EFFECT OF DRILL INDUCED NOISE ON CONTRALATERAL NORMAL EAR FOLLOWING CORTICAL MASTOIDECTOMY

By

DR. DANDOLU SANJANA KRISHNA REDDY

DISSERTATION SUBMITTED TO SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH CENTRE, KOLAR

In partial fulfilment of the requirements for the degree of

MASTER OF SURGERY

IN

OTORHINOLARYNGOLOGY

Under the guidance of

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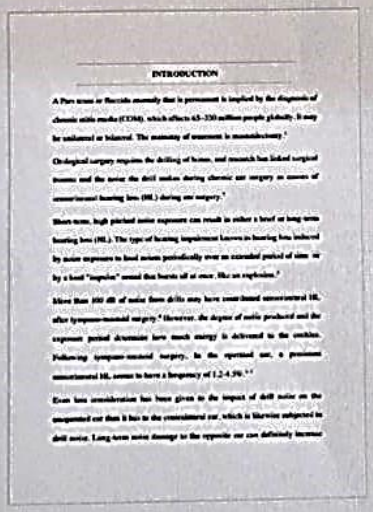

INTRODUCTION

A Pure tones or fluctuate anomaly that is permanent is implied by the diagnosis of chronic otitis media (COM), which affects 65–330 million people globally. It may be unilateral or bilateral. The mainstay of treatment is tympanoplasty.[1]

Otological surgery requires the drilling of bones, and research has linked surgical tinnitus and the noise the drill makes during chronic ear surgery as sources of sensorineural hearing loss (HL) during ear surgery.[2]

Short-term, high pitched noise exposure can result in either a brief or long-term hearing loss (HL). The type of hearing impairment known as hearing loss induced by noise exposure to loud noises periodically over an extended period of time or by a loud "impulse" sound that bursts all at once, like an explosion.[3]

More than 100 dB of noise from drills may have contributed sensorineural HL after tympano-mastoid surgery.[4] However, the degree of noise produced and the exposure period determine how much energy is delivered to the cochlea. Following tympano-meatal surgery, in the operated ear, a prominent sensorineural HL seems to have a frequency of 1.2-4.5%.[5,6]

Even less consideration has been given to the impact of drill noise on the unoperated ear than it has to the sensorineural ear, which is likewise subjected to drill noise. Long-term noise damage to the opposite ear can definitely increase

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PRIOR PERMISSION TO START OF STUDY

The Institutional Ethics Committee of Sri Devaraj Urs Medical College, Tamaka, Kolar has examined and unanimously approved the synopsis entitled **"Effect of drill induced noise on contralateral normal ear following cortical mastoidectomy"** being investigated by **DR. DANDOLU SANJANA KRISHNA REDDY**, Dr. K C Prasad in the Department of ENT at Sri Devaraj Urs Medical College, Tamaka, Kolar. **Permission is granted by the Ethics Committee to start the study.**

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Dr.DANDOLU SANJANA KRISHNA REDDY

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

S. No	Abbreviation	Explanation
1	AC	Air conduction
2	BC	Bone conduction
3	ABG	Air Bone Gap
4	HL	Hearing loss
5	CSOM	Chronic suppurative otitis media
6	AOM	Acute otitis media
7	OM	Otitis media
8	Hz	Hertz
9	dB	Decibel
10	EAC	External auditory canal
11	HRCT	High resolution computed tomography
12	PTA	Pure tone audiometry
13	OAE	Otoacoustic emissions

ABSTRACT

Introduction: Chronic suppurative otitis media is a long standing infection of the middle ear cleft. This leads to ear discharge and perforation of tympanic membrane. It is highly prevalent in individuals from poor socio-economic conditions. Mastoidectomy with or without tympanoplasty is done. The drill used in ear surgery will generate noise that may damage the affected or opposite inner ear and may lead to decrease in hearing that may be transient or permanent.

Aim and Objective:

1. To describe the opposite normal ear's hearing acuity after mastoid operation.

2.To evaluate impact of drill sound on contralateral normal ear

Methodology: Patients diagnosed with CSOM presenting to department of otorhinolaryngology of R.L.Jalappa Hospital, Tamaka, Kolar from January 2021 to August 2022.

Fulfilling the inclusion and exclusion criteria patients underwent routine clinical and radiological investigations. After undergoing the surgeries, all patients were followed up on postoperative day 7 and 1 month after surgery and PTA was done to evaluate the hearing outcome and those findings were noted and those were compared with preoperative results.

Type of study: Observational study

Results: Total 61 patients were included in our study. The mean preoperative PTA of contralateral ear bone conduction among the study participants was 6.48. Similarly, the mean

post-operative PTA of contralateral ear bone conduction at 7th day for the same participants was 7.77. This mean difference was statistically significant according to Paired T-test (P = 0.001).The mean preoperative PTA of contralateral ear bone conduction among the study participants was 6.48. Similarly, the mean post-operative PTA of contralateral ear bone conduction at 1st month for the same participants was 6.02. This mean difference was not statistically significant according to Paired T-test (P = 0.208).The mean difference was not statistically significant for air bone gap and air conduction before and after the surgery.

Conclusion: Mastoid drilling is associated with an incidence of hearing loss which is minimal. Temporary threshold shift was demonstrated in our study. PTA alone cannot be used to detect this type of hearing loss so other audiological investigations such as otoacoustic emissions can be done.

Keywords: cortical mastoidectomy , unilateral CSOM, drill generated noise, hearing outcome.

INTRODUCTION

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A Pars tensa or flaccida anomaly that is permanent is implied by the diagnosis of chronic otitis media (COM), which affects 65–330 million people globally. It may be unilateral or bilateral. The mainstay of treatment is mastoidectomy.[1]

Otological surgery requires the drilling of bones, and research has linked surgical trauma and the noise the drill makes during chronic ear surgery as causes of sensorineural hearing loss (HL) during ear surgery.[2]

Short-term, high pitched noise exposure can result in either a brief or long-term hearing loss (HL). The type of hearing impairment known as hearing loss induced by noise exposure to loud noises periodically over an extended period of time or by a loud "impulse" sound that bursts all at once, like an explosion.[3]

More than 100 dB of noise from drills may have contributed sensorineural HL after tympano-mastoid surgery.[4] However, the degree of noise produced and the exposure period determine how much energy is delivered to the cochlea. Following tympano-mastoid surgery, In the operated ear, a persistent sensorineural HL seems to have a frequency of 1.2-4.5%.[5–7]

Even less consideration has been given to the impact of drill noise on the unoperated ear than it has to the contralateral ear, which is likewise subjected to drill noise. Long-term noise damage to the opposite ear can definitely increase the chance of temporary hearing loss.[5] Even so, the noise level on the opposing ear is only lowered by 5–10 dB.[2]

Depending on the initial severity, noise-induced HL recovers after overexposure with an exponential time course for two to three weeks. Loss of primary neurons likely has

significant effects on how the ear processes suprathreshold stimuli, even while threshold sensitivity has recovered, especially in challenging listening contexts.[8]

Both through the skull and around the ear, a drill-induced noise can reach the unoperated ear.[2] In addition to mechanical death of outer hair cells, the type of hearing loss brought on by noise is also brought on by many biological processes involved in hair cell proliferation. After excessive exposure, damage to hair cells may become apparent in a matter of minutes and may eventually result in hair cell death over the course of many days. Noise-induced hearing loss may be influenced by genetic variables.[3] Other likely causes of postoperative hearing SNHL in a patient after middle ear surgery include vibrations, inner ear damage, ossicular manipulation, and a few unidentified factors.[1]

In the past, electrocochleography, high frequency audiometry, otoacoustic emissions (OAEs), and pure tone audiometry (PTA) have all been used to examine how drill-induced trauma on the cochlea during ear surgery impacts it.[9,10,1112] According to Pye and Ulehlova, loud noise generated significant modifications that first appeared at the commencement of the external hair cells, then moved to internal hair cells to finally damaged all cells in afflicted area.[13] Since noise-induced cochlear damage first affects outer hair cells, it makes sense to use OAEs and audiometry to evaluate hearing in the healthy contralateral ear.[14,2,5,15]

This study sought to determine whether drilling noise results in any hearing loss in the opposite ear, to determine whether any such loss would be brief or permanent, also investigate the relationship between hearing loss and drill-induced noise following mastoidectomy.

OBJECTIVES

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- To describe the opposite normal ear's hearing acuity after mastoid operation.

- To evaluate impact of drill sound on contralateral normal ear.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Structure of Human Ear

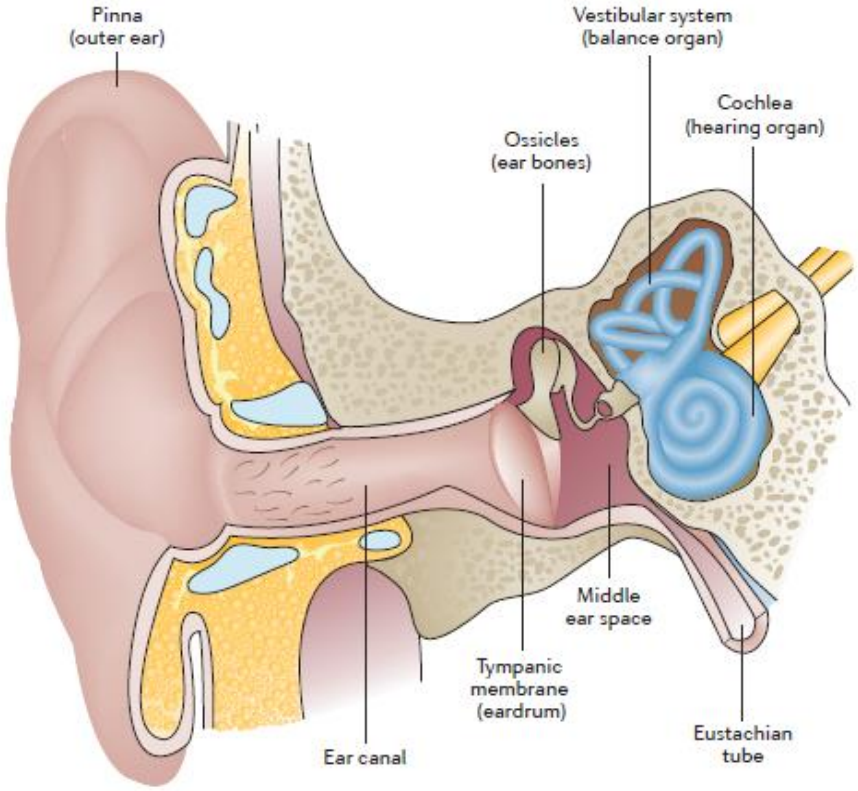

Figure 1: Anatomy of Humar ear

There are three parts to an ear: the external, middle, and internal parts. The outer ear includes the auricle (also known as the pinna) and the ear canal. The middle ear and the outer ear are separated by the tympanic membrane (eardrum), a narrow cone-shaped membrane. The middle ear is made up by the middle ear chamber and the malleus, incus, and stapes, which are connected to the tympanic membrane. Through the oval window, the cochlea and semicircular ducts, which are a portion of the inner ear, are linked to the middle ear. The middle ear cavity and the nasopharynx are connected by the eustachian tube.[5,7]

Mechanism of hearing:

Several processes that convert incoming sound waves into electrical impulses are necessary for hearing. These impulses are delivered by the auditory nerve through a sophisticated series of steps to the brain.

i. The ear canal, a narrow channel, is where sound waves from the outer ear travel before reaching the eardrum.

ii. When sound waves reach the ear, the eardrum osscilates, sending those vibrations to three small bones in the middle ear. Malleus, incus, and stapes are the names given to these three bones.

iii. Sound waves conveyed from middle ear are received by the cochlea of the inner ear, which has a snail-like shape and is filled with fluid. The cochlea is split into an upper and a lower section from beginning to end by an elastic barrier. This wall is referred to as the basilar membrane because it serves as the ground floor or foundation for significant hearing structures.

iv. Once the vibrations force the fluid inside the cochlea to shake, a travelling wave forms along the basilar membrane. On top of the basilar membrane, hair cells, which are sensory cells, ride the wave.

v. Hair cells move up and down, causing stereocilia, which are small projections that resemble hair and are situated on top of the hair cells, to flex and bump against an underlying structure. When twisted, the stereocilia's tips, which resemble channels or pores, enlarge. At that point, chemicals flow into the cell and form an electrical signal.

vi. The auditory nerve conveys this electrical data to the brain, which converts it into a sound that we can recognise and understand.[5]

Transformer mechanism of middle ear:

1.**Catenary lever:** The malleus , the tympanic membrane's central attachment amplifies the sound energy , which is then sent to perilymph through the ossicular chain.

2.**Ossicular lever action:** It alters the wavelength of the rotation of malleus and incus about the axis of ossicles. The stapes moves at 2/3rd of the manubrium's speed , and the lever action of 1.5:1.

3.**Hydraulic lever:** The tympanic membrane collects the sound pressure over a larger area before transmitting it to the smaller areas , therefore the force is proportionate to the ratio of the area involved. Amplitude of oval window is significantly smaller due to transformer action than the tympanic membrane amplitude and the force(pressure) at the oval window increases by the same factor or 18.3 times[15].

Chronic otitis media with suppuration

The most obvious sign of CSOM is continual ear discharge caused by a hole in the tympanic membrane. Middle ear and mastoid cavity chronic inflammation is how CSOM is defined.

CSOM also causes conductive hearing loss by affecting the middle ear ossicles. It also increases the likelihood of spread of infection to brain and persisting sensorineural hearing loss. (hearing loss brought on by damage to the inner ear).[16]

Although the prevalence of this ailment varies greatly between nations, low- and middle-income nations are those where it occurs most frequently.[17] Significant improvements have been made worldwide since the publication of a seminal analysis on otitis media(OM) more than ten years back, especially in the areas of OM prevention through pneumococcal vaccination and OM treatment adhering to new guidelines that strongly emphasise correct

result and the prudent utilisation antimicrobials.[18]These incidents have changed the global incidence and diagnostic profile of OM.[19]

Epidemiology

The estimated annual incidence rate for CSOM is 4.8 new episodes per 1,000 people (of all ages). According to estimates, there are 31 million new CSOM incidents each year, 22% of which include children under the age of five. The first year of life has the greatest incidence rates of CSOM worldwide (15.4 new cases per 1,000 children per year).[17] The three groups where it is most prevalent are some racial population, children with craniofacial deformities, and emerging nations. The Inuit of Alaska, Canada, and Greenland, American Indians, and Australian Aborigines are believed to have the biggest prevalence of CSOM in children, with rates ranging from 7% to 46% [19,22—25]. In the South Pacific Islands, Africa, Korea, India, and Saudi Arabia, intermediate incidence rates of 1% to 6% have been documented.[16]

In India, one of the frequent otological conditions for which patients consult an otorhinolaryngologist is CSOM. [20]

Advances in pathogenesis

Otitis media is primarily an inflammatory condition that is caused by immune system's interaction with the microbial load (bacterial and viral). All known risk factors for OM are related to these two fundamental causes (figure 2) host factors like age, hereditary factors, and allergy are related to the immune system being compromised, whereas ecological factors like siblings (usually older), group day care, and season of the year are related to microbial load. [18]

The eustachian tube serves as the nasopharyngeal entry point for middle-ear infections and is crucial for the removal of middle-ear secretions.

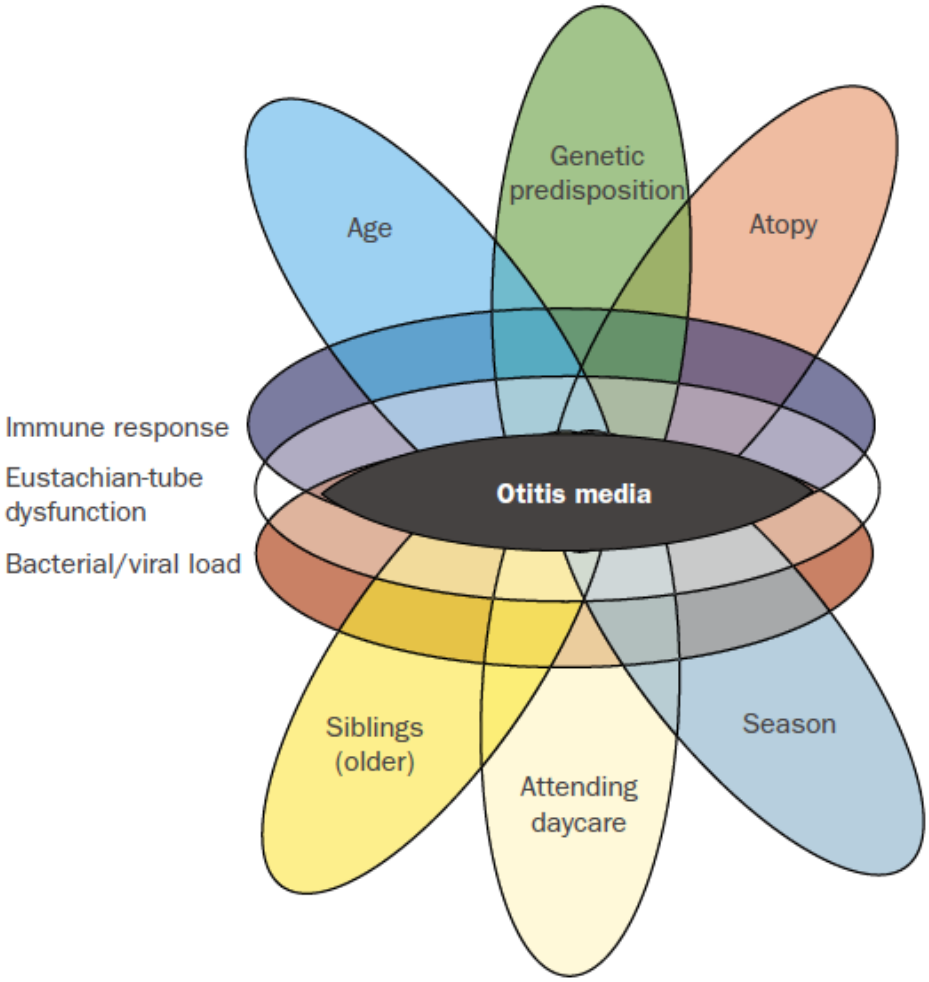

Figure 2:Aetiology of OM

AOM aetiology involves numerous factors. Nasopharynx, eustachian tube for instance, may become congested as a result of an upper respiratory viral infection (figure 3). Due to this congestion, the middle ear's tubal function is compromised, resulting in poor pressure management and clearance of secretions. If the malfunction persisted, viral and bacterial migration from the nasopharynx into the middle ear as a potential pathogen might occur. By stimulating local resident cells, bacteria or their by-products draw the inflammatory response triggered by immune system cells and is mostly responsible for clinical symptoms.[21]

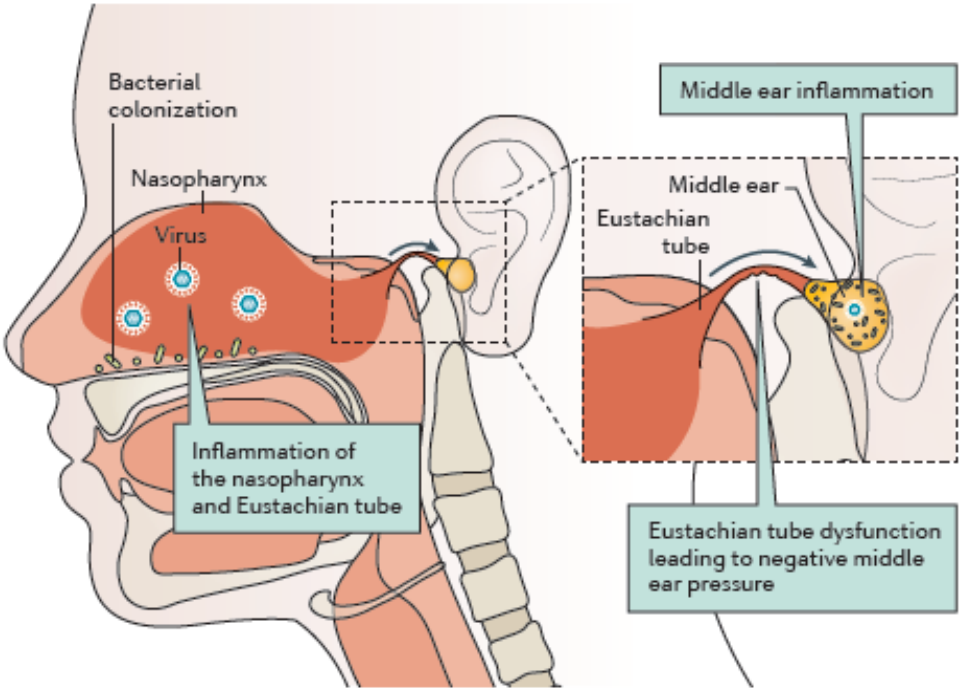

Figure 3 pathogenesis of Acute Otitis Media

OME's onset likely involves a comparable series of circumstances, despite the fact that it manifests fewer symptoms than AOM does. The middle ear cavity becomes fluid-filled when excessive mucin synthesis overwhelms normal muco-ciliary clearance systems.[22] After bacterial death in AOM, persistent inflammation is typically the initiating culprit. In this light, OME could be viewed as a typical side effect of AOM, from which it may take a long time to fully recover from. On the other hand, poor pressure management brought on by tubal dysfunction or de-novo MEE from middle ear mucosa inflammation could be the initiating culprit.[18]

Eustachian tube function

In addition to helping to protect the middle ear from the entry of bacterial oto-pathogens and respiratory viruses, a healthy and functional eustachian tube is crucial for the drainage of secretions from the middle ear space and for pressure adjustment. Infants' undeveloped

eustachian tube structure plays a crucial part in their propensity to develop middle ear infections.[19]

Eustachian tube epithelium serves as first line of protection against the invasion as well as colonisation of otopathogens from the nasopharynx. The mucoid and serous secretions are both produced by glandular cells, which are scattered throughout ciliated respiratory epithelial cells that make lysozyme and other antimicrobial proteins in the eustachian tube epithelium. Epithelial secretion of antimicrobial proteins in conjunction with the course of the middle ear's mucociliary circulation via the eustachian tube and into the nasopharynx prevents bacterial colonisation of the middle ear.[19]

Newborns and young kids (under 1 year) have anatomically shorter, wider, and more linear eustachian tubes compared to adults, which increases the likelihood of OM by facilitating otopathogen passage into the middle ear. Infants who are frequently placed in the supine position run a higher risk of contracting an illness. The base of the skull grows downward as infants grow, causing the angle of the eustachian tube to gradually increase from 10° at birth to 45° in adulthood. In parallel, the eustachian tube length increases from 13 to 48mm. As children get older, these structural changes as well as the defence system's functional maturation may aid to reduce OM risk, even in children who are at high risk of OM.[19]

Complications and sequelae of CSOM

The most common CSOM sequela, hearing loss, either conductive or sensorineural, which may impair a young child's language development and scholastic achievement. Chronic middle ear infection results in hole in tympanic membrane, oedema of the middle ear lining, and discharge, causes a conductive hearing loss of 20 to 60 dB.[23,24]

Some research suggests that CSOM contributes to sensorineural hearing loss. Animal studies have shown that cochlear hair cells can die when inflammatory mediators pass through the

round window membrane and into the inner ear.[25,26] The basal turn of the cochlea of CSOM patients had lost both their outer and inner hair cells, according to a recent human study.[27]

A retrospective study of 218 patients with unilateral CSOM reported that the bone conduction threshold was 9–14 dB lower in ear with disease than in ear without disease (average age, 35 years). [28] Another retrospective study indicated that in 121 patients (average age 37 years) with unilateral CSOM, the bone conduction threshold was 10–12 dB in the affected ear and 3–4 dB in the healthy ear.[29]

Serious extracranial and intracranial consequences from CSOM are possible. Extracranial problems alone range from 0.5% to 1.4%, and intracranial complications range from 0.3% to 2.0%, according to the reported overall extra and intracranial complication rate in CSOM[30] Children with CSOM tended to experience issues at a higher rate than adults. However, it is impossible to adequately compare the rates of complications in children and adults due to the higher prevalence of CSOM in children.

Facial paralysis, subperiosteal abscess, mastoiditis, and labyrinthitis have been found to occur most frequently among extracranial sequelae, with reported rates of 13—58%, 40—68%, 14—74%, and 7—34%, respectively. [30–33]

Meningitis, cerebral abscess, lateral sinus thrombosis, extradural abscess, otic hydrocephalus, and encephalitis are the most prevalent intracranial consequences of CSOM, with documented rates of 21–72%, 18–42%, 2–26%, 7–16%, 5–11%, and 2% of all intracranial problems, respectively. [30–33]

Medical management of CSOM

In the short duration (4 weeks), topical quinolones have been proven to be more successful at clearing CSOM-related auditory discharge.[34,35] The efficiency of eardrops containing quinolones as opposed to those without is currently unknown,[35] albeit quinolones has the

benefit of causing reduced damage to ear.[36] A combination of systemic and topical antibiotics may not be any more successful than topical antibiotics alone in treating patients with CSOM, according to the limited data presented. [34] There were fewer postoperative tympanic membrane perforations with a cartilage graft but no differences in hearing in two reviews comparing two distinct autologous graft materials to treat tympanic membrane perforation (i.e., temporalis muscle fascia tympanoplasty with cartilage tympanoplasty).[37,38]

Surgical treatment of CSOM

Tympano-mastoidectomy has been recommended as the preferred surgical procedure for CSOM since the 1970s. [16,39]However, there haven't been any published prospective, randomised, controlled trials that support this advice. [40] There are just three available retrospective studies on surgical treatment for CSOM. According to Vartianen et al., 221 CSOM-affected ears in children and adults were treated with either a one-stage tympanomastoidectomy (84%) or a mastoidectomy with a second-stage tympanoplasty planned in 15% of cases. [39] The total success rate, which was determined by having both a dry ear and a movable, intact eardrum, was 73% (95% CI, 67—79). There were no variations between the outcomes for adults and children. In a further study by the same authors that focused only on children with CSOM, the success rate for (tympano)mastoidectomy was shown to be 74% (95% CI, 59—89). [41] Balyan et al. examined the results of the surgery in 323 individuals with CSOM, ranging in age from 4 to 68 years, were treated in one of three ways: tympanoplasty and mastoidectomy (discharging ears); tympanoplasty alone (discharging ears) (dry ears). In groups I through III, the graft success rates were 91% (95% CI, 83–98), 86% (95% CI, 73–99), and 90% (95% CI, 85–93), respectively. There were respective mean residual air-bone gaps of 17, 20, and 19 dB. Following surgery, children under the age of 16 appeared to have a higher success rate[42]. The impact of symptom duration on the result was not researched.

Radical mastoidectomy, with or without mastoid obliteration, may be considered in situations of therapy-resistant CSOM.[43–46] 80 percent of patients who underwent a drastic revision mastoidectomy in 16 participants in one retrospective case study (average age 44 years) developed dry ear (95 percent confidence interval, 60—99).[43,46]

Complications following surgical procedure

The reasons for mastoidectomy are extremely diverse and include the need to access the internal auditory canal and the skull base, as well as infections of the middle ear and mastoid (30%), cholesteatoma (50%), various tumours of the temporal bone, access for facial nerve surgery, cochlear implantation, closing of cerebrospinal fluid (CSF) leakage. Even though the surgeon is familiar with the procedure, intra- and postoperative problems with varying degrees of seriousness can still happen.[47]

The following conditions can complicate the post-mastoidectomy course: wound complications (7.7-42.1%), hearing loss (1.7-9%), vertigo, tinnitus, facial nerve paralysis (1.7-4%), recurrent cholesteatoma (5-66%), lateralized or perforated tympanic membrane (1-5%), posterior canal wall atrophy (4.8%), retro-auricular defect or fistula, stenosis or atresia of external auditory canal.[48–54]

Meningitis, cholesterol granulomas, pneumocephalus, papilledema, perichiasmatic granulomas, malignant external otitis, toxic shock syndrome, brain herniation, and nominal aphasia are only a few of the uncommon consequences that have been reported. [55–62] Brain abscess was described as a side effect of mastoidectomy by Cottrell and Pulec in 1971 but no further information was provided[63]. Otogenic intracranial problems continue to pose a serious threat and may potentially result in death despite current antibiotic treatment. [64–68] The infection may spread from the mastoid or middle ear through hematogenous dissemination, bone erosion, thrombophlebitis, or a preexisting route. Additionally, the condition known as

osteo-thrombophlebitis allows the inflammatory process to go via the arterial channels of an undamaged bone.

According to various writers, the noise produced by the drill during surgery during mastoidectomy can cause sensorineural hearing loss in both operated and non operated ear.[12,69]

Noise induced Hearing loss (NIHL)

An explosion is extremely example of an intense "impulse" sound that can result in NIHL. Other loud noises, such as the noise produced in a carpentry shop, can also be exposed to repeatedly over time.

Decibels are used to measure sound. Even after prolonged exposure, hearing loss is unlikely to occur when exposed to sounds at or below 70 A-weighted decibels (dBA).However, chronic or repeated exposure to sound at or above 85dBA can result in hearing damage. The duration of NIHL shortens with increased sound intensity.

One well-known factor that might cause sensorineural hearing loss is exposure to noise (SNHL). Numerous instruments with noticeable noise outputs are utilised in otology. A patient may have surgical trauma if they are having an ear procedure while being subjected to a loud noise.[70]

Drill-induced noise has been implicated as a cause of SNHL in the operated ear because drilling and surgical equipment can particularly cause noise-induced hearing loss when employed on or near the ossicular chain and stapes footplate as well as during operations on the mastoid bone.[71]

The effects of rotating speed, burr type, burr size, and drill-induced noise levels during ear surgery have been studied.[72]

By monitoring the vibrations in whole human cadaver skulls and temporal bones, the noise level in the cochlea during mastoid surgery is calculated. [73] The ipsilateral cochlea is subjected to noise levels of approximately 100 dB each time a drill is utilised, while the contralateral cochlea is subjected to noise levels that are 5 to 10 dB lower. [74] For instance, the mastoid cavity drilling procedure could produce noise levels of up to 117 dB. When recordings were performed close to the circular window, cochleostomy noise levels varied from 114 to 128 dB SPL.[70]

The noise levels produced by the drill and the duration of exposure determine the degree of hearing loss related to the type of surgery. Higher levels of noise-induced hearing impairments are anticipated with a mastoid procedure because of the longer drilling exposure time. Using lasers can increase these hazards further. Acoustic trauma can also be caused by it. Therefore, when choosing and using these instruments, especially when used on or near the stapes footplate, ossicular chain, or both, surgeons should carefully evaluate these peculiarities.[75]

Equipment that produce noise should be kept away from the cochlea and used as quickly as feasible for the reasons mentioned above. It is impossible to significantly reduce drill noise during an ear surgery. Only by cutting down on drilling time and, consequently, the amount of time the cochlea is exposed to harmful sounds can noise damage to the inner ear be avoided.[76]

Transient hearing loss brought on by noise during drilling during mastoid surgery is possible. Both the patient and the physician must consider the practical ramifications of this. [10] Noise exposure results in malfunctioning outer hair cells, which could cause transient hearing loss during surgery or in other ears.[15] By way of an auditory damage mechanism, tympanoplasty can potentially result in an SNHL. Although this lesion seems to occur seldom in clinical

practise, physicians' failure to evaluate the auditory frequencies beyond 8,000 Hz is the source of its low seeming incidence.[76]

Audiometric investigations

Pure tone audiogram

Pure-tone audiometry may be used to assess hearing losses by spot-checking specific frequencies when hearing loss is suspected or to assess deficits more thoroughly.[77] Using an audiometer, pure-tone audiometry is carried out. Handheld audiometers have a 92 and 94 percent sensitivity and specificity for detecting sensorineural hearing loss, respectively. [78] Although there are many different kinds of audiometers, they all function by allowing the tester to adjust the signal's frequency (pitch, measured in cycles per second or Hz), and intensity (loudness, measured in decibels [dB]).

Main types of pure-tone audiometry are screening and threshold search. During screening audiometry, tones in the speech spectrum (500–4,000 Hz) are played at the highest human hearing thresholds. [79] If it appears that the patient's hearing levels are outside of the normal ranges, the results are recorded as pass or refer, advising that a second screening test or a threshold search test is indicated.

Using threshold search audiometry, the lowest sound that a patient can hear at each frequency 50% of the time is determined. Compared to screening audiometry, this testing takes more time and knowledge. The American speech language hearing Association has accepted the modified Hughson-Westlake approach for pure-tone baseline search testing.[77] Starting with the ear that the patient believes has greater hearing, testing is conducted. The tester emits a clean tone that is audibly loud. As soon as the patient reacts to the pure-tone signal, the tester reduces the signal's power by 10 dB and shows the tone once more. The tester employs a "down 10" pattern if the patient responds to this tone by lowering the tone's volume by 10 dB

and presenting further tones until the patient stops reacting. The tester then increases the tone intensity by 5 dB after the patient responds. [77]

To ensure accuracy, the tone level should be lowered by 10 dB once more. If the patient doesn't respond, the tester should then gradually increase the signal's intensity by 5 dB until the patient responds to the signal once more. The tester records the dB level at which the patient regularly responds as the air conduction threshold (minimum two out of three responses in ascending order). After testing the ear that is believed to have better hearing in the patient, the tester checks the other ear.[77]

In PTA air conduction(AC) , bone conduction(BC) , air-bone gap(ABG) are measured at 500,100,2000,4000Hz.

-Types of hearing loss on PTA

When AC and BC are less than 15 , with ABG <10dB , indicates normal hearing level.

AC >15dB, BC <15dB, ABG >10dB indicates conductive hearing loss.

AC >15dB, BC >15dB, ABG<10dB indicates sensorineural hearing loss.

AC>15dB, BC>15dB,ABG>10dB indicates mixed hearing loss.

-Degree of hearing loss is measured using PTA

WHO CLASSIFICATION(2021)

a. Normal hearing loss from 0 to 25dB
b. 26 to 40dB HL is graded as mild hearing loss
c. 41 to 55dB HL is graded as moderate hearing loss
d. 56 to 70dB HL is graded as moderately severe hearing loss
e. 71 to 90dB HL is graded as severe hearing loss

f. 91+dB HL is graded as profound hearing loss

MODIFIED GOODSMAN CLASSIFICATION PROPOSED BY CLARK for degree of hearing loss[98]

a. Normal hearing loss from -10 to 15dB
b. 16 to 20dB HL is minimal hearing loss
c. 26 to 40dB HL is graded as mild hearing loss
d. 41 to 55dB HL is graded as moderate hearing loss
e. 61 to 70dB HL is graded as moderately severe hearing loss
f. 71 to 90dB HL is graded as severe hearing loss
g. 91+dB HL is graded as profound hearing loss

Speech recognition

Pure tone thresholds alone have historically been used to gauge the severity of NIHL, underestimating both its prevalence and functional consequences ,NIHL can be connected to a deterioration in speech recognition performance in both silent and background noise, even in the presence of a normal pure tone audiogram. [80] This is likely related to synaptopathic mechanisms and poor temporal processing capacities since noise-induced altered connections between inner hair cells and low spontaneous rate auditory nerve fibres, which are essential for temporal processing, are present. To assess noise-induced damage, speech recognition tests in both quiet and noisy environments should be conducted in addition to pure tone thresholds.[81,82]

Relevant articles describing the effect of Effect of drill‐induced noise on hearing in non‐operated ear

1. In the clinical research run by Abtahi et al. in Iran, total of 23 individuals with mastoidectomy and normal contralateral hearing were included. Patients were evaluated both before and after surgery using low- and high-frequency DPOAE tests as well as low- and high-frequency PTA (1 and 7 days later). They concluded that drilling sounds during ear operation might cause temporary alterations to PTA, DPOAEs, and TEOAEs in the ear that wasn't operated on.[2]

2. Goyal et al. conducted a prospective clinical investigation in New Delhi, India, comprising thirty people who have cholesteatoma on one side and opposite healthy hearing. Patients were evaluated before surgery and for five days following using top frequency pure tone audiometry. They came to the conclusion that transcranial noise and vibration from drilling during mastoid surgery endangers hearing in the opposite ear.[14]

3. Jerath et al. carried out a hospital-based observational study in Maharashtra, India, undergoing mastoidectomy and tympanoplasty on 25 patients with unilateral COM. Preoperative and postoperative recordings of PTA were made to determine whether there had been any hearing loss on the oblique side. The results showed that drill noise had statistically no significant effects on the contralateral ear's inner ear function as measured by PTA.[1]

4. Zdamar et al. in Turkey carried out observational research with 38 patients with CSOM.DPOAE were calculated on patient’s opposite normal ear before and after surgery(on day 4). They concluded that drilling done during mastoidectomy

operations causes acoustic harm to healthy contralateral ears. This study found that hearing loss was transient and that it was more noticeable at higher frequencies.[91]

5. 50 patients with unilateral CSOM necessitating mastoidectomy surgery participated in the clinical longitudinal observational study conducted by Nabeel Latheef et al in Pondicherry, India. Postoperatively on day 1 and day 7, PTA and OAE of the opposite ear were calculated for every patient. Best way to assess the impact of drill-induced sound and oscillation during mastoid surgery is by using DPOAEs. This is because higher frequency auditory baseline of the opposite healthy ear are temporarily shifted much higher in sensitive individuals.[20]

6. Shenoy et al. performed a comparative and prospective study in Mangalore, India included 49 patients who underwent myringotomy/myringoplasty operations and 49 patients who underwent modified radical mastoidectomy or cortical. In the initial post-operative period, they saw that DPOAE amplitudes considerably dropped in those who had mastoidectomies over all tested frequencies, but they had recovered by the seventh post-operative day. They came to the conclusion that drill-induced noise can temporarily reduce DPOAEs postoperatively, leading to temporary hearing loss for a week.[92]

7. Karimi Yazdi et al. analysed 49 patients who had had mastoidectomy for noise trauma brought on by drilling in the non-operated ear as part of the descriptive analytic analysis. On the patient's other ear, PTA and DPOAE evaluated the patient's preoperative condition as well as the postoperative condition. In conclusion, a small number of individuals experience drill-induced hearing loss on the unoperated ear, and it is frequently treatable.[93]

8. Migirov et al. carried out a comparative prospective study in Israel with 18 patients who underwent mastoid surgery (group 1, study participants) and type I tympanoplasty (group 2, controls). They came to the conclusion that changes in DPOAE in the non-operated ear can be caused by drill-induced noise during mastoidectomy. Following mastoid surgery, OHC function may be compromised for longer than a month.[69]

9. In the Observational study by Palva and Sorri in Finland, 55 patients underwent pure tone audiometry to assess their hearing in the contralateral ear following a single or modified radical mastoidectomy. A sensorineural hearing loss of at least 20 dB was discovered in the contralateral ear of 12 individuals, which was primarily high tone. This was enduring in six instances. With longer operations, there were more patients who had hearing loss. They came to the conclusion that the noise produced by the burr must be the cause of this hearing loss.[94]

MATERIALS AND METHODS

MATERIALS AND METHODS

STUDY DESIGN:

Patients with unilateral chronic otitis media undergoing Tympanoplasty with cortical mastoidectomy were involved in the observational trial

STUDY PERIOD AND DURATION:

Period between January 2021 and August 2022 (1 year 8 months)

STUDY POPULATION:

All patients admitted to RL Jalappa hospital and diagnosed with chronic otitis media and posted for surgery in the department of Otorhinolaryngology during the period between January 2021 and August 2022.

SAMPLE SIZE CALCULATION

Sample size is calculated based on mean difference in PTA in an observational study design Effect of drill-induced noise on hearing in non-operated ear reported an average variance estimate of 11, considering an alpha error of 5% with a power of 80% to detect 30% difference in pre and post Pure Tone Audiometry, required sample size is 61.

Assuming alpha error of 5% (95% confidence limit) and an absolute precision (d) of 10%,

The sample size was derived from the following formula:

Sample size (n) = $(\boldsymbol{P}*\boldsymbol{Q})/\boldsymbol{d^2}$ where

Z is the critical value for 95% Confidence Interval

D is the absolute precision

P is the expected proportion and q=1-p

The sample size was calculated using OpenEpi software version 3.01 (Open-Source Epidemiologic Statistics for Public Health).

INCLUSION CRITERIA:

Patients of 18 to 60 years with unilateral CSOM undergoing Tympanoplasty with cortical mastoidectomy.

EXCLUSION CRITERIA:

a) Patients with a history of usage of ototoxic drugs.

b) Patients undergoing ear surgeries other than cortical mastoidectomy

c) Patients with bilateral sensorineural hearing loss irrespective of cause.

SAMPLING METHOD:

All patients admitted to RL Jalappa hospital and diagnosed with chronic otitis media and posted for surgery in the department of Otorhinolaryngology during the period between January 2021 and August 2022.

DATA COLLECTION PROCEDURE

Patients undergoing cortical mastoidectomy after fulfilling the inclusion and exclusion criteria were taken up for study.A detailed written informed consent has been taken prior to procedure.

The patients underwent a thorough history taking and clinical examination, the findings of which were recorded in a structured proforma. Complete blood picture (CBC) , renal function test(RFT) , serum electrolytes , electrocardiogram(ECG) , chest X-ray(CXR) ,Pure Tone Audiometry (PTA) and plain High Resolution Computerized Tomography temporal bones were also performed on the patients as part of their standard preoperative haematological examinations.

The patients were brought in for mastoidectomy surgery after receiving anaesthesia approval for the procedure. We kept track of the total amount of time spent drilling intraoperatively. All patients were treated with intravenous antibiotics in the postoperative period as per antibiotic guidelines for as period of 5 days and were discharged on postoperative day 8 after changing the mastoid dressing.

Air conduction, bone conduction and air bone gap in PTA of the opposite ear was performed for all patients postoperatively on day 7 (the day of surgery being treated as day 0). Once a month after surgery, the patients were checked on, and PTA were repeated.

Salient steps of surgery.

(a) Patient is positioned with head turned as the diseased ear will be in upward position. Infiltration was given with 2% premix (2% lignocaine with adrenaline) with normal saline in 1:1 ratio.

(b) Incision was taken at the bony-cartilagenous junction 5mm lateral to fibrous annulus at 6’0 clock and 12’0 clock and joined with horizontal incision. William wilde’s postaural incision was given 0.5-1cm away from postauricular groove and temporalis fascia graft of adequate size was harvested.

(c) Margins of perforation were freshened.

(d) Tympano-meatal flap was elevated.

(e) Mastoid antrum is identified antero-superior to spine of henle and cortical mastoidectomy done. Initially large conical cutting burrs were used to remove a major portion of bone followed by appropriate size cutting burrs to exenterate. Towards vital structures such as facial bony canal, lateral semicircular canal , polishing burrs such as diamond burrs were used.

(f) The mean drilling time in our study was 30 minutes, time ranging from 25 minutes to 35 minutes

(g) At the end of cortical Mastoidectomy , the following landmarks were identified-

(i) Anteriorly – Posterior wall of external auditory canal.

(ii) Posteriorly - Sigmoid sinus.

(iii) Medially – Dome of lateral semicircular canal and mastoid antrum.

(iv) Superiorly - Tegmen plate.

(v) Inferiorly - Digastric Ridge.

(h) Graft was placed by underlay technique.

(i) Haemostasis was achieved and mastoid dressing was placed.

(j) Patients were put on antibiotics , analgesics , antihistamines for 7 days. Mastoid dressing was changed on 5^{th} day postoperatively .Postaural sutures were removed on 10^{th} day. PTA was done on postoperative day 7 and at the end of 1 month.

STUDY TOOLS

The hearing threshold sensitivity at discrete frequencies spanning a range crucial for human communication was established using pure-tone audiometry. To demonstrate how threshold sensitivity fluctuates over the frequency range, threshold values were plotted on an audiogram. The air- and bone-conduction threshold curves and air bone gap were measured at 500,1000,2000,4000Hz for each ear make up the full pure tone audiogram. In a sound-treated room, we used an arphi Model 500 MK 1 diagnostic portable pure tone audiometer to assess the normal contralateral ear both before and after surgery. The thresholds of the healthy and sick ear's bone and air conduction were measured. The thresholds for bone conduction were measured at 500, 1000, 2000, and 4000 Hz. The time gap between each reading was maintained constant.

ETHICAL CONSIDERATION

Ethical approval was taken from the Institutional Ethics Committee. All ethical morality was followed in the study. The gathered data was casted-off only for the projected purpose of the study; the confidentiality and clandestineness of participants were preserved all over the process as assured by the researchers.

DATA ANALYSIS

- The collected data were entered in Ms excel and analysed using IBM.SPSS statistics software 23.0 Version.

- The data was described in descriptive statistics as frequency analysis, percentage analysis was used for discrete variables. Mean, median and standard deviation was used for continuous variables.

- To study the association of contralateral ear air conduction, bone conduction and air-bone gap among the study participants between pre-operative PTA and post-operative PTA at 7th day and end of first month, paired T test was used.

- In all the above statistical tools the probability value(p) 0.05 was considered as significant level.

IMAGE GALLERY

IMAGE GALLERY

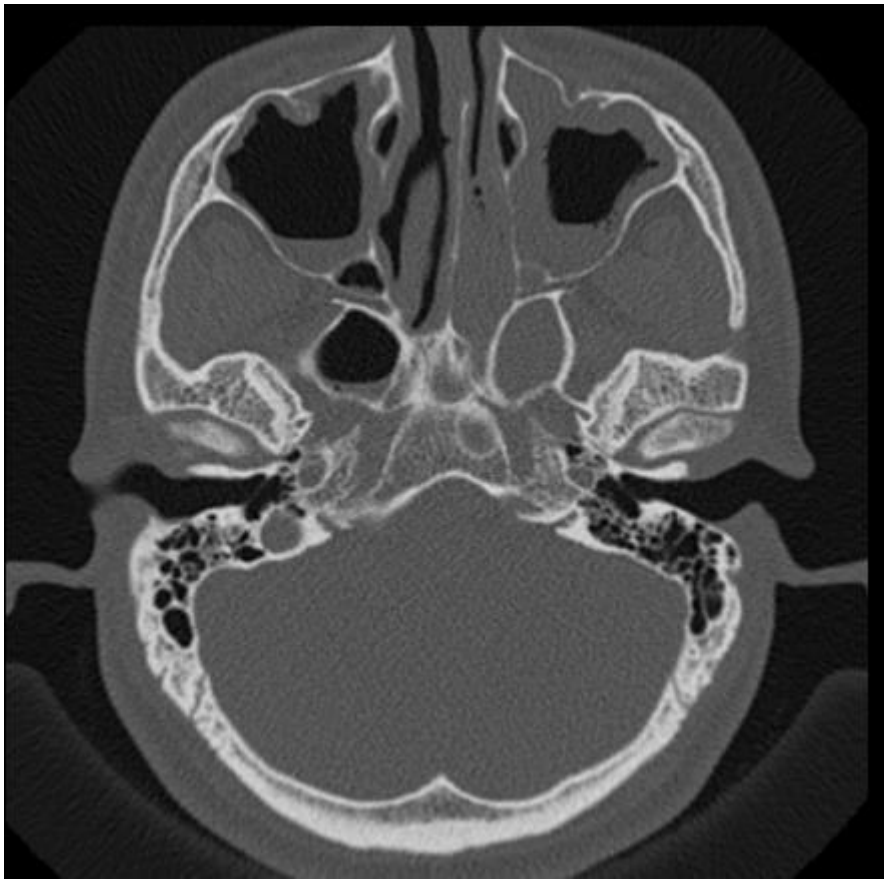

Figure 4 : HRCT temporal bone axial view

Figure 5: Instruments used in ear surgery

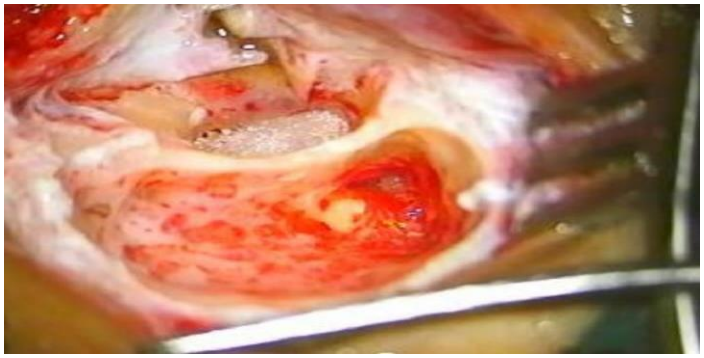

Figure 6:Cortical mastoidectomy done in left ear

Figure 7:PTA being done on a patient

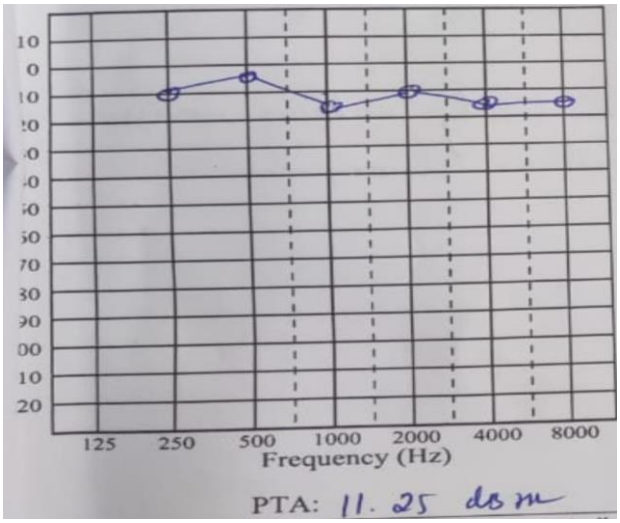

Figure 8:PTA OF RIGHT EAR preoperative

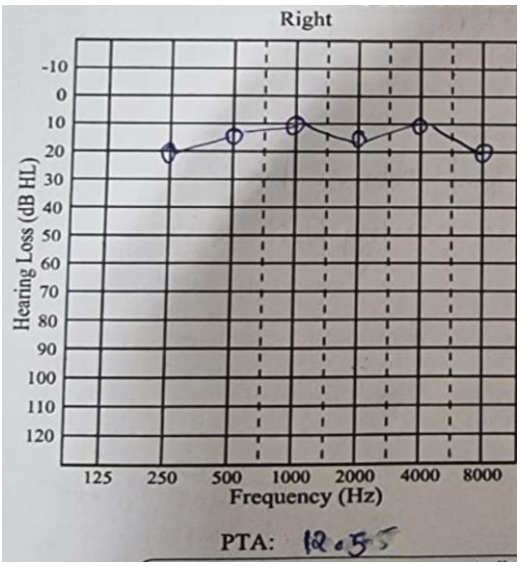

Figure 9:PTA of right ear on postop day 7

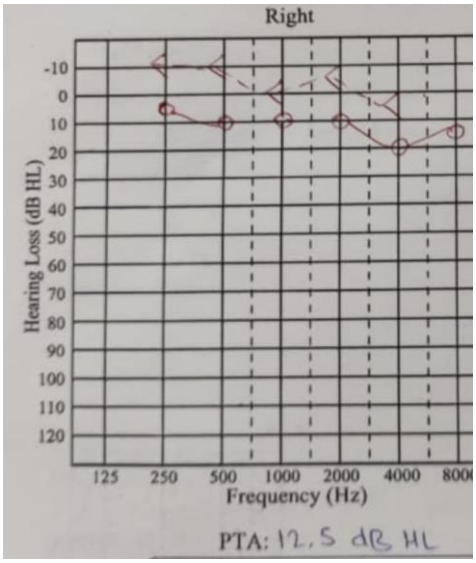

Figure 10:PTA of right ear after 1 month postop

RESULTS

RESULTS

Table 1 Age distribution of the study participants (n = 61)

Age	
Mean	34.16
Median	35.00
Mode	35
Std. Deviation	8.092
Minimum	19
Maximum	46
Interquartile range	28.0 - 41.0

Among the study participants, the mean age of them was 34.16 years with the standard deviation of 8.092 years.

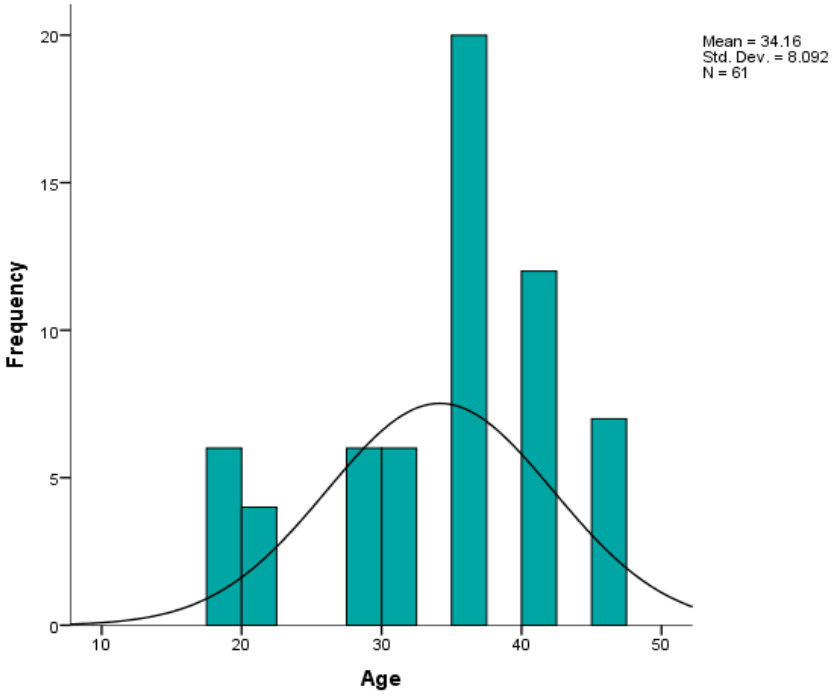

Figure 11 Age distribution of the study participants (n = 61)

Table 2 Distribution of study participants according to their duration of symptom of ear pain (n = 61)

Duration of ear pain	
Mean	2.390
Median	2.000
Mode	3.0
Std. Deviation	1.3715
Minimum	.8
Maximum	5.0
Interquartile range	1.0 - 3.0

Among the study participants, the mean duration of ear pain symptom was 2.3 days with the standard deviation of 1.3 days.

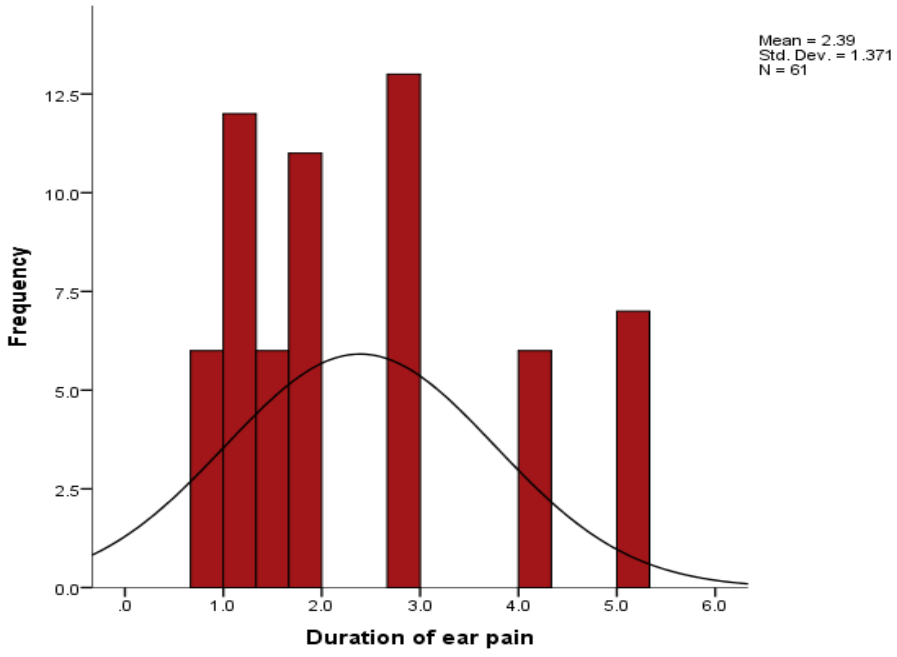

Figure 12 Distribution of study participants according to their duration of symptom of ear pain (n = 61)

Table 3 Gender distribution of the study participants (n = 61)

Gender	Frequency	Percent
Female	25	41.0
Male	36	59.0
Total	61	100.0

Among the study participants, most of them were males (59 percent).

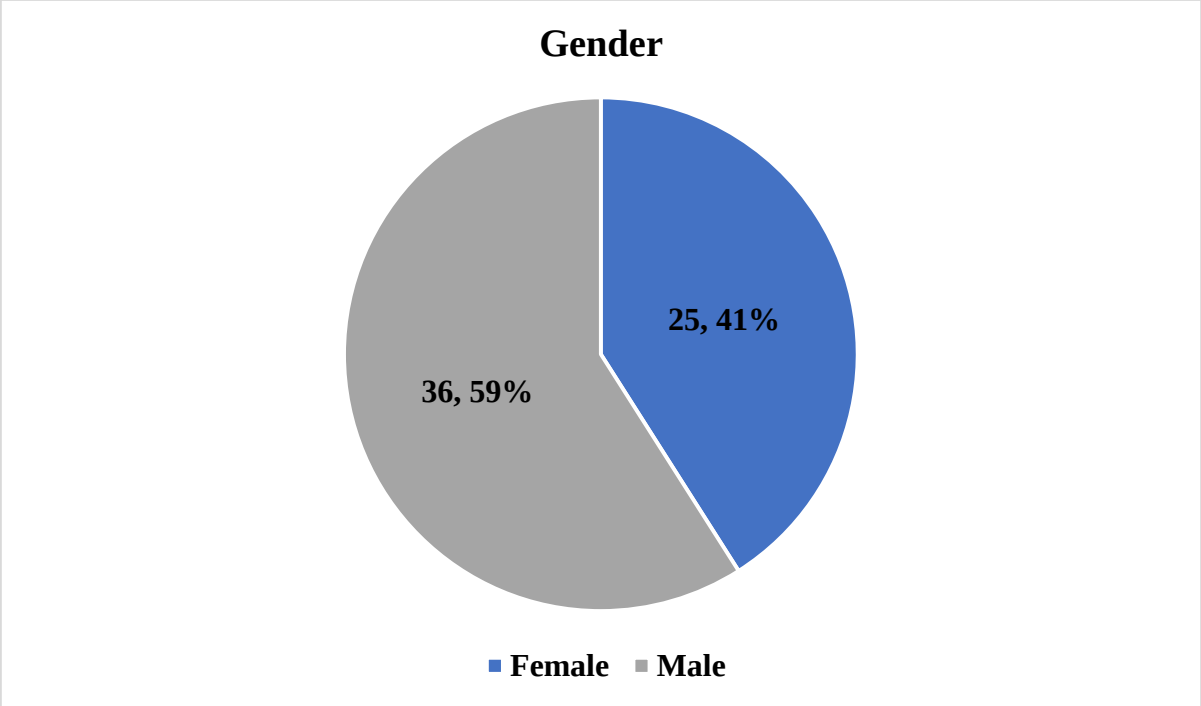

Figure 13 Gender distribution of the study participants (n = 61)

Table 4 Distribution of study participants according to type of ear pain complaint (n = 61)

Type of ear pain	Frequency	Percent
Dull aching	13	21.3
Pricking	16	26.2
Throbbing	32	52.5
Total	61	100.0

Among the study participants, most of them had throbbing type of ear pain (52.5 percent) followed by pricking type (26.2 percent) and dull aching (21.3 percent).

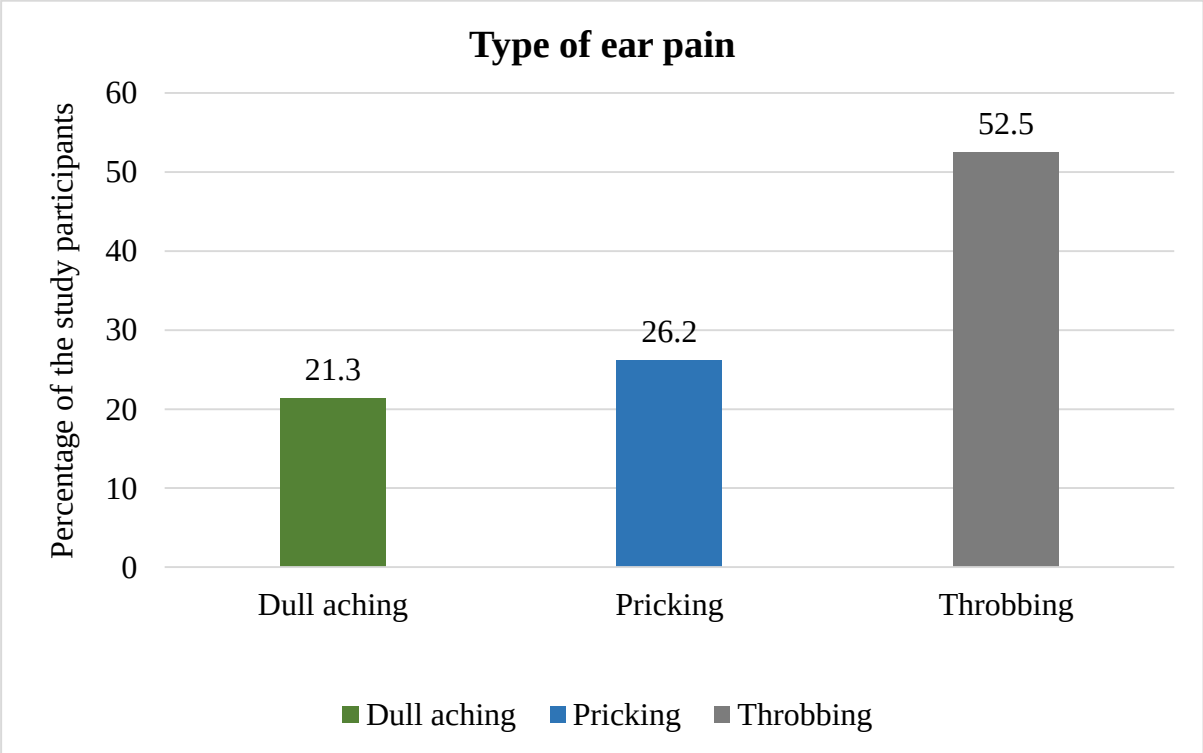

Figure 14 Distribution of study participants according to type of ear pain complaint (n = 61)

Table 5 Distribution of study participants according to the symptom of ear discharge (n = 61)

Ear discharge	Frequency	Percent
Mucoid	31	50.8
Mucopurulent	30	49.2
Total	61	100.0

Among the study participants, the prevalence of mucopurulent ear discharge was about 49 percent.

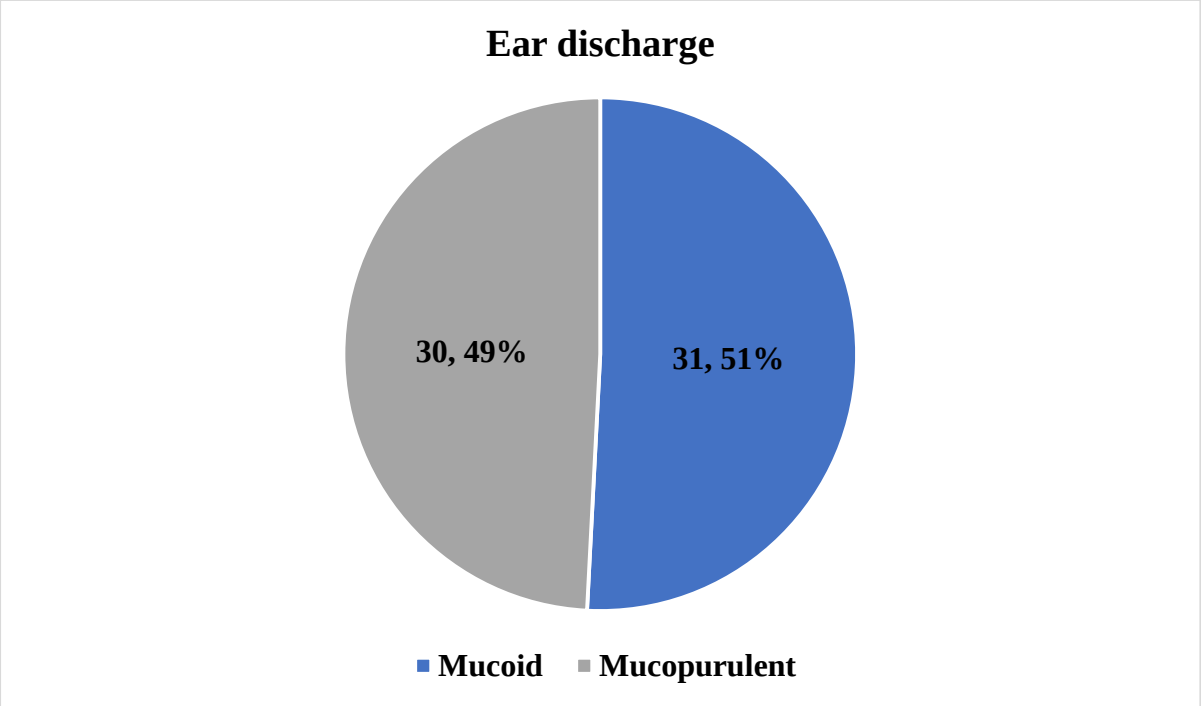

Figure 15 Distribution of study participants according to the symptom of ear discharge (n = 61)

Table 6 Distribution of study participants according to symptom of tinnitus (n = 61)

Tinnitus	Frequency	Percent
No	55	90.2
Yes	6	9.8
Total	61	100.0

Among the study participants, the prevalence of tinnitus was about 10 percent

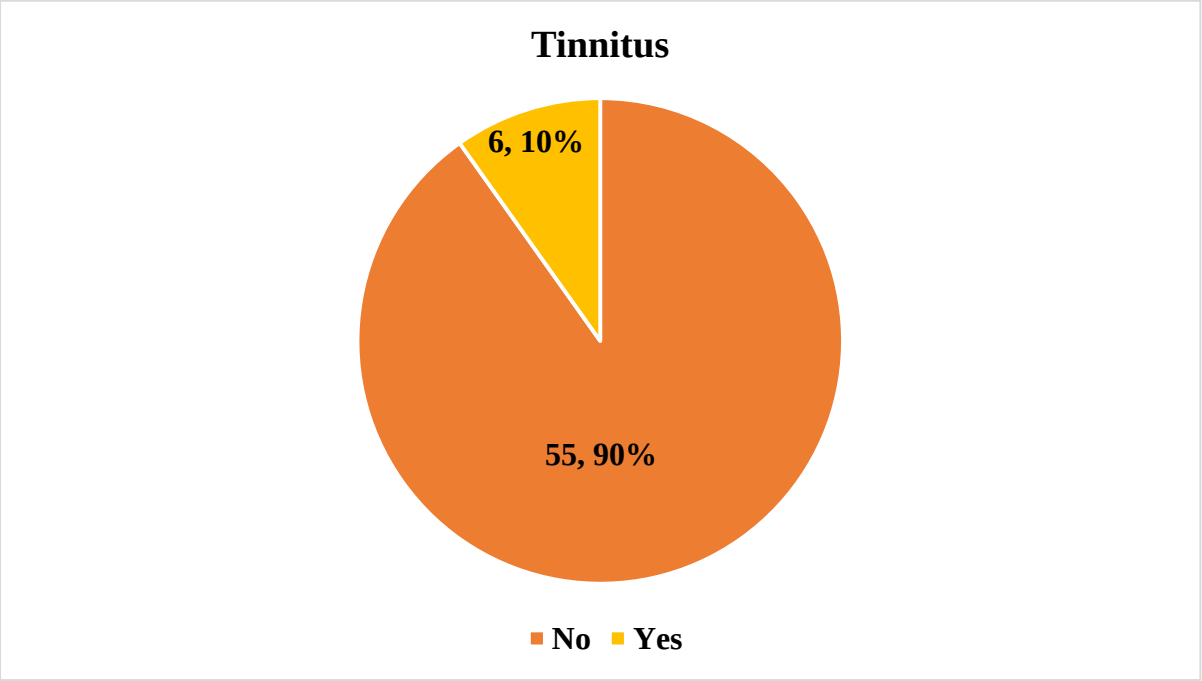

Figure 16 Distribution of study participants according to symptom of tinnitus (n = 61)

Table 7 Distribution of study participants according to side of affected ear (n = 61)

Side of affected ear	Frequency	Percent
Right side	29	47.5
Left side	32	52.5
Total	61	100.0

Among the of the study participants, about 52 percent of them affected on right side and 48 percent of them had affected on left side.

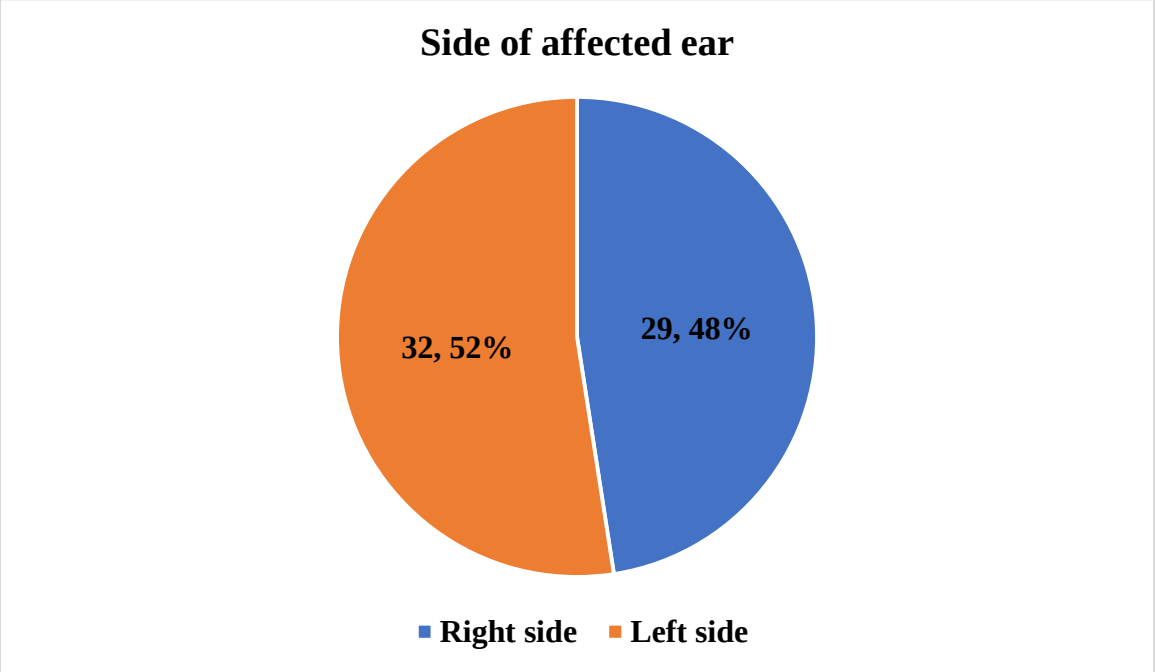

Figure 17 Distribution of study participants according to side of contralateral ear (n = 61)

Table 8 Distribution of study participants according to the examination finding of pre and post auricular region (n = 61)

S. No	Variables		Frequency	Percent
1	**Pre-auricular region**	Normal	61	100.0
2	**Post-auricular region**	Normal	61	100.0

Table 9 Distribution of study participants according to the examination finding of external auditory canal (n = 61)

S. No	Variables		Frequency	Percent
1	**External auditory canal - Discharge**	Yes	61	100.0
2	**External auditory canal - Polyp**	No	61	100.0

Table 10 Distribution of study participants according to the examination finding of facial nerve involvement (n = 61)

S. No	Variables		Frequency	Percent
1	**Facial nerve involvement**	No	61	100.0

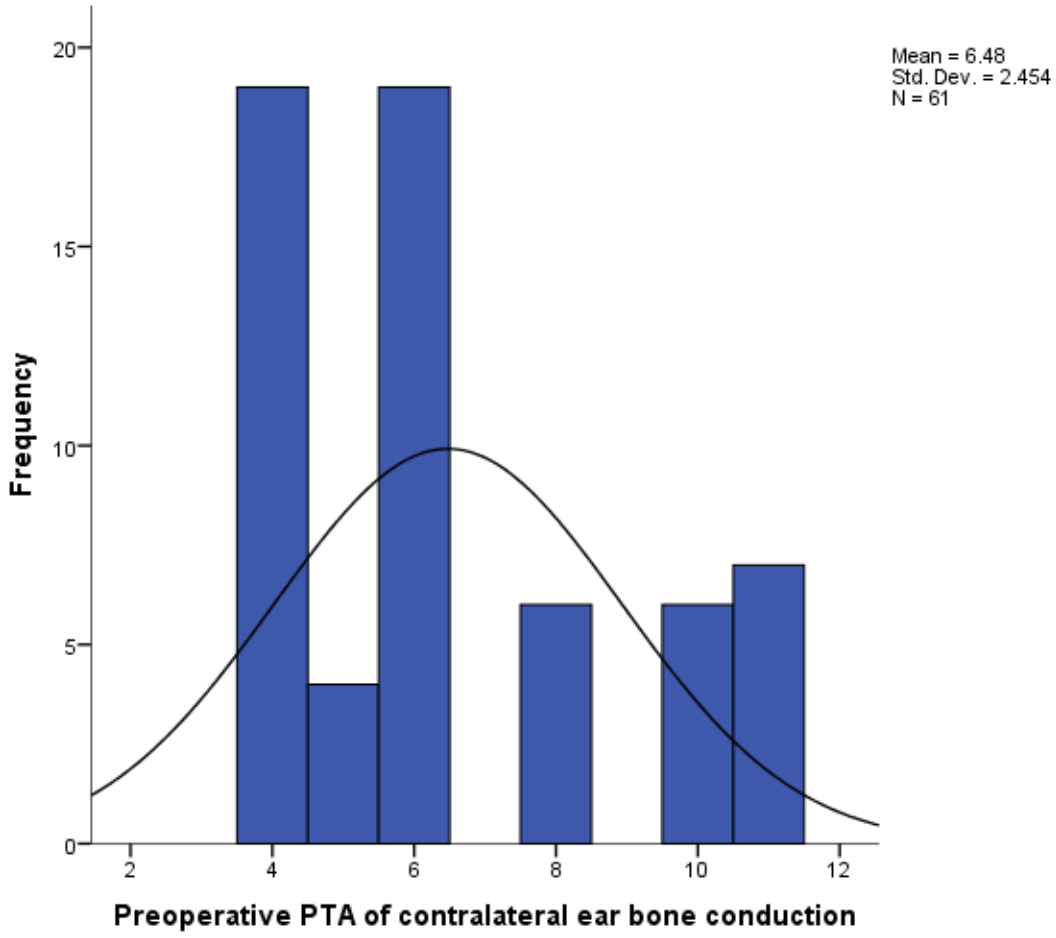

Figure 18 Distribution of study participants according to the preoperative pure tone audiometry (PTA) value with respect to contralateral ear bone conduction (n = 61)

Table 11 Distribution of study participants according to the preoperative pure tone audiometry (PTA) value with respect to contralateral ear (n = 61)

	Preoperative PTA of contralateral ear air conduction	Preoperative PTA of contralateral ear bone conduction	Preoperative PTA of contralateral ear air-bone gap
Mean	11.89	6.48	3.92
Median	10.00	6.00	4.00
Mode	10	4	4
Std. Deviation	2.131	2.454	1.282
Minimum	7	4	2
Maximum	14	11	6
Interquartile range	9.0 - 12.0	4.0 - 8.0	3.0 - 5.0

Among the study participants, the mean preoperative PTA of contralateral ear air conduction and bone conduction were 11.89 and 6.48 respectively. Similarly, the mean preoperative PTA of contralateral ear air-bone gap was 5.41 with the standard deviation of 1.282.

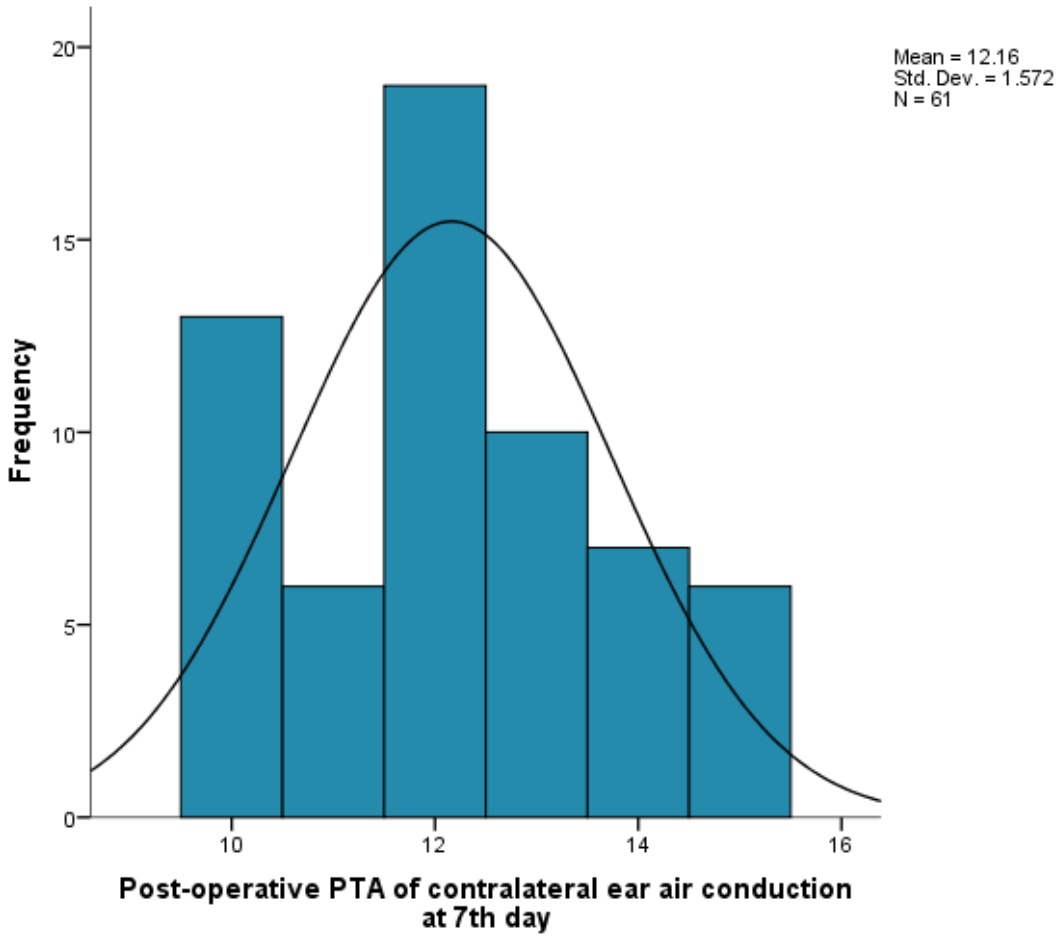

Figure 19 Distribution of study participants according to the post-operative pure tone audiometry (PTA) value with respect to contralateral ear air conduction at 7th day (n = 61)

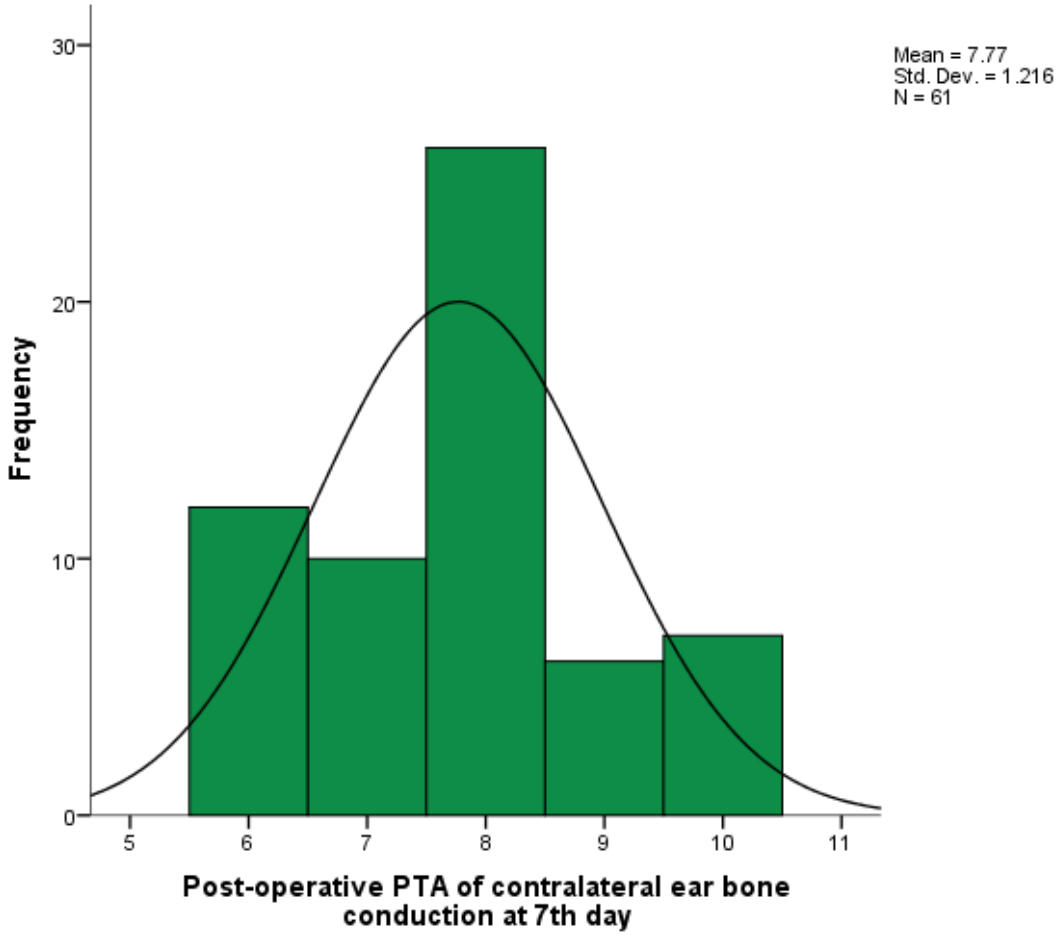

Figure 20 Distribution of study participants according to the post-operative pure tone audiometry (PTA) value with respect to contralateral ear bone conduction at 7th day (n = 61)

Table 12 Distribution of study participants according to the post-operative pure tone audiometry (PTA) value with respect to contralateral ear at 7th day (n = 61)

	Post-operative PTA of contralateral ear air conduction at 7th day	Post-operative PTA of contralateral ear bone conduction at 7th day	Post-operative PTA of contralateral ear air-bone gap at 7th day
Mean	12.16	7.77	4.30
Median	12.00	8.00	4.00
Mode	12	8	4
Std. Deviation	1.572	1.216	1.564
Minimum	10	6	2
Maximum	15	10	7
Interquartile range	11.0 - 13.0	7.0 - 8.0	4.0 - 6.0

Among the study participants, the mean postoperative PTA of contralateral ear air conduction and bone conduction on 7th day were 12.16 and 7.77 respectively. Similarly, the mean postoperative PTA of contralateral ear air-bone gap on 7th day was 4.30 with the standard deviation of 1.564.

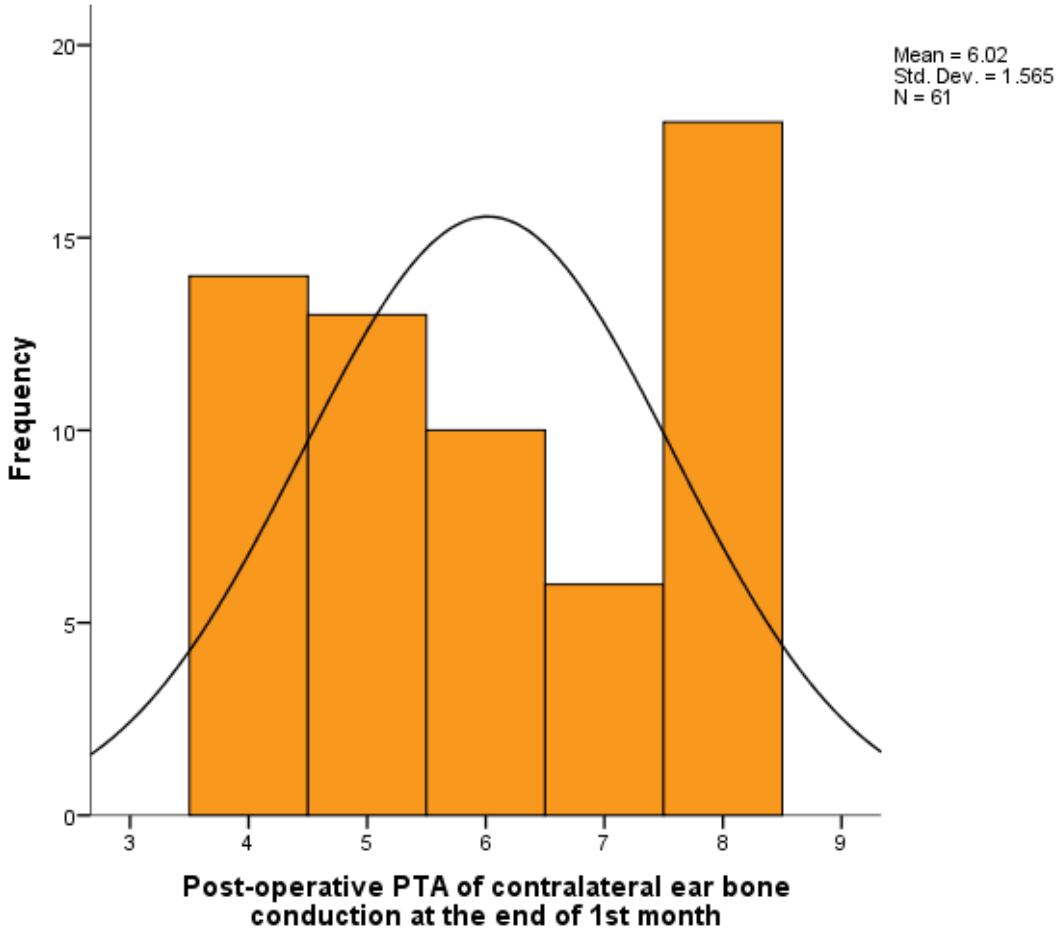

Figure 21 Distribution of study participants according to the post-operative pure tone audiometry (PTA) value with respect to contralateral ear bone conduction at the end of 1st month (n = 61)

Table 13 Distribution of study participants according to the post-operative pure tone audiometry (PTA) value with respect to contralateral ear at the end of 1st month (n = 61)

	Post-operative PTA of contralateral ear air conduction at the end of 1st month	Post-operative PTA of contralateral ear bone conduction at the end of 1st month	Post-operative PTA of contralateral ear air-bone gap at the end of 1st month
Mean	11.93	6.02	3.64
Median	11.00	6.00	5.00
Mode	11	8	4
Std. Deviation	1.167	1.565	1.782
Minimum	9	4	2
Maximum	13	8	8
Interquartile-range	10.0 - 12.0	5.0 - 8.0	4.0 - 6.0

Among the study participants, the mean post-operative PTA of contralateral ear air conduction and bone conduction at the end of 1st month were 11.93 and 6.02 respectively. Similarly, the mean post-operative PTA of contralateral ear air-bone gap at the end of 1st month was 3.64 with the standard deviation of 1.782.

Table 14 Association of contralateral ear air conduction among the study participants between pre-operative PTA and post-operative PTA at 7th day and end of first month (n = 61)

S. No	Paired Samples Statistics	Mean	Std. Deviation	Mean difference	T - Value	P - Value	Statistical significance
1	Preoperative PTA of contralateral ear air conduction	11.89	2.131	- 0.270	- 6.791	0.4274	No Significant difference
	Post-operative PTA of contralateral ear air conduction at 7th day	12.16	1.572				
2	Preoperative PTA of contralateral ear air conduction	11.89	2.131	- 0.04	- 2.459	0.9083	No Significant difference
	Post-operative PTA of contralateral ear air conduction at the end of 1st month	11.93	1.167				

The mean preoperative PTA of contralateral ear air conduction among the study participants was 11.89. Similarly, the mean post-operative PTA of contralateral ear air conduction on 7th day for the same participants was 12.16. This mean difference was not statistically significant according to paired T-test (P = 0.4274).

The mean preoperative PTA of contralateral ear air conduction among the study participants was 11.89. Similarly, the mean post-operative PTA of contralateral ear air conduction at end of 1st month for the same participants was 11.93. This mean difference was not statistically significant according to paired T-test (P = 0.9083).

Inference: There was no significant change in the mean value of PTA before and after surgery according to air conduction in the contralateral ear.

Table 15 Association of contralateral ear bone conduction among the study participants between pre-operative PTA and post-operative PTA at 7th day and end of first month (n = 61)

S. No	Paired Samples Statistics	Mean	Std. Deviation	Mean difference	T - Value	P - Value	Statistical significance
1	Preoperative PTA of contralateral ear bone conduction	6.48	2.454	- 1.295	- 3.420	0.001	Significant difference
	Post-operative PTA of contralateral ear bone conduction at 7th day	7.77	1.216				
2	Preoperative PTA of contralateral ear bone conduction	6.48	2.454	0.459	1.274	0.208	No significant difference
	Post-operative PTA of contralateral ear bone conduction at the end of 1st month	6.02	1.565				

The mean preoperative PTA of contralateral ear bone conduction among the study participants was 6.48. Similarly, the mean post-operative PTA of contralateral ear bone conduction on 7th day for the same participants was 7.77. This mean difference was statistically significant according to paired T-test (P = 0.001).

The mean preoperative PTA of contralateral ear bone conduction among the study participants was 6.48. Similarly, the mean post-operative PTA of contralateral ear bone conduction at end of 1st month for the same participants was 6.02. This mean difference was not statistically significant according to paired T-test (P = 0.208).

Inference: There was a significant change in the mean value of PTA before and after surgery on 7th day according to bone conduction in the contralateral ear. There was no significant change in the mean value of PTA before and after surgery at end of 1st month according to bone conduction in the contralateral ear.

Table 16 Association of contralateral ear air-bone gap among the study participants between pre-operative PTA and post-operative PTA at 7th day and end of first month (n = 61)

S. No	Paired Samples Statistics	Mean	Std. Deviation	Mean difference	T - Value	P - Value	Statistical significance
1	Preoperative PTA of contralateral ear air-bone gap	3.92	1.282	-0.377	- 1.573	0.121	No significant difference
	Post-operative PTA of contralateral ear air-bone gap at 7th day	4.30	1.564				
2	Preoperative PTA of contralateral ear air-bone gap	3.92	1.282	0.2800	-3.528	0.321	No Significant difference
	Post-operative PTA of contralateral ear air-bone gap at the end of 1st month	3.64	1.782				

The mean preoperative PTA of contralateral ear air-bone gap among the study participants was 3.91. Similarly, the mean post-operative PTA of contralateral ear air-bone gap on 7th day for the same participants was 4.30. This mean difference was not statistically significant according to paired T-test (P = 0.121).

The mean preoperative PTA of contralateral ear air-bone gap among the study participants was 3.92. Similarly, the mean post-operative PTA of contralateral ear air-bone gap at end of 1st month for the same participants was 3.64. This mean difference was not statistically significant according to paired T-test (P = 0.321).

Inference:

There was no significant change in the mean value of PTA before and after surgery according to air-bone gap in the contralateral ear.

DISCUSSION

DISCUSSION

The major goal of this study was to ascertain how drill noise affected patients who were planned for tympano-mastoid surgery on the contralateral ear in cases of unilateral CSOM . There is conflicting information in the literature on the impact of drilling during mastoid surgery on the unoperated ear.

Bone drilling is a crucial part of otological surgery, but it exposes both cochleae to a high amount of vibration and noise. The intricate interaction between the transmission and damping properties of the skull, cranial contents, and surrounding soft tissue is represented by transcranial vibration. The noise produced by the drill during the mastoid surgery may be conveyed directly to both cochleae via bone vibration because there is little interaural attenuation of the skull. Sensorineural hearing loss can be brought on by drilling noise in the ear that is not affected. The otologic drill is a powerful vibration generator in addition to a source of noise. A powerful oscillation is sent into the cochlea during otologic drilling. Burr noise stimulation combined with movement of the cochlear parts can harm the cochlea more than noise alone[89,97].

In our study, average age of research participants was 34.16 years, with a standard deviation of 8.092 years. About 52% of the study's subjects were afflicted on their right side, while 48% were affected on their left.

In our study, according to mean air conduction, bone conduction, and air-bone gap measured in the contralateral ear when the patients were monitored preoperatively and on postoperative day 7 and one month after surgery, there was no significant difference in the mean value of PTA before and after surgery.

According to some studies, sensorineural hearing loss can occur between 1.2 percent and 4.5 percent of the time in ears that have had drilling done. Along with these investigations,

another study showed that, despite minor drilling-related alterations in the operated ear, there was no statistically significant change in the hearing level of the contralateral ear. It has been stated that additional sources of potential postoperative sensorineural hearing loss should be looked into because sensorineural hearing loss linked with drilling does not occur even in the operated ear after tympano-mastoid surgery.[91,92,94]

The pre- and postoperative bone conduction thresholds for frequencies 0.25 to 16 kHz were examined in a research by Hallmo and Mair involving 46 participants. They noticed that neither the operated ear nor the ear on the opposite side showed any statistically significant postoperative threshold shift at any particular frequency. While not present in the contralateral, unoperated ear, the mean threshold increase of 1.4 dB for the ipsilateral extended high-frequency octave of 8–16 kHz was marginally significant ($p = 0.02$).[95]

Tos et al. performed the trans-labyrinthine operation on 50 consecutive patients to remove a unilateral acoustic neuroma. According to statistics, there is no decline in hearing in the opposite ear that can be linked to potential acoustic stress after trans-labyrinthine bone resection.[96]

There could be a number of causes for the absence of hearing loss in the opposite ear. A tiny (1-4 mm) diamond burr was used for the majority of the surgery to do the cortical mastoidectomy. Kylen et al. study, which looked at factors influencing drill-generated noise during ear surgery, demonstrated how the noise made by diamond burrs and cutting burrs differ significantly from one another.[72] In comparison to cutting burrs, diamond burrs have mean noise levels that are 5–11 dB lower. The burr's size has the strongest impact on noise levels of all the factors. The noise decreases with decreasing burr size; a 2 mm diamond burr reduces noise at 8 kHz by 20 dB. All of the other factors have negligible effects on the noise levels generated compared to the burr size. In the investigation by Tos et al., most of the

surgery was performed using a small diamond burr; it is unlikely that this produced a noise loud enough to harm the contralateral cochlea. Second, Tos et al. assessed hearing using pure tone and speech audiometry up to just 8000 Hz, and this was carried out three months following surgery. Since frequencies beyond 8000 Hz were not employed, a change in higher frequencies could not be detected, making the detection of a transient threshold shift unlikely.[96]This is similar to our study since we didn't evaluate the higher frequencies that are more than 8000Hz on PTA.

25 patients with unilateral CSOM posted for mastoidectomy and tympanoplasty who met the inclusion criteria were enrolled in a study by Jerath and Raghavan. They noticed that there had been no postoperative alteration in the bone-conduction thresholds in the ear on the opposite side. The signal-to-noise ratio of TEOAE at all frequencies did, however, noticeably deteriorate in the postoperative period. They came to the conclusion that drill noise has statistically significant effects on the inner ear function in the contralateral ear as measured by TEOAE, but that PTA cannot detect those effects.[1]

In contrast, hearing loss happened more frequently and more severely in individuals with drilling times of less than three hours, according to a research by Palva and Sorri on the non-operated ears of patients who had had simple or radical mastoidectomy. In our circumstances, the average drilling time came out to 39 minutes. Drill noise levels were not affected by irrigation during procedure.[94]

By observing changes in the DPOAEs' amplitudes before and after ear surgery, Da Cruz et al. investigated drill-induced hearing loss in the unoperated ear. Only 2 out of a total of 12 patients had OHC dysfunction owing to an intraoperative temporary drill.[97]DPOEA cannot be evaluated because we only employed pure tone audiometry in our current study.

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SUMMARY

SUMMARY

- Chronic Suppurative Otitis Media (CSOM) is a long-standing infection of the middle ear cleft. This leads to ear discharge and perforation of tympanic membrane. It is highly prevalent in individuals from poor socio-economic conditions. Based on the middle ear cleft pathology mastoidectomy procedures will be decided. This study has been performed with the purpose to study the hearing outcome in the opposite normal ear following cortical mastoidectomy in patients with unilateral CSOM.

- Our objectives were.

    1. To describe the opposite normal ear's hearing acuity after mastoid operation.
    2. To evaluate impact of drill sound on contralateral normal ear

Patients diagnosed with unilatreral CSOM presented to the department of Otorhinolaryngology of R.L.Jalappa hospital, Tamaka, Kolar from January 2021 to July 2022..

With an age group between 18 years and 60 years diagnosed with unilateral CSOM were planned for cortical mastoidectomy were involved in our study.

Patients with bilateral sensorineural hearing loss irrespective of cause, patients undergoing surgeries other than cortical mastoidectomy, patients with history of usage of ototoxic drugs were excluded in our study.

Patients were addressed for surgery after taking detailed history, examination, Tuning Fork Test and PTA assessment,HRCT temporal bone.

61 patients were included in our study.All patients underwent pre operative PTA and AC threshold, bone conduction threshold and ABG were counted at 500, 1000, 2000 Hz,4000Hz.

After performing surgery follow-up a repeat PTA was done to evaluate the hearing outcome in the opposite ear on postoperative day 7 and at the end of 1 month of surgery.

Ear discharge and reduced hearing were more common. Right ear was more affected.. The mean Bone conduction preoperatively was 6.48 and on postoperative day 7 mean is 7.77 which is statistically significant. The mean Bone conduction at the end of 1 month after surgery is 6.02 which is not statistically significant indicating the presence of temporary threshold shift.

There is no statistical difference between mean air conduction and air bone gap preoperatively and postoperatively.

It was concluded in our study that mastoid drilling is associated with a certain amount of hearing loss that is transient and is attributed to temporary threshold shift. A larger study with other audiological investigations such as otoacoustic emissions are required to confirm the hearing loss more accurately .

CONCLUSION

CONCLUSION

According to air conduction, bone conduction, and air-bone gap in the contralateral ear when the patients were monitored up to one month after surgery, there was no significant difference in the mean value of PTA before and after surgery in the current study. A definite temporary threshold shift was demonstrated but it may require audiological investigations such as otoacoustic emissions to confirm the hearing loss more accurately.

Therefore, it is likely that some outer hair cell damage caused by drill noise during mastoidectomy, but not to the extent that PTA may detect hearing loss, does occur. When planning a surgery, keep this in mind, especially for patients with a low cochlear reserve and for those who need repeated or multiple surgeries involving drilling the temporal bone.

To formally validate a cause-and-effect relationship, larger studies with other audiological investigations such as otoacoustic emissions could be necessary.

LIMITATION AND RECOMMENDATION

LIMITATION

- This study was conducted with smaller sample size. Larger sample size could yield better results.

- Distortion product otoacoustic emission values at different Hz could be measured pre and post operatively.

RECOMMENDATION

Studies with a bigger sample size and other audiological investigations such as otoacoustic emissions may be able to clarify the auditory or vibrational stress caused by drilling to the human cochlea.

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ANNEXURES

ANNEXURE

PROFORMA

Particulars of the patients

Name

Age

Gender

Occupation

UHID NO:

Date of admission:

Date of surgery:

Date of discharge:

EAR PAIN DURATION TYPE OF PAIN - PRICKING - THROBBING - RADIATING - NON RADIATING	
EAR DISCHARGE DURATION IF SO TYPE: MUCOID PURULENT MUCOPURULENT FOUL SMELLING AMOUNT	
TINNITUS	
GIDDINESS	

HARD OF HEARING DURATION UNILATERAL-RIGHT/LEFT BILATERAL	
HEAD ACHE	
FEVER	
NASAL OBSTRUCTION	

Hypertension	
Diabetes Mellitus	
Primary Tuberculosis	
Bronchial asthma	
History of previous surgery	
Treatment History	

DIET	
APPETITE	
SLEEP	
BOWEL AND BLADDER HABITS	

SMOKING If yes , duration No of packs per day	
ALCOHOL If yes, duration	

GENERAL PHYSICAL EXAMINATION

Build and Nourishment

Level of consciousness

Temperature

Pulse

Blood pressure

Respiration

LOCAL EXAMINATION

EAR EXAMINATION

RIGHT **LEFT**

- PREAURICULAR
  SINUS
  CYSTS
  ABSCESS

- POSTAURICULAR
  SINUS
  ABSCESS
- PINNA
  SHAPE
  SIZE

- TRAGUS TENDERNESS

- EXTERNAL AUDITORY CANAL
  DISCHARGE

  - TYPE OF DISCHARGE

  EDEMA

  MASS/POLYP

- TYMPANIC MEMBRANE
  - CONE OF LIGHT

  - PERFORATION

    - SITE

    - SIZE

- FACIAL NERVE

  TUNNNG FORK TESTS
- RINNES TEST
  WEBERS TEST

NOSE EXAMINATION

- EXTERNAL FRAME WORK
  - ANY ABNORMALITY
- COLUMELLA
- VESTIBULE
- SEPTUM
  - DEVIATION
- PNS TENDERNESS

ORAL CAVITY AND OROPHARYNX

MOUTH OPENING

LIPS /TEETH /TONGUE

BUCCAL MUCOSA

AP/PP/PPW

SYSTEMIC EXAMINATION

CVS

CNS

RS

P/A

INVESTIGATIONS –

Preoperative

air conduction threshold	
Bone conduction threshold	
Air bone gap	

SURGERY PERFORMED :

Course in the hospital: -

Condition of the patient on discharge: -

Post operative Pure tone audiometry postoperative day 7

Air conduction threshold	
Bone conduction threshold	
Air Bone gap	

Post operative Pure tone audiometry at end of 1 month

Air conduction threshold	
Bone conduction threshold	
Air Bone gap	

INFORMED CONSENT FORM

Name of the study - "Effect of Drill induced noise on contralateral normal ear following cortical mastoidectomy".

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily to participate as a participant in this research.

Print Name of Participant_____

Signature of Participant _____ Date _____

For illiterate –

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print name of witness_____ AND Thumb print of participant

Signature of witness _____ Date _____

Statement by the researcher/person taking consent I have accurately read out the information sheet to the potential participant with the best of my ability.I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

A copy of this ICF has been provided to the participant.

Print Name of Researcher taking the consent_____

Signature of Researcher taking the consent_____

Date_____

PRINCIPAL INVESTIGATOR'S NAME : Dr D.Sanjana Krishna Reddy

MOBILE NUMBER : 9849043129

EMAIL ID : sanjanakrishnareddy9@gmail.com

ತಿಳಿವಳಿಕೆ ಸಮ್ಮತಿ ನಮ್ೂನೆ

ಅಧ್ಯಯನದ ಹೆಸರು - ''ಕಾರ್ಟಿಕಲ್ ಮಾಸೊ್ೂಯ್ಡೆಕೊಮಿ ನಂತರ ಕಾಂಟ್ಾಾಟ್ಿರಲ್ ಸಾಮಾನಯ ಕಿವಿಯ ಮೇಲೆ ಡ್ರಾಲ್ ಪೆ್ೀರಿತ ಶಬ್ದದ ಪರಿಣಾಮ್''.

ನಾನು ಮೇಲಿನ ಮಾಹಿತಿಯನು್ನ ಓದಿದೆದೇನೆ, ಅಥವಾ ಅದನು್ನ ನನಗೆ ಓದಲಾಗಿದೆ. ಅದರ ಬ್ಗೆಿಪಾಶ್ಿುಗಳನು್ನ ಕೆೀಳುವ ಅವಕಾಶ ನನಗೆ ಸಿಕಿದೆ ಮತು್ತನಾನು ಕೆೀಳಿದ ಯಾವುದೆೀ ಪಾಶ್ಿುಗಳಿಗೆ ನನು ತೃಪ್ತುಗೆ ಉತುರಿಸಲಾಗಿದೆ. ಈ ಸಂಶ್ಿ ್ೀಧ್ನೆಯಲಿಿಪಾಲೊ್ಗಳಳಲು ನಾನು ಸವಯಂಪೆ್ೀರಣೆಯಂದ ಒಪು್ತುತೆು್ೀನೆ.

ಭಾಗವಹಿಸುವವರ ಮ್ುದಾಣ ಹೆಸರು _____

ಭಾಗವಹಿಸುವವರ ಸಹಿ _____ ದಿನಾಂಕ _____

ಅನಕ್ಷರಸಥರಿಗೆ –

ಸಂಭಾವಯ ಪಾಲೊ್ಗಳುಳವವರಿಗೆ ಒಪ್ತುಗೆಯ ರೂಪವನು್ನ ನಿಖರವಾಗಿ ಓದುವುದಕೆಿ ನಾನು ಸಾಕ್ಷಿಯಾಗಿದೆದೇನೆ ಮತು್ತವಯಕಿುಯು ಪಾಶ್ಿುಗಳನು್ನ ಕೆೀಳುವ ಅವಕಾಶವನು್ನ ಹೊಂದಿದಾದನೆ. ವಯಕಿುಯು ಮ್ುಕುವಾಗಿ ಒಪ್ತುಗೆ ನಿೀಡ್ರದಾದನೆ ಎಂದು ನಾನು ಖಚಿತಪಡ್ರಸುತು್ತೆು್ೀನೆ.

ಸಾಕ್ಷಿಯ ಮ್ುದಾಣ ಹೆಸರು _____ ಮತು್ತಭಾಗವಹಿಸುವವರ ಹೆಬ್ಿೆರಳು ಮ್ುದಾಣ ಸಾಕ್ಷಿಯ ಸಹಿ _____ದಿನಾಂಕ_____

ಸಂಶ್ಿ ್ೀಧ್ಕ / ವಯಕಿುಯ ಒಪ್ತುಗೆಯ ಹೆ್ೀಳಿಕೆ ನನು ಸಾಮ್ಥಯಿದ ಅತುಯತುಮ್ ಸಂಭಾವಯ ಪಾಲೊ್ಳುಳವವರಿಗೆ ಮಾಹಿತಿ ಹಾಳೆಯನು್ನ ನಾನು ನಿಖರವಾಗಿ ಓದಿದೆದೇನೆ. ಭಾಗವಹಿಸುವವರಿಗೆ ಅಧ್ಯಯನದ ಬ್ಗೆಿಪಾಶ್ಿುಗಳನು್ನ ಕೆೀಳಲು ಅವಕಾಶ ನಿೀಡಲಾಗಿದೆ ಎಂದು ನಾನು ಖಚಿತಪಡ್ರಸುತು್ತೆು್ೀನೆ, ಮತು್ತಕೆೀಳಿದ ಎಲಾಿಪಾಶ್ಿುಗಳು

ಭಾಗವಹಿಸುವವರಿಗೆ ಸರಿಯಾಗಿ ಮತು್ತನನು ಸಾಮ್ಥಯಿಕೆಿ ಉತುರಿಸಲಾಗಿದೆ. ಒಪ್ತುಗೆ ನಿೀಡುವಂತೆ ವಯಕಿುಯನು್ನ ಒತಾುಯಸಲಾಗಿಲಿಮತು್ತಒಪ್ತುಗೆಯನು್ನ ಮ್ುಕುವಾಗಿ ಮತು್ತಸವಯಂಪೆ್ೀರಣೆಯಂದ ನಿೀಡಲಾಗಿದೆ ಎಂದು ನಾನು ಖಚಿತಪಡ್ರಸುತು್ತೆು್ೀನೆ. ಭಾಗವಹಿಸುವವರಿಗೆ ಈ ಐಸಿಎಫ್ ನಕಲನು್ನ ಒದಗಿಸಲಾಗಿದೆ.

ಒಪ್ತುಗೆ ತೆಗೆದುಕೊಳುಳವ ಸಂಶ್ಿ ್ೀಧ್ಕರ ಮ್ುದಾಣ ಹೆಸರು _____

ಒಪ್ತುಗೆಯನು್ನ ತೆಗೆದುಕೊಳುಳವ ಸಂಶ್ಿ ್ೀಧ್ಕರ ಸಹಿ _____ ದಿನಾಂಕ _____

ಪ್ತಾನಿಿಪಾಲ್ ಇನೆವಸಿೊಗೆೀಟರ್ ಹೆಸರು: ಡಾ.ಡ್ರ.ಸಂಜನಾ ಕೃಷ್ಣರೆಡ್ಡಿ ಮೊಬ್ಿೆೈಲ್ ಸಂಖ್ಿಯ: 9849043129 ಇ

ಮೇಲ್ ಐಡ್ರ: sanjanakrishnareddy9@gmail.com

PATIENT INFORMATION SHEET

Name of the study - "Effect of Drill induced noise on contralateral normal ear following cortical mastoidectomy".

The PURE TONE AUDIOMETRY is required for the confirming the effects of drill nose on opposite ear following cortical mastoidectomy.We are conducting this study to predict the onset and severity of this condition.The Dept of Otorhinolaryngology, at Sri Devaraj Urs Academy of Higher Education & Research has decided to undertake a study on this regard.

We are inviting patients undergoing cortical mastoidectomy in this study, however based on criteria list, eligible participants will be chosen among the interested ones. Your participation in this research is entirely voluntary. It is your choice whether to participate or not. If you agree to participate in this study, you will undergo Pure Tone Audiometry test. By participating in this research you will help in identifying any hazardous effects of drill nose on opposite normal ear following surgery. It will also benefit other patients with chronic otits media undergoing surgery in future. The study will not add any risk or financial burden to you if you are part of the study.In case of any complication during surgery patient will be treated accordingly .

All information collected from you will be strictly confidential & will not be disclosed to any outsider. This information collected will be used for research purpose. This information will not reveal your identity & this study have been reviewed by central ethical committee. For any further clarification you are free to contact the Principal investigator, Dr.D.Sanjana krishna reddy , mobile – 9849043129.

There is no compulsion to participate in this study, further you are at the liberty to withdraw from the study at anytime if you wish to do so. Your treatment aspect will not be affected if you not wish to participate. You are required to sign only if you voluntarily agree to participate in proposed study. This document will be stored in a safe locker at the Dept of Otorhinolaryngology and strict confidentiality will be maintained. A copy of this document will be given to you for your information.

PRINCIPAL INVESTIGATOR'S NAME : Dr.D.Sanjana krishna reddy

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ರೊೀಗಿಯ ಮಾಹಿತಿ ಹಾಳೆ

ಅಧ್ಯಯನದ ಹೆಸರು - ‘‘ಕಾರ್ಟಿಕಲ್ ಮಾಸೊೂಯ್ಡೆಕೊಮಿ ನಂತರ ಕಾಂಟ್ಾಾಟ್ಿರಲ್ ಸಾಮಾನಯ ಕಿವಿಯ ಮೇಲೆ ಡ್ರಾಲ್ ಪೊರಿತ ಶಬ್ದದ ಪರಿಣಾಮ್’’.

ಕಾರ್ಟಿಕಲ್ ಮಾಸೊೂಯ್ಡೆಕೊಮಿ ನಂತರ ಎದುರು ಕಿವಿಯಲಿ್ಡ್ರಾಲ್ ಮ್ೂಗಿನ ಪರಿಣಾಮ್ಗಳನುು ದೃ ming ೀ ೀಕರಿಸಲು ಶುದಧಟ್ಿೂೀನ್ ಆಡ್ರಯೊಮರ್ಾ ಅಗತಯವಿದೆ. ಈ ಸಿಥತಿಯ ಆಕಾಮ್ಣ ಮ್ತುತೀವಾತೆಯನುು to ಹಿಸಲು ನಾವು

ಈ ಅಧ್ಯಯನವನುು ನಡೆಸುತಿುದೆದೀವೆ. ಶ್ಾೀ ದೆೀವರಾಜ್ ಉರ್ಸಿ ಅಕಾಡೆಮಿ ಆಫ್ ಹೆೈಯರ್ ಎಜುಕೆೀಶನ್ ಮ್ತುಒಟ್ಿೂರಿನೊೀಲರಿಂಗೊೀಲಜಿ ವಿಭಾಗ ಈ ನಿರ್ೊನಲಿ್ಅಧ್ಯಯನವನುು ಕೆೈಗೊಳಳಲು ಸಂಶ್ಿ ೀಧ್ನೆ ನಿಧ್ಿರಿಸಿದೆ. ಈ ಅಧ್ಯಯನದಲಿ್ನಾವು ಕಾರ್ಟಿಕಲ್ ಮಾಸೊೂಯ್ಡೆಕೊೂಮಿಗೆ ಒಳಗಾಗುವ ರೊೀಗಿಗಳನುು ಆಹಾವನಿಸುತಿುದೆದೀವೆ, ಆದರೆ ಮಾನದಂಡಗಳ ಪರ್ೊಯ ಆಧಾರದ ಮೇಲೆ, ಆಸಕುರಲಿ್ಅರ್ಿ ಭಾಗವಹಿಸುವವರನುು ಆಯ್ಿ ಮಾಡಲಾಗುತುದೆ. ಈ ಸಂಶ್ಿ ೀಧ್ನೆಯಲಿ್ನಿಮ್ಮ ಭಾಗವಹಿಸುವಿಕೆ ಸಂಪೂಣೆವಾಗಿ ಸವಯಂಪೊರಿತವಾಗಿದೆ. ಭಾಗವಹಿಸಬ್ಿೀಕೆ ಅಥವಾ ಬ್ಿೀಡವೆೀ ಎಂಬ್ುದು ನಿಮ್ಮ ಆಯ್ಿಯಾಗಿದೆ. ಈ ಅಧ್ಯಯನದಲಿ್ಭಾಗವಹಿಸಲು ನಿೀವು ಒಪ್ುದರೆ, ನಿೀವು ಶುದಧಟ್ಿೂೀನ್ ಆಡ್ರಯೊಮರ್ಾ ಪರಿೀಕ್ಷೆಗೆ ಒಳಗಾಗುತಿುೀರಿ. ಈ ಸಂಶ್ಿ ೀಧ್ನೆಯಲಿ್ ಭಾಗವಹಿಸುವ ಮ್ೂಲಕ ಶಸರಚಿಕಿತೆ್ಿಯ ನಂತರದ ಸಾಮಾನಯ ಕಿವಿಗೆ ಡ್ರಾಲ್ ಮ್ೂಗಿನ ಯಾವುದೆೀ ಅಪಾಯಕಾರಿ ಪರಿಣಾಮ್ಗಳನುು ಗುರುತಿಸಲು ನಿೀವು ಸಹಾಯ ಮಾಡುತಿುೀರಿ. ಭವಿಷ್ಯದಲಿ್ಶಸರಚಿಕಿತೆ್ಿಗೆ ಒಳಗಾಗುವ ದಿೀರ್ಿಕಾಲದ ಓರ್ಟಿಸ್ ಮಾಧ್ಯಮ್ ಹೊಂದಿರುವ ಇತರ ರೊೀಗಿಗಳಿಗೆ ಇದು ಪಾಯೊೀಜನವನುು ನಿೀಡುತುದೆ. ನಿೀವು ಅಧ್ಯಯನದ ಭಾಗವಾಗಿದದರೆ ಅಧ್ಯಯನವು ನಿಮ್ಗೆ ಯಾವುದೆೀ ಅಪಾಯ ಅಥವಾ ಆರ್ಥಿಕ ಹೊರೆ ಸೆೀರಿಸುವುದಿಲಿ. ಶಸರಚಿಕಿತೆ್ಿಯ ಸಮ್ಯದಲಿ್ಯಾವುದೆೀ ತೊಡಕುಗಳ ಸಂದಭೆದಲಿ್ರೊೀಗಿಗೆ ಅನುಗುಣವಾಗಿ ಚಿಕಿತೆ್ಿ ನಿೀಡಲಾಗುತುದೆ. ನಿಮಿಮಂದ ಸಂಗಾಹಿಸಲಾದ ಎಲಾ್ಮಾಹಿತಿಯು ಕಟುೊನಿಟ್ಾೊಗಿ

ಗೌಪಯವಾಗಿರುತುದೆ ಮುಯಾವುದೇ ಹೊರಗಿನವರಿಗೆ ಬಿರಂಗಪಡ್ರಸುವುದಿಲಿ. ಸಂಗಾಹಿಸಿದ ಈ ಮಾಹಿತಿಯನು ಸಂಶ್ ೀಧ್ನಾ ಉದೆದೇಶಕಾಿಗಿ ಬಳಸಲಾಗುತುದೆ. ಈ ಮಾಹಿತಿಯು ನಿಮ್ಮ ಗುರುತನು ಬಿರಂಗಪಡ್ರಸುವುದಿಲಿಮುುಈ ಅಧ್ಯಯನವನು ಕೇಂದಾ ನೈತಿಕ ಸಮಿತಿಯು ಪರಿಶ್ೀಲಿಸಿದೆ. ಯಾವುದೇ ಹೆಚಿಿನ ಸುಷ್ೊೀಕರಣಕಾಿಗಿ ನಿೀವು ಪಾಧಾನ ತನಿಖ್ಾಧಿಕಾರಿ ಡಾ.ಡ್ರ.ಸಂಜನಾ ಕೃಷ್ಣರೆಡ್ರೆ, ಮೊಬ್ೈಲ್ - 9849043129 ಅನು ಸಂಪಕಿಸಲು ಮ್ುಕುರಾಗಿದಿದೇರಿ.

ಈ ಅಧ್ಯಯನದಲಿಿಭಾಗವಹಿಸಲು ಯಾವುದೇ ಕಡಾಿಯವಿಲಿ, ಮ್ುಂದೆ ನಿೀವು ಬ್ಯಸಿದರೆ ಯಾವುದೇ ಸಮ್ಯದಲಿಿಅಧ್ಯಯನದಿಂದ ಹಿಂದೆ ಸರಿಯುವ ಸಾವತಂತಾಯವಿದೆ. ನಿೀವು ಭಾಗವಹಿಸಲು ಬ್ಯಸದಿದದರೆ ನಿಮ್ಮ ಚಿಕಿತೆಿಯ ಅಂಶವು ಪರಿಣಾಮ್ ಬೀರುವುದಿಲಿ. ಉದೆದೇಶ್ತ ಅಧ್ಯಯನದಲಿಿಭಾಗವಹಿಸಲು ನಿೀವು ಸವಯಂಪೆಾೀರಣೆಯಂದ ಒಪ್ತುಕೊಂಡರೆ ಮಾತಾ ನಿೀವು ಸಹಿ ಮಾಡಬ್ೇಕಾಗುತುದೆ. ಈ ಡಾಕುಯಮಂಟ್ಸ ಅನು ಒಟ್ಿಿರಿನೊೀಲರಿಂಗೊೀಲಜಿ ವಿಭಾಗದಲಿಿಸುರಕ್ಷಿತ ಲಾಕರ್ನಲಿಿಸಂಗಾಹಿಸಲಾಗುತುದೆ ಮ್ುಕಟುೊನಿಟ್ಾೊದ ಗೌಪಯತೆಯನು ಕಾಪಾಡ್ರಕೊಳಳಲಾಗುತುದೆ. ನಿಮ್ಮ ಮಾಹಿತಿಗಾಗಿ ಈ ಡಾಕುಯಮಂಟ್ಸನ ನಕಲನು ನಿಮ್ಗೆ ನಿೀಡಲಾಗುವುದು.

ಪ್ತಾನಿಿಪಾಲ್ ಇನೆವಸಿೊಗೆೀಟರ್ ಹೆಸರು: ಡಾ.ಡ್ರ.ಸಂಜನಾ ಕೃಷ್ಣರೆಡ್ರೆ ಮೊಬ್ೈಲ್ ಸಂಖ್ಿಯ: 9849043129 ಇಮೇಲ್ ಐಡ್ರ: sanjanakrishnareddy9@gmail.com

KEY TO MASTERCHART

M- male

F-female

UHID – Unique hospital ID number

ABG-Air bone gap

Hz-hertz

Unit of air conduction , bone conduction , air bone gap – Hertz

s_no	age	gender	UHID	Diagnosis	Surgery done	Date of surgery	preoperative air conduction of contralateral normal ear(in Hz)	preoperative bone conduction of contralateral normal ear(inHz)	preoperative air bone gap of contralateral normal ear(in Hz)	postoperative air conduction of contralateral normal ear on day 7 of surgery(in Hz)	postoperative bone conduction of contralateral normal ear on day 7 of surgery(in Hz)	postoperative air bone gap of contralateral normal ear on day 7 of (in Hz)	Postoperative air conduction of contralateral normal ear at end of 1 month(in Hz)	Postoperative bone conduction of contralateral normal ear at end of 1 month(in Hz)	postoperative air bone gap of contralateral normal ear at 1 month(in Hz)
1	21	Male	874113	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	18.12.2020	10	5	5	13	7	6	10	6	4
2	32	Female	861721	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	16.1.2021	12	6	6	12	8	4	11	8	4
3	41	Male	877109	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	26.2.2021	8	4	4	10	6	4	10	7	3
4	19	Male	889131	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	3.7.2021	11	6	5	15	8	7	13	8	5
5	28	Female	883505	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	17.3.2021	9	4	5	11	9	2	11	5	6
6	35	Male	892825	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	4.7.2021	10	6	4	14	10	4	12	4	8
7	46	Male	891661	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	19.5.2021	7	4	3	10	8	2	9	4	5
8	35	Female	892057	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	2.2.2021	13	11	2	12	8	4	12	5	7
9	37	Female	884760	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	27.5.2021	14	10	4	12	6	6	11	6	4
10	41	Male	877610	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	6.7.2021	10	8	2	13	7	5	10	8	2
11	21	Male	897013	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	14.6.2021	10	5	5	13	7	6	10	6	4
12	32	Female	857406	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	19.7.2021	12	6	6	12	8	4	11	8	4
13	41	Male	930153	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	23.7.2021	8	4	4	10	6	4	10	7	3
14	19	Male	928812	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	27.7.2021	11	6	5	15	8	7	13	8	5
15	28	Female	941336	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	8.7.2021	9	4	5	11	9	2	11	5	6
16	35	Male	931623	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	15.8.2021	10	6	4	14	10	4	12	4	8
17	46	Male	946832	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	19.9.2021	7	4	3	10	8	2	9	4	5
18	35	Female	948434	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	10.10.2021	13	11	2	12	8	4	12	5	7

s_no	age	gender	UHID	Diagnosis	Surgery done	Date of surgery	preoperative air conduction of contralateral normal ear(in Hz)	preoperative bone conduction of contralateral normal ear(inHz)	preoperative air bone gap of contralateral normal ear(in Hz)	postoperative air conduction of contralateral normal ear on day 7 of surgery(in Hz)	postoperative bone conduction of contralateral normal ear on day 7 of surgery(in Hz)	postoperative air bone gap of contralateral normal ear on day 7 of (in Hz)	Postoperative air conduction of contralateral normal ear at end of 1 month(in Hz)	Postoperative bone conduction of contralateral normal ear at end of 1 month(in Hz)	postoperative air bone gap of contralateral normal ear at 1 month(in Hz)
19	37	Female	25232	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	11.11.2021	14	10	4	12	6	6	11	6	4
20	41	Male	20995	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	12.7.2021	10	8	2	13	7	5	10	8	2
21	32	Female	45612	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	16.1.2022	12	6	6	12	8	4	11	8	4
22	41	Male	58963	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	25.1.2022	8	4	4	10	6	4	10	7	3
23	19	Male	57246	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	2.4.2022	11	6	5	15	8	7	13	8	5
24	28	Female	64792	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	14.2.2022	9	4	5	11	9	2	11	5	6
25	35	Male	57682	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	24.2.2022	10	6	4	14	10	4	12	4	8
26	46	Male	46571	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	3.8.2022	7	4	3	10	8	2	9	4	5
27	35	Female	34621	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	17.3.2022	13	11	2	12	8	4	12	5	7
28	37	Female	94384	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	15.9.2021	14	10	4	12	6	6	11	6	4
29	41	Male	884849	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	5.2.2021	10	8	2	13	7	5	10	8	2
30	21	Male	883805	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	8.3.2021	10	5	5	13	7	6	10	6	4
31	32	Female	892109	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	16.3.2021	12	6	6	12	8	4	11	8	4
32	41	Male	896791	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	18.3.2021	8	4	4	10	6	4	10	7	3
33	19	Male	891697	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	20.3.2021	11	6	5	15	8	7	13	8	5
34	28	Female	890732	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	20.3.2021	9	4	5	11	9	2	11	5	6
35	35	Male	877632	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	5.4.2021	10	6	4	14	10	4	12	4	8
36	46	Male	899028	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	24.6.2021	7	4	3	10	8	2	9	4	5

s_no	age	gender	UHID	Diagnosis	Surgery done	Date of surgery	preoperative air conduction of contralateral normal ear(in Hz)	preoperative bone conduction of contralateral normal ear(inHz)	preoperative air bone gap of contralateral normal ear(in Hz)	postoperative air conduction of contralateral normal ear on day 7 of surgery(in Hz)	postoperative bone conduction of contralateral normal ear on day 7 of surgery(in Hz)	postoperative air bone gap of contralateral normal ear on day 7 of (in Hz)	Postoperative air conduction of contralateral normal ear at end of 1 month(in Hz)	Postoperative bone conduction of contralateral normal ear at end of 1 month(in Hz)	postoperative air bone gap of contralateral normal ear at 1 month(in Hz)
37	35	Male	880067	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	24.11.2021	10	6	4	14	10	4	12	4	8
38	46	Male	40931	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	2.1.2022	7	4	3	10	8	2	9	4	5
39	35	Female	37407	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	4.3.2022	13	11	2	12	8	4	12	5	7
40	37	Female	40401	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	11.3.2022	14	10	4	12	6	6	11	6	4
41	41	Male	53017	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	13.3.2022	10	8	2	13	7	5	10	8	2
42	21	Male	53822	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	15.4.2022	10	5	5	13	7	6	10	6	4
43	32	Female	40931	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	17.4.2022	12	6	6	12	8	4	11	8	4
44	41	Male	40921	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	4.6.2022	8	4	4	10	6	4	10	7	3
45	19	Male	30987	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	8.6.2022	11	6	5	15	8	7	13	8	5
46	28	Female	33678	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	15.6.2022	9	4	5	11	9	2	11	5	6
47	35	Male	33456	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	22.6.2022	10	6	4	14	10	4	12	4	8
48	46	Male	35678	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	27.6.2022	7	4	3	10	8	2	9	4	5
49	35	Female	84274	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	5.7.2022	13	11	2	12	8	4	12	5	7
50	37	Female	61345	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	6.2.2022	14	10	4	12	6	6	11	6	4
51	41	Male	81984	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	19.6.2021	10	8	2	13	7	5	10	8	2
52	32	Female	139177	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	24.6.2021	12	6	6	12	8	4	11	8	4
53	41	Male	101394	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	4.7.2021	8	4	4	10	6	4	10	7	3
54	19	Male	124647	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	12.7.2021	11	6	5	15	8	7	13	8	5

s_no	age	gender	UHID	Diagnosis	Surgery done	Date of surgery	preoperative air conduction of contralateral normal ear(in Hz)	preoperative bone conduction of contralateral normal ear(inHz)	preoperative air bone gap of contralateral normal ear(in Hz)	postoperative air conduction of contralateral normal ear on day 7 of surgery(in Hz)	postoperative bone conduction of contralateral normal ear on day 7 of surgery(in Hz)	postoperative air bone gap of contralateral normal ear on day 7 of (in Hz)	Postoperative air conduction of contralateral normal ear at end of 1 month(in Hz)	Postoperative bone conduction of contralateral normal ear at end of 1 month(in Hz)	postoperative air bone gap of contralateral normal ear at 1 month(in Hz)
55	28	Female	106532	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	19.7.2021	9	4	5	11	9	2	11	5	6
56	35	Male	115525	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	24.7.2021	10	6	4	14	10	4	12	4	8
57	46	Male	138004	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	8.8.2021	7	4	3	10	8	2	9	4	5
58	35	Female	72193	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	17.8.2021	13	11	2	12	8	4	12	5	7
59	35	Female	7836	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	25.8.2021	13	11	2	12	8	4	12	5	7
60	37	Female	805376	Right chronic suppurative otitis media	Right cortical mastoidectomy+Tympanoplasty	19.9.2021	14	10	4	12	6	6	11	6	4
61	41	Male	73297	Left chronic suppurative otitis media	Left cortical mastoidectomy+Tympanoplasty	8.3.2022	10	8	2	13	7	5	10	8	2