit not to call the summary of both Cholesteatoma total – I assume it's all study participants. Therefore I would call "Cholesteatoma no/yes" rather as CSOM with or without Chole

5.5. Sign and symptoms of study participants

All of the study participants 329 (100%) both with cholesteatoma and without ~~have had~~ signs and symptoms of ear discharge. ~~Regarding hearing loss a~~ Almost all 34 (97%) of the study participants with cholesteatoma had hearing loss, while ~~amongst~~ those without cholesteatoma had 259 (88%) hearing loss. Among study participants with cholesteatoma 5 (14%) ~~had reported~~ tinnitus and only 40 (13.6%) of the study participants without cholesteatoma ~~had reported~~ tinnitus (**Figure 3**).

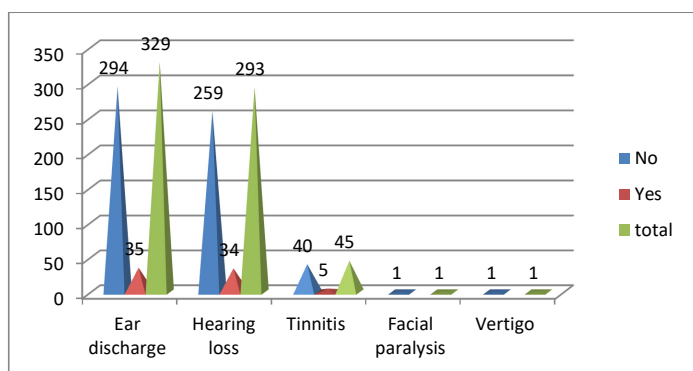


Figure 3: sign and symptoms of study participants with Chronic Suppurative Otitis Media at SPHMMC, Addis Ababa, Ethiopia 2023(n=329).

Commented [FU25]: Use for all figures the same design.

5.6. Complication of patient with and without cholesteatoma

All—most all of the study participants had a complication of hearing loss. Patients with cholesteatoma had complication 10 (28.6%), 8 (22.9%), 2 (5.7%), 2 (5.7%) and 1 (2.9%) of Tegmen erosion, Ossicular erosion, post auricular fistula, facial canal exposure and Sigmoid sinus exposure respectively. One patient (0.3%) without cholesteatoma had a facial palsy. Regarding vertigo 5 (1.8%) of the patients without cholesteatoma and 3 (8.6%) of patients with cholesteatoma had complication of vertigo (figure 3).

Commented [FU26]: Hearing loss is not a complication, it's a symptom

Commented [FU27]: Please rewrite this sentence that one can easy relate numbers and complications.

Commented [FU28]: Rewrite. To start a sentence with regarding is not a good English

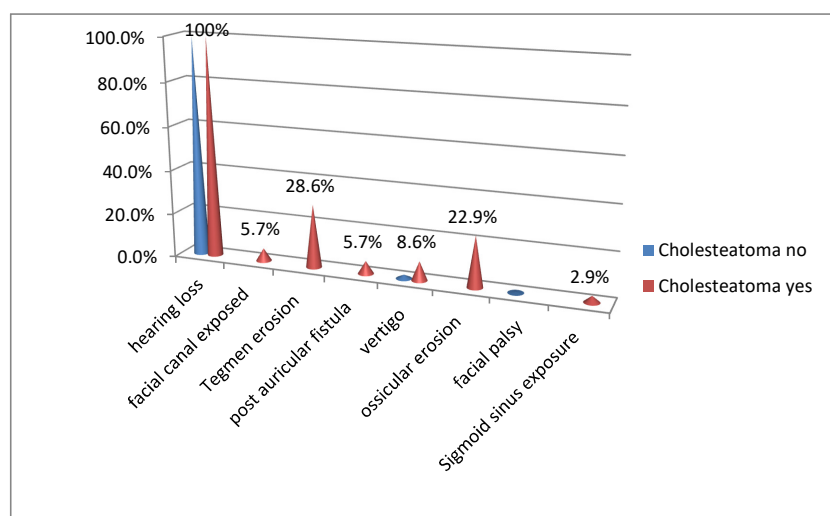


Figure 4: Complication of patient with and without cholesteatoma among Chronic Suppurative Otitis Media patients at SPHMMC, Addis Ababa, Ethiopia 2023(n=329)

Commented [FU29]: Same design for all figures

5.7 Factors associated with cholesteatoma

The bivariate analysis showed that only four variables were with a P- value less than 0.25. The four variables with a P- value less than 0.25 have been exported to the multivariable logistic

regression. The multivariable analysis showed that only two variables have shown a significant association.

Accordingly, the likelihood of developing cholesteatoma among COM patients with longer duration of ear discharge (≥ 30 years) was 17.8 times [AOR 17.8 (CI 1.511, 208.7) more likely to develop cholesteatoma compared with their counterpart. In addition the log of developing cholesteatoma was 4% times [AOR 0.004(CI 0.001, 0.018)] less likely to on those who had central perforation than those who had attic perforation **(Table 4)**.

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Table 4: Factors associated with cholesteatoma among Chronic Suppurative Otitis Media patients at SPHMMC, Addis Ababa, Ethiopia 2023(n=329). (Bivariate and multivariate analysis)

Variable	Category	COR (95%CI)	AOR (95%CI)
Residence	Addis Ababa	1	1
	Other than Addis	1.636 (.806, 3.321)	0.392 (0.133, 1.151)
Ear involved	Unilateral	1	1
	Bilateral	0.466 (0.228, 0.953)	2.239 (0.774, 6.474)
Type of perforation	Attic	1	1
	Central	0.009 (0.003, 0.028)	0.004(0.001, 0.018)*
Duration of ear discharge	<5	1	
	5-15	0.937 (0.348, 2.522)	10.19 (0.75, 138.0)
	15-30	0.946 (0.361, 2.483)	4.945 (0.482, 50.74)
	≥ 30	0.473 (.093, 2.419)	17.8 (1.511, 208.7)*

* shows statistically significant variable

6. Discussion

The aim of this study was to assess the prevalence of cholesteatoma among patients with chronic suppurative otitis media and its associated factors. The study assessed that the prevalence of cholesteatoma among patients with chronic otitis media was 10.6% and the study also identified that type of perforation and duration of ear discharge to be significantly associated with cholesteatoma among patients with chronic suppurative otitis media.

In this study the prevalence rate of cholesteatoma among patients with chronic otitis media was recorded as 10.6%, which was in line with a study conducted in Pakistan, Rawalpindi, among patients with CSOM showed that the prevalence rate of Cholesteatoma was 10.63% (4). But the prevalence rate found in this study was higher than in a study conducted in Donka Medical University, Guinea, which showed that the prevalence rate of Cholesteatoma there was 1.33% (32). The reason for this deviation is that the later study used all patients attended their ENT clinic as a denominator but this study used only chronic otitis media patients. The prevalence rate of this study was much lower in a study conducted in Brazil and the Republic of Kosovo with a prevalence rate of 25.5% and 18.08% respectively (24, 33). The reason for this deviation could be due to difference in health seeking behavior. Both countries are upper middle income countries with advanced medical technology. Therefore, a high index of suspicion and modern

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Write like: In our study it was seen, that...

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imaging diagnostic procedures are available which might result in higher prevalence rates and early diagnosis of choleateatoma.

Commented [FU34]: This reason might be good, even though I do not feel it's convincing. I would also suspect genetics or other unknown reasons

In this study it was found that the likelihood of developing cholesteatoma among COM patients with longer duration of ear discharge (≥ 30 years) was 17.8 times [AOR 17.8 (CI 1.511, 208.7)] more likely compared with their counterpart. Cholesteatoma typically arises from the migration of the epithelial tissue from the external ear canal into the middle ear. Prolonged ear discharge can allow the migration of epithelial cells into the middle ear cavity, contributing to the formation of cholesteatoma. ~~and the~~ Another explanation ~~is~~ might be that longer duration of ear discharge shows persistent ear infection which leads to changes in the middle ear environment, promoting the growth of abnormal skin cells and the formation of cholesteatoma (38).

Commented [FU35]: Patients with!!!

Commented [FU36]: Who is their counterpart?

This study has revealed that the probability of developing cholesteatoma was 4% times [AOR 0.004 (CI 0.001, 0.018)] less likely ~~on~~ for those patients who had a central perforation, than for those who had an atticocranial perforation. Marginal perforations are more sinister, ~~because it they~~ are sometimes ~~is~~ associated with cholesteatoma formation. Stratified squamous epithelium from the external auditory canal can grow into the middle ear in any type of marginal perforation by immigration and form a cholesteatoma. Therefore, all marginal perforations are considered dangerous (39).

Anatomic and morphologic details in the posterior-superior quadrant hold 28.7% largest quadrants of the ear drum and may explain the greater incidence of retraction pockets and marginal perforations that provide origin for the cholesteatoma (40).

Commented [FU37]: This sentence does not make sense, please rewrite/explain proper

Commented [FU38]: Your discussion is unbelievable short! Please put a bit more effort into that.

7. Conclusion and recommendation

Commented [FU39]: Before the conclusion there is usually some paragraph about strengths and limitations. Please add this

7.1 Conclusion

This study has found that the prevalence rate of cholesteatoma among patients with chronic otitis media was 10.6%. This study has revealed that the development of choleateatoma is associated with longer duration of ear discharge and a marginal perforation of tympanic membrane.

7.2 Recommendations

- Health care professional should provide follow up and monitoring for patients diagnosed with chronic otitis media.
- Ministry of health in collaboration with respected media should provide health education and information to patients with chronic otitis media about the potential risks and complications associated with prolonged ear discharge.
- Health care professionals should encourage individuals with chronic otitis media, especially those experiencing prolonged ear discharge, to seek early evaluation and management by ENT specialist.

Commented [FU40]: You write in each recommendation: ... should do ...
Try to improve the sentences, that's it's not such a redundancy. I also wonder if it's good to say the MOH or anybody should ...

8. References

1. Digna C. Rosario, Mendez. MD. Chronic Suppurative Otitis: StatPearls Publishing LLC; 2023 [cited 2023 October 17]. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK554592/#:~:text=Chronic%20suppurative%20otitis%20media%2C%20also,middle%20ear%20and%20mastoid%20cavity.>
2. Lawrence R. Lusting, Charles J. Limb, Marlene L. Durand. Chronic otitis media and cholesteatoma in adults: UpToDate; 2023 [cited 2023 October 17].
3. Organization. WH. Prevention of Deafness and Hearing Impairment. Geneva: 1986 Contract No.: A39/14.
4. Muhammad Musharaf Baig, Muhammad Ajmal, Ifra Saeed, Fatima. S. Prevalence of Cholesteatoma and its Complications in Patients of Chronic Suppurative Otitis Media. Journal of Rawalpindi Medical College (JPMC). 2011;15(1):16-7.
5. Manas Ranjan Rout, Diganta Mohanty, Y Vijaylaxmi, B Kamalesh, Chakradhar. M. Prevalence of cholesteatoma in chronic suppurative otitis media with central perforation. Indian Journal of Otolaryngology 2012 18(1).
6. Cruz OL, Costa SS. Otologia Clínica e Cirúrgica. EdRevinter. 1999.
7. Costa SS, Roithmann R, Matheus MC. A patogênese dos colesteatomas. Rev Bras Otor. 1992;57(4):30-5.
8. G. Isaacson. "Diagnosis of pediatric cholesteatoma". Pediatrics. 2007;120(3):603–8
9. M. T. Semaan, C. A. Megerian. The pathophysiology of cholesteatoma. Otolaryngologic Clinics of North America., 2006;39(6):1143–59.
10. C. Dornelles, S. S. da Costa, L. Meurer, C. Schweiger. Some considerations about acquired adult and pediatric cholesteatomas. Revista Brasileira de Otorrinolaringologia. 2005;71(4):536–46.
11. J. M. Robinson. Cholesteatoma: skin in the wrong place,. Journal of the Royal Society of Medicine. 1997;90(2):93–6.
12. K. C. Y. Sie. Cholesteatoma in children. Pediatric Clinics of North America. 1996;43(6):1245–52.

13. J. Nevoux, M. Lenoir, G. Roger, F. Denoyelle, H. D. Le Pointe, E.-N. Garabedian. Childhood cholesteatoma. *European Annals of Otorhinolaryngology , Head and Neck Diseases*. 2010;127(4):143–50
14. Rout MR, Mohanty D, Vijaylaxmi Y, Kamalesh B, Chakradhar M. Prevalence of cholesteatoma in chronic suppurative otitis media with central perforation. *Indian J Otol* 2012;18(1):7.
15. Monasta L, Ronfani L, Marchetti F, Montico M, Brumatti LV, Bavcar A, et al. Global Burden of disease caused by otitis media: systematic review and global estimates. *PLoS ONE*. 2012;7(4).
16. M. Tos. Incidence, etiology and pathogenesis of cholesteatoma in children. *Advances in Oto-Rhino-Laryngology*. 1988;40:110–7.
17. C. D. Bluestone, J. O. Klein, C.D. Bluestone, editors. *Intratemporal complications and sequelae of otitis media in Pediatric Otolaryngology*. 4 ed. Saunders, Philadelphia, USA 2003.
18. J. E. A. P. de Aquino, N. A. C. Filho, J. N. P. de Aquino. Epidemiology of middle ear and mastoid cholesteatomas: study of 1146 cases. *Brazilian Journal of Otorhinolaryngology*. 2011;77(3): 341–7.
19. E. Olszewska, M. Wagner, M. Bernal-Sprekelsen, et al. Etiopathogenesis of cholesteatoma. *European Archives of Oto-Rhino-Laryngology*. 2004;261(1): 6–24
20. M. Nelson, G. Roger, P. J. Koltai, et al. Congenital cholesteatoma: classification, management, and outcome. *Archives of Otolaryngology-Head and Neck Surgery*. 2002;128(7):810–4.
21. W. P. Potsic, S. B. Korman, D. S. Samadi, R. F. Wetmore. Congenital cholesteatoma: 20 years' experience at the Children's Hospital of Philadelphia. *Otolaryngology-Head and Neck Surgery*. 2002;126(4):409–14.
22. R. Shihada, A. Brodsky, M. Luntz. Giant cholesteatoma of the temporal bone. *Israel Medical Association Journal*. 2006;8(10):718–9.
23. Mustafa A, Heta A, Kastrati B, Dreshaj Sh. Complications of chronic otitis media with cholesteatoma during a 10-year period in Kosovo. *Eur Arch Otorhinolaryngol* 2008;265:1477–82.
24. Aziz Mustafa, Shkëlzen Kuçi, Behramaj A. Management of cholesteatoma complications: Our experience in 145 cases. *Indian Journal of Otolaryngology*. April 2014;20(2).
25. Browning GG, Weir J, Kelly G, Swan IRC. *Scott-Brown's Otorhinolaryngology Head & Neck Surgery*. : Roca Raton: CRC Press; 2018.
26. Cristina Dornelles, Sady S. da Costa, Luíse Meurer, Cláudia Schweiger. Some considerations about acquired adult and pediatric cholesteatomas. *Rev Bras Otorrinolaringol*. 2005;71(4):536–46.
27. J. M. Triglia, J. C. Gillot, A. Giovanni, M. Cannoni. Cholesteatoma of the middle ear in children. Apropos of 80 cases and review of the literature. *Annales d'Oto-Laryngologie*. 1993;110(8):437–43.
28. C.-L. Kuo, C.-F. Lien, C.-H. Chu, A.-S. Shiao. Otitis media with effusion in children with cleft lip and palate: a narrative review. *International Journal of Pediatric Otorhinolaryngology*. 2013;77(9):1403–9
29. S. C. Prasad, S.-H. Shin, A. Russo, G. di Trapani, M. Sanna. Current trends in the management of the complications of chronic otitis media with cholesteatoma. *Current Opinion in Otolaryngology and Head and Neck Surgery*. 2013;21(5):446–54.
30. Dongol K, Rayamajhi P, Gurung U. Complications of Acute and Chronic Otitis Media in a Tertiary Referral Center in Nepal. *Turk Arch Otorhinolaryngol* 2020;58(4): 234–40.
31. Muhammad Musharaf Baig, Muhammad Ajmal, Ifra Saeed, Syeda Fatima. Prevalence of Cholesteatoma and its Complications in Patients of Chronic Suppurative Otitis Media. *Journal of Rawalpindi Medical College (JRMCC)*. 2011;15(1):16–7.
32. Abdoulaye Keita, Ibrahima Diallo, Mamadou A., Diallo, Mamadou M. R., Diallo, et al. Cholesteatoma of the middle ear: about 50 cases in Donka University Hospital. *International Journal of Otorhinolaryngology and Head and Neck Surgery*. 2022;8(10):787–91.
33. Rosito LP, da Silva MN, Selaimen FA, Jung YP, Pauletti MG, Jung LP, et al. Characteristics of 419 patients with acquired middle ear cholesteatoma. *Braz J Otorhinolaryngol*. 2017;83:126–31.
34. Olszewska E, Wagner M, Bernal-Sprekelsen M, Ebmeyer J, Dazert S, Hildmann H, et al. Etiopathogenesis of cholesteatoma *Eur Arch Otorhinolaryngol*. 2004;261(1):6–24.

35. Abhay Gupta, S.R. Agarwal. A Study of Prevalence of Cholesteatoma in Complications of Suppurative Otitis Media. IJO & HNS. 1998;50(2).
36. Chin-Lung Kuo, An-Suey Shiao, Matthew Yung, Masafumi Sakagami, Holger Sudhoff, Chih-Hung Wang, et al. Updates and Knowledge Gaps in Cholesteatoma Research
BioMed Research International. 2015;17.
37. E. Matin~o, M. P. Venegas, S. D´íaz a, J. Pinart. Antibiotic treatment in surgery for cholesteatoma," Anales Otorrinolaringologicos Ibero-Americanos 1999;26(5):445-55.
38. James T. Castle. Cholesteatoma Pearls: Practical Points and Update. Springer Head and Neck Pathology SPECIAL ISSUE: EAR. 2018) 12:419-29.
39. Rout, Manas Ranjan, Mohanty Diganta, Vijaylaxmi Y, Kamalesh B, Chakradhar M. Prevalence of cholesteatoma in chronic suppurative otitis media with central perforation. Indian Journal of Otology Jan-Mar 2012;18(1):7-10.
40. João Paço, Carla Branco, Hugo Estibeiro, Diogo Oliveira e Carmo. The posterosuperior quadrant of the tympanic membrane. OTOLOGY AND NEUROTOLOGY. 2009 (140):884-8.

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Please revise

9. ANNEX

St Paul hospital millennium medical college

9.1 Checklist

Part I: socio-demographic

S.No	Characteristics	Response	Skip to
101	Age	_____ in years	
102	Sex	1. Female 2. Male	
103	Residence	1. Addis Ababa 2. Other than Addis	

Part II: cholesteatoma related factors

201	Cholesteatoma	1. Yes 2. No	
202	History of child hood ear discharge	1. Yes 2. No	
203	Presenting chief compliant	1. Ear discharge 2. Not responding for antibiotics	

		3. Hearing loss 4. Facial paralysis 5. Tinnitus 6. Vertigo 7. Other(specify)	
204	If there was ear discharge for how long	_____ in years	
205	History of previous ear surgery	1. Yes 2. No	
206	History of cleft palate surgery	1. Yes 2. No	
207	History of skull fracture	1. Yes 2. No	
208	If yes to #201 type of perforation	1. Central 2. Atticoantral	

Part III: Presence of chronic illness

301	DM	1. Yes 2. No	
302	HIV	1. Yes 2. No	
303	HTN	1. Yes 2. No	
304	Others(specify) _____		

Commented [FU42]: Please format the table neat and nice

Part IV: presence of complications

401	hearing loss	1. Yes 2. No	
402	facial canal exposed	1. Yes 2. No	
403	Tegmen erosion	1. Yes 2. No	
404	post auricular fistula	1. Yes 2. No	
405	vertigo	1. Yes 2. No	

Commented [FU43]: Same here. Why are some left, others more in the middle?

406	ossicular erosion	No	3. Yes
407	facial palsy	No	3. Yes
408	Sigmoid sinus exposure	No	3. Yes
409	Others (specify)		

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