

# A Clinical Profile of Chronic Suppurative Otitis Media patients with Complications - A Prospective Study

Dr. Vinod Kandakure<sup>1</sup>, Dr. Roshini Tamilalagan<sup>2</sup>

**Abstract:** *Chronic Suppurative Otitis Media (CSOM) is a persistent middle ear infection with significant global health implications, especially in underdeveloped and developing regions. This prospective study, conducted at a Government Tertiary Care Center, evaluated the clinical profile, complications, and surgical outcomes of CSOM patients over two years. The findings revealed a higher prevalence among young adult males, predominantly from rural areas. Extracranial complications, such as subperiosteal abscess and facial nerve palsy, were most common, while intracranial complications were absent. The study emphasized the importance of early diagnosis, appropriate antibiotic use, and surgical intervention, particularly canal wall down mastoidectomy, for effective disease management. Pseudomonas aeruginosa was the most frequently isolated pathogen. Postoperative follow-ups highlighted the need for meticulous surgical techniques to address common issues like delayed wound healing and recurrent discharge. These results underscore the necessity for improved healthcare accessibility and patient awareness to mitigate the morbidity associated with CSOM complications.*

**Keywords:** CSOM, chronic ear infection, complications, mastoidectomy, Pseudomonas aeruginosa

## 1. Introduction

Chronic Suppurative Otitis Media (CSOM) is a common condition in clinical practice and represents a significant global health challenge, particularly in underdeveloped and developing nations, including India. CSOM is characterized by a persistent middle ear infection with a perforated tympanic membrane [1]. This condition is marked by chronic inflammation of the middle ear and mastoid cavity that persists for more than two months, leading to a perforated eardrum and continuous ear discharge [2]. The persistent inflammation and infection can have severe health consequences, including intracranial complications and considerable morbidity [3].

CSOM is a common source of hearing loss, disability, and reduced quality of life. In severe cases, it may result in serious complications such as intracranial infections and acute mastoiditis, which can be life-threatening. [4]. The global frequency is approximately 4.76 per 1,000 people, equating to around 31 million cases annually, with 22.6% occurring in children under five years old. The highest incidence rates are observed in the Western Pacific and Southeast Asian regions [5].

The risk of developing complications from CSOM is influenced by multiple factors, including age, upper respiratory tract infections, enlarged adenoids, immune deficiencies, overall health status, childcare attendance, environmental conditions, exposure to household smokers, housing quality, genetic factors, and the availability and adequacy of healthcare [6].

Furthermore, the severity of the infection, the patient's immune system response, inadequate antibiotic treatment for acute ear and mastoid infections, and the presence of chronic health conditions can significantly influence the development of complications [6-7].

Complications of CSOM are classified into extracranial and intracranial categories. Extracranial complications are further categorized into intratemporal and extratemporal types. Intratemporal complications include mastoiditis, mastoid abscess, petrositis, labyrinthitis, and facial nerve paralysis [8-9]. Extratemporal complications involve postaural abscess, zygomatic abscess, Bezold's abscess, meatal (Luc's) abscess, Citelli's abscess, parapharyngeal abscess and retropharyngeal abscess. Intracranial complications encompass extradural abscess, subdural abscess, brain abscesses (temporal lobe and cerebellar), sigmoid and lateral sinus thrombophlebitis, meningitis and otitic hydrocephalus [10]. The mechanisms leading to these complications include progressive retrograde thrombophlebitis of venules in adjacent cranial bones, bone erosion due to mechanical forces pre-existing pathways, and hematogenous spread [10]. Diagnosing CSOM typically involves a combination of clinical evaluation, patient history and diagnostic tests. Common symptoms include chronic otorrhea (persistent ear discharge), otalgia (ear pain), and hearing impairment [4]. The primary bacteria responsible for CSOM are Pseudomonas aeruginosa, Klebsiella sp., Proteus sp and Staphylococcus aureus. Audiological assessment using PTA for air and bone conduction is crucial for evaluating the type of hearing loss and determining the airborne gap.

Mastoidectomy is a surgical procedure performed on the temporal bone to open postauricular air cells by removing the thin bony partitions between them. Schwartz's scholarly treatise in 1873 described the cortical mastoidectomy, which involved limited exenteration of mastoid air cells [11]. Bondy later modified this procedure, noting that if the disease was confined to the pars flaccida, it could be exteriorized, leaving the middle ear intact [12].

Effective management of CSOM is crucial due to its significant impact as a leading cause of middle ear disease. Timely diagnosis, through a detailed medical history and clinical examination is essential. Unfortunately, patient awareness and understanding often fall short, increasing the risk of extracranial or intracranial complications that can be fatal if not promptly identified and treated. This study aims to

evaluate the clinical profile of CSOM patients with complications and assess the outcomes following surgical intervention.

### Aim and Objectives

#### Aim

To study the incidence, clinical profile, treatment and outcome of CSOM patients presenting with complications.

#### Objectives

- To assess the patients with complications of Chronic Suppurative Otitis Media.
- To determine the postoperative outcome of these patients.

## 2. Methodology

**Source of Data:** The current study was conducted in the Department of ENT at the Government Tertiary Care Center. The study focused on patients presenting with complications of CSOM.

**Study Design:** This was a prospective study.

**Study Setting:** The research was carried out at a tertiary health center.

**Study Duration:** The study took place over a two-year period, from August 2022 to August 2024. Informed consent was secured from all participants.

**Study Population:** The study included all patients who met the inclusion and exclusion criteria for complications of Chronic Suppurative Otitis Media.

#### Sample Size:

In India, the prevalence of CSOM is 3.22%. The sample size determined,

$$N = 4pq / l^2$$

Where;

- $n$  = sample size,  $p$  = prevalence = 3.22,  $q$  =  $100 - p$ ,  $l$  = absolute error = 5
- $n = 4 * 3.22 * 96.8 / 5^2 = 1246.78 / 25 = 49.8$

The calculated sample size comes to approximately 50. Therefore, for this study, all patients with CSOM complications presenting to the ENT outpatient department (OPD) from August 2022 to August 2024 will be included until a minimum sample size of 50 is reached.

#### Inclusion Criteria:

- All Cases of Tubotympanic and Atticoantral Chronic Suppurative Otitis Media
- With Intracranial and Extracranial Complications.
- Patients of either sex
- Patients of any age
- Patient willing to give Written Informed Consent
- Patients with Mental Disorders

#### Exclusion Criteria:

- All cases of Acute Suppurative Otitis Media
- Patient not willing to give Written Informed Consent
- Patients not reporting for follow up.

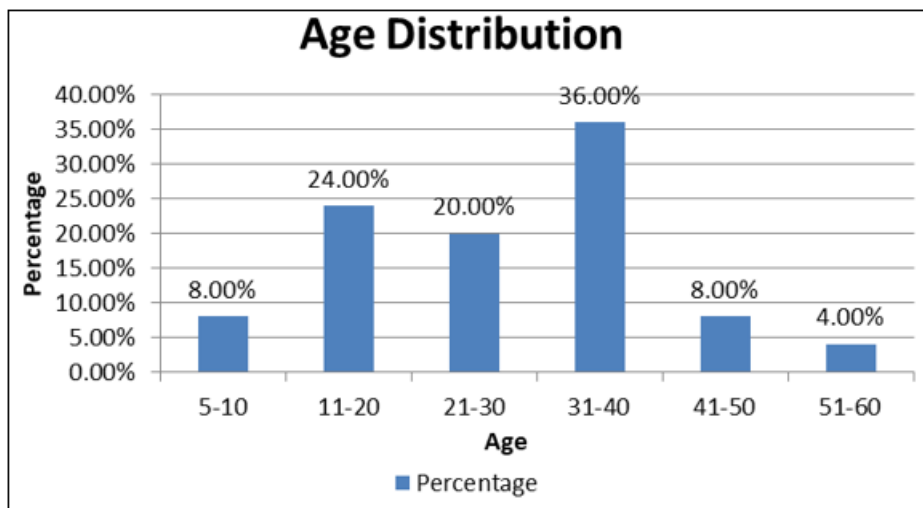
## 3. Procedures

- This was a prospective study conducted on patients who attended the ENT Department at the Government Tertiary Care Centre. The study focused on patients diagnosed with CSOM with complications and hearing loss, who underwent surgery for their condition. The study was performed in with the approval of the institutional ethical committee. Prior to participation, written informed consent was obtained from all patients.
- The demographic information on age, gender, sex along with previous medical history was collected from each patient. A detailed history was taken to assess various factors related to the condition such as history related to the ear discharge (whether from one or both ears), duration and quality of discharge, type of discharge (continuous or intermittent).
- Associated symptoms such as allergy, sore throat, or post-aural pain these details were systematically recorded in a preformatted proforma for each patient.
- The clinical examination included ear, nose, throat and general physical examination.
- Ear Swab Culture and sensitivity of the pus was carried out in all ear discharge patients.
- Hearing was assessed by PTA for each patient prior to surgery. PTA test measures the patient's hearing threshold levels at different frequencies (500, 1000, and 2000 Hz) to assess the degree of hearing loss.
- Patients underwent HRCT temporal bone and the results were recorded. This was done to plan and assess the disease's severity. It carried out in order to schedule the surgery and assess the severity of the illness.
- Plain X-ray of the mastoid region to assess mastoid air cells and detect any structural abnormalities.
- During the procedure the primary pathology (e.g., cholesteatoma, granulation tissue), condition of the ossicles, infection sites, presence of remaining air cells, and any complications were documented.
- Patients were reassessed at 1 month, 3 months, and 6 months after the surgery. At follow-up appointments, patients underwent evaluations, including otoscopic examination to assess the healing of the surgical site, check for any residual infection, and determine if there were any signs of recurrent cholesteatoma or granulation tissue. Facial nerve examination was conducted to check for any signs of facial nerve weakness or paralysis. Pure tone audiometry was also performed after 3<sup>rd</sup> month to determine the prognosis.

## 4. Results

**Table 1:** Distribution according to Age.

Age	No. of cases	Percentage
5-10	4	8.00%
11-20	12	24.00%
21-30	10	20.00%
31-40	18	36.00%
41-50	4	8.00%
51-60	2	4.00%
Total	50	100.00%



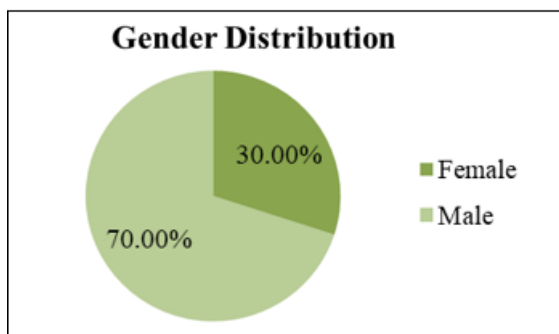
**Graph 1:** Distribution according to Age.

The cases analysed had a varied distribution across different age groups: 5-10 years (8.00%), 11-20 years (24.00%), 21-30 years (20.00%), 31-40 years (36.00%), 41-50 years (8.00%), and 51-60 years (4.00%). This breakdown highlighted the age diversity among individuals affected by pleural effusions in the study population.

The above table showed that the gender distribution revealed that 70% of cases involved males (35 cases), while females accounted for 30% (15 cases).

**Table 2:** Distribution according to Gender.

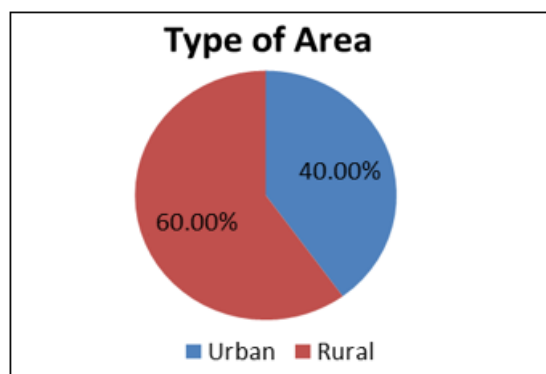
Gender	No. of cases	Percentage
Female	15	30.00%
Male	35	70.00%
Total	50	100.00%



**Graph 2:** Distribution according to Gender

**Table 3:** Distribution according to Area.

Area	No. of cases	Percentage
Urban	20	40.00%
Rural	30	60.00%
Total	50	100.00%

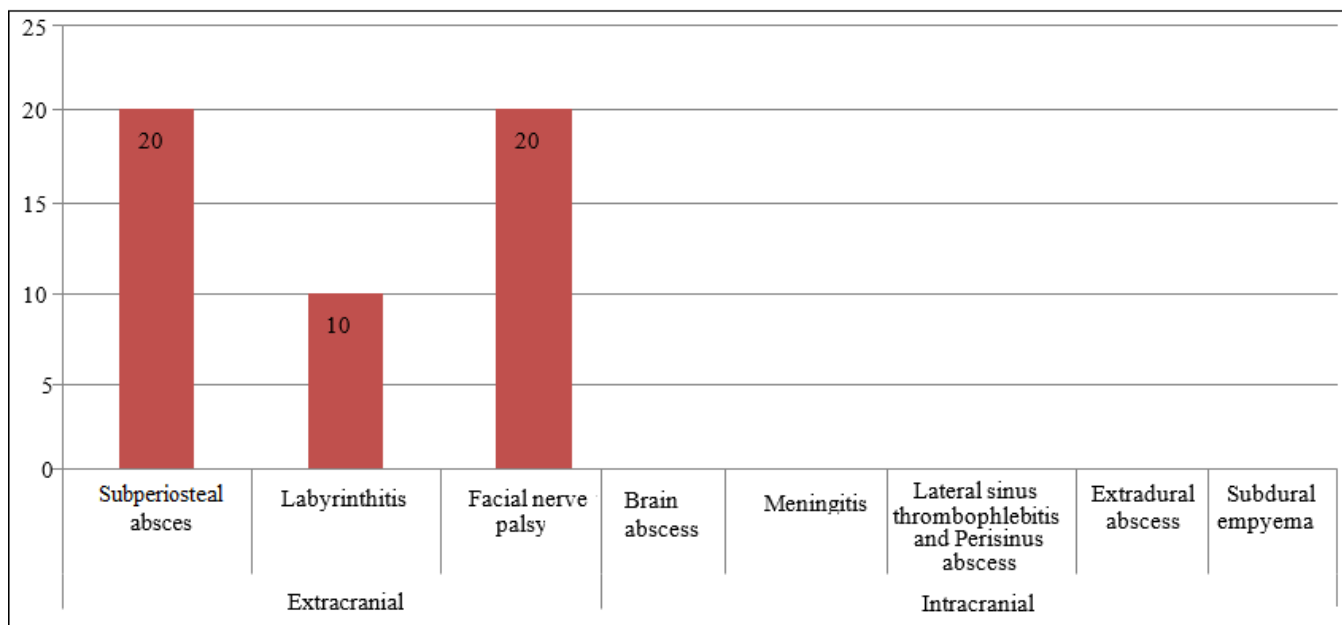


**Graph 3:** Distribution according to Area

The above table showed that the 60% of cases were from rural areas (30 cases), while urban areas accounted for 40% (20 cases).

**Table 4:** Distribution according to Complications.

Complication	Type of complication	No. of cases	Percentage
Extracranial	Subperiosteal abscess	20	40.00%
	Labyrinthitis	10	20.00%
	Facial nerve palsy	20	40.00%
Intracranial	Brain abscess	0	0.00%
	Meningitis	0	0.00%
	Lateral sinus thrombophlebitis and Peri sinus abscess	0	0.00%
	Extradural abscess	0	0.00%
	Subdural empyema	0	0.00%

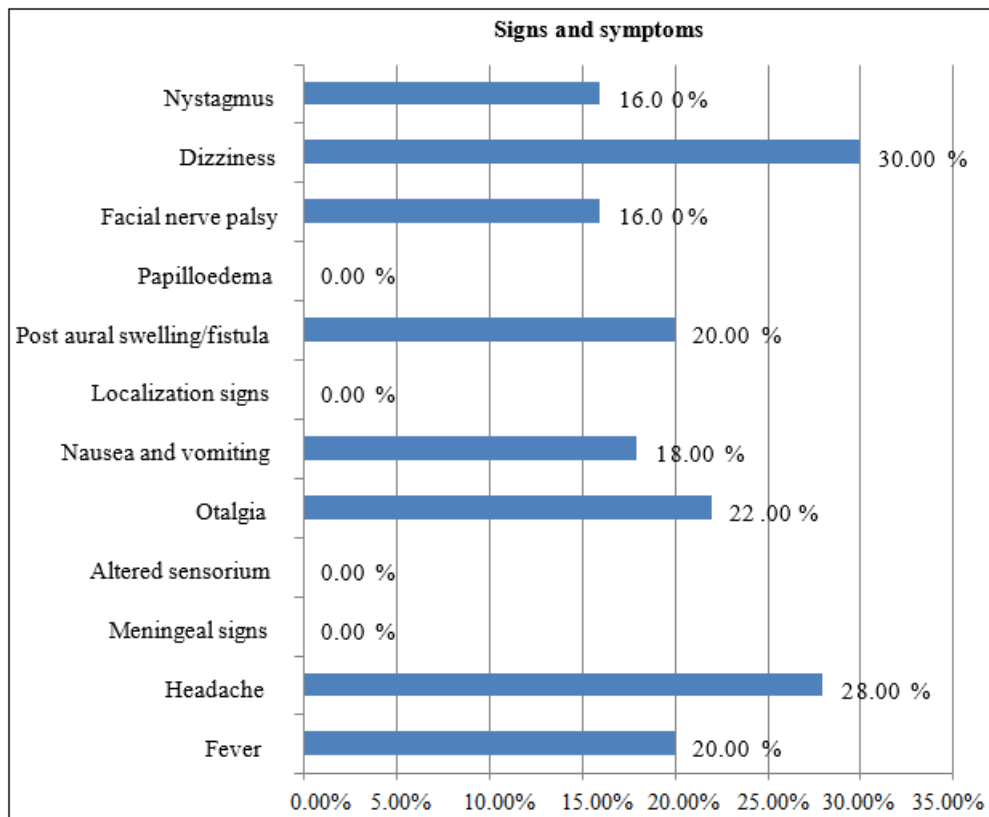


**Graph 4:** Distribution according to Complications

The table presents complications categorized into extracranial and intracranial types, along with the number of cases and percentages. Among extracranial complications, subperiosteal abscess and facial nerve palsy each occur in 20 cases (40%), while labyrinthitis occurs in 10 cases (20%). Intracranial complications, including brain abscess, meningitis, lateral sinus thrombophlebitis, peri sinus abscess, extradural abscess, and subdural empyema, show no reported cases (0%). This indicates that extracranial complications are relatively common, whereas intracranial complications were not observed.

**Table 5:** Distribution according to Signs & Symptoms.

Signs and symptoms	EC group (no. of cases)	Percentage
Fever	10	20.00%
Headache	14	28.00%
Meningeal signs	0	0.00%
Altered sensorium	0	0.00%
Otalgia	11	22.00%
Nausea and vomiting	9	18.00%
Localization signs	0	0.00%
Post aural swelling/fistula	10	20.00%
Papilledema	0	0.00%
Facial nerve palsy	8	16.00%
Dizziness	15	30.00%
Nystagmus	8	16.00%

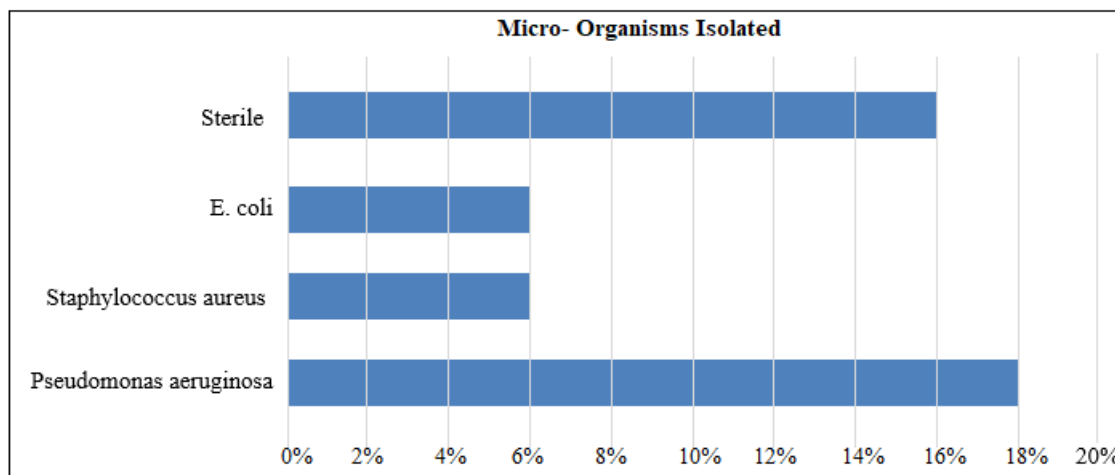


Graph 5: Distribution according to Signs & Symptoms

The table lists the signs and symptoms observed in the EC group, detailing the number of cases and their corresponding percentages. Dizziness is the most common symptom, occurring in 15 cases (30%), followed by headache in 14 cases (28%) and otalgia in 11 cases (22%). Both fever and post-aural swelling/fistula are seen in 10 cases each (20%). Nausea and vomiting occur in 9 cases (18%), while facial nerve palsy and nystagmus are each present in 8 cases (16%). Notably, there are no reported cases of meningeal signs, altered sensorium, localization signs, or papilledema (0%).

Table 6: Bacterial organisms isolated on culture in Extracranial

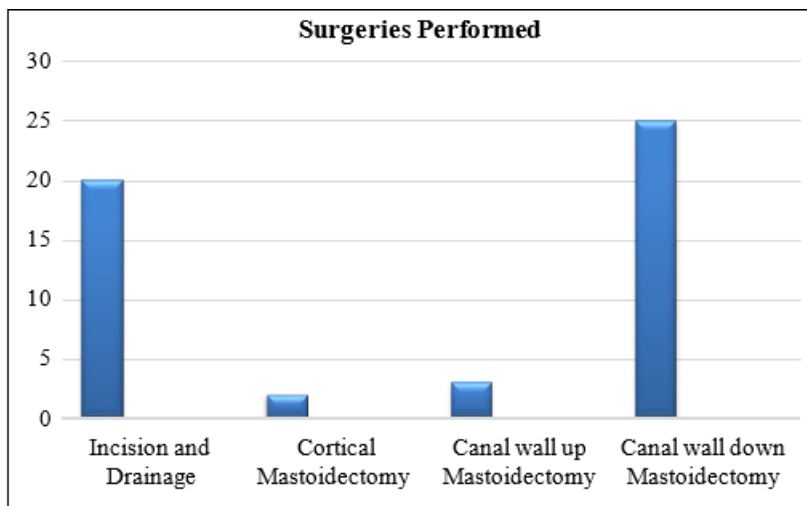
Organism isolated	No. of cases	Percentage
Staphylococcus aureus	3	6.00%
Pseudomonas aeruginosa	9	18.00%
E. coli	3	6.00%
Sterile	8	16.00%



Graph 6: Bacterial organisms isolated on culture.

Table 7: Surgeries Performed

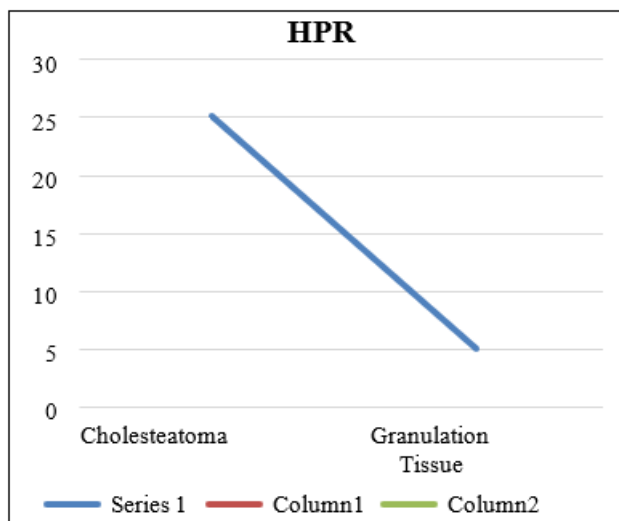
S.no	Surgery	No. of cases
1	Incision and Drainage	20
2	Cortical Mastoidectomy	1
3	Canal wall up Mastoidectomy	4
4	Canal wall down Mastoidectomy	25



Graph 7: Surgeries Performed

Table 8: Histopathology Reports

HPR	No. of cases
CHOLESTEATOMA	25
GRANULATION TISSUE	5



Graph 8: Histopathology Reports

## 5. Conclusion

- COM is a long- standing infection of a part or whole of the middle ear cleft characterized by ear discharge and a permanent perforation.
- It affects both sexes and all age groups.
- Pathways of spread of infection include direct bone erosion, venous thrombophlebitis, pre formed pathways.
- Classification of complications: Extracranial - Mastoiditis, facial paralysis, labyrinthitis, petrositis, sub periosteal abscess. Intracranial - Meningitis, extradural abscess, subdural abscess, brain abscess, lateral sinus thrombophlebitis, otitic hydrocephalus.
- Development of complications depends upon: organism's virulence, poor resistance of the patient, systemic disease, resistance to antibiotics, poor socioeconomic status, lack of awareness about healthcare, lack of outpatient department and doctor-dependent.
- My study concluded that the complications of SOM had a higher prevalence among young adult males

- The Majority of the cases were from rural area. We also noticed that patients from far flung areas are more prone to develop full-fledged complication as they have no medical facilities available and disease progresses to morbidity and complication.
- In our patients, there were risk factors to develop a complication such as recurrent upper respiratory tract infections, Diabetes mellitus, anemia and chronic adenotonsillitis.
- Appropriate antibiotics, based on culture and sensitivity reports, play a vital role in managing complications associated with it. At the same time, Excessive use and misuse of antibiotic treatment masked presentations, thereby reducing the chances of early diagnosis.
- The most common microorganism isolated was Pseudomonas aeruginosa.
- The most common complications encountered were subperiosteal abscess and facial nerve palsy.
- Early detection of symptoms associated with both intracranial (IC) and extracranial (EC) complications can facilitate early diagnosis and prompt intervention
- CT scan of temporal bone gives information regarding the extent of the disease and presence of bony erosion.
- Depending upon the radiological evaluation and intra-operative extent of the disease, definitive treatment usually involves a **Canal Wall Down Mastoidectomy**.
- This ensures removal of extensive cholesteatoma and granulation tissue and frequent inspection of the cavity to rule out recurrence.
- High surgical gain is defined as improvement in facial function by two or more grades by **House Brackman grading system** after surgery.
- CWDM yielded satisfactory outcomes clinically with ample epithelialization of postoperative cavities by the end of 6 months.
- The commonest cavity problem was delayed healing of the wound **chronic ear drainage** and an inadequate canal contour for a hearing aid followed by granulations and accumulation of debris.
- In view of the presence of these cavity problems following CWDM as a primary procedure, there is a need for meticulous surgery (adequately lowered facial ridge, circumferential saucerization, and wide meatoplasty) in every patient.

- Good recovery is seen in cases of COM with short duration of onset of facial nerve paralysis, the absence of previous surgery, non cholesteatomatous inflammatory granulation tissue and a healthy bony labyrinth.
- In the follow up, the most common problems involved were accumulation of wax, recurrent discharge and otomycosis which were tackled by op basis management.

**My study could be improved by adding mastoid cavity obliteration procedures and by prolonging the follow up.**

In the management of SOM with either an extra or intracranial complications,

**"Never let the sun set without performing ear surgery on the patient."**

## References

- [1] Pawar SR, Shukla Y. A clinical study on complications of chronic suppurative otitis media and level of awareness in patients admitted at a tertiary care hospital in central India. *Int J Community Med Public Health*. 2015;2(3):223-7.
- [2] Morris P. Chronic suppurative otitis media. *BMJ Clin Evid*. 2012 Aug 6;2012:0507. PMID: 23870746; PMCID: PMC3412293.
- [3] Khairkar M, Deshmukh P, Maity H, Deotale V. Chronic suppurative otitis media: A comprehensive review of epidemiology, pathogenesis, microbiology, and complications. *Cureus*. 2023;15(8). doi: 10.7759/cureus.43729. PMID: 37727177; PMCID: PMC10505739.
- [4] Acuin J. Chronic suppurative otitis media. *BMJ Clin Evid*. 2007;2007:0507. PMID: 19454051; PMCID: PMC2943814.
- [5] Heward E, Saeed H, Bate S, Rajai A, Molloy J, Isba R, Ashcroft DM, Hay AD, Nichani JR, Bruce IA. Risk factors associated with the development of chronic suppurative otitis media in children: Systematic review and meta-analysis. *Clin Otolaryngol*. 2024;49(1):62-73.
- [6] Vijayappan A, Deshmukh PT, Gaurkar S. Clinical profile of squamosal chronic otitis media among paediatric and adult patients in rural population of central India: A cross-sectional study. *J Clin Diagn Res*. 2023;17(6).
- [7] Shukla SK, Thakur AK, Mashih J, Shukla P, Shrivastava PK. Clinical study of patients suffering from chronic suppurative otitis media. *Res J PharmacolPharmacodyn*. 2012;4(2):98-101.
- [8] Gleeson M, Scott-Brown. *Scott-Brown's Otolaryngology*, 7th edition. Volume 3. Hodder Arnold; 2008. p. 3395-445.
- [9] Bansal M. *Disease of Ear Nose and Throat*. Mohan Bansal, 1st edition. Jaypee Brothers; 2013. p. 216-226.
- [10] Artono A, Purnami N, Rahmawati R. Biofilm bacteria play a role in CSOM pathogenesis and have significant correlation with unsafe type CSOM. *FMI*. 2015;51(4).
- [11] Noordzij JP, Dodson EE, Ruth RA, Arts HA, Lambert PR. Chronic otitis media and sensorineural hearing loss: is there a clinically significant relation? *Am J Otol*. 1995;16(4):420-3.
- [12] Shwetha. Chronic otitis media with cholesteatoma: clinical presentation and surgical management. *Int J Otorhinolaryngol Head Neck Surg*. 2018; 4:1212-9.
- [13] Brennan-Jones CG, Head K, Chong LY, Tu N, Burton MJ, Schilder AGM, Bhutta MF. Topical antibiotics for chronic suppurative otitis media. *Cochrane Database Syst Rev*. 2018 Jun 18;2018(6). doi: 10.1002/14651858.CD013051.
- [14] Monasta L, Ronfani L, Marchetti F, et al. Burden of disease caused by otitis media: systematic review and global estimates. *PLoS One*. 2012; 7:0.
- [15] Bluestone CD. *Studies in otitis media: Children's Hospital of PittsburghUniversity of Pittsburgh progress report-2004*. *Laryngoscope*. 2004; 114:1-26.
- [16] Wan Draman WNA, Md Daud MK, Mohamad H, Hassan SA, Abd Rahman N. Evaluation of the current bacteriological profile and antibiotic sensitivity pattern in chronic suppurative otitis media. *Laryngoscope Investig Otolaryngol*. 2021 Oct 18;6(6):1300-6. doi: 10.1002/lio2.682. PMID: 34938866; PMCID: PMC8665472.
- [17] Orji F. A survey of the burden of management of chronic suppurative otitis media in a developing country. *Ann Med Health Sci Res*. 2013;4(3):598-601. doi: 10.4103/2141-9248.122126.
- [18] Jensen RG, Koch A, Homøe P. The risk of hearing loss in a population with a high prevalence of chronic suppurative otitis media. *Int J Pediatr Otorhinolaryngol*. 2013;77(9):1530-5. doi: 10.1016/j.ijporl.2013.06.025.
- [19] Darmawan AB, Soesatyo MHNE, Restuti RD, Surono A. The role of mannosebinding lectin serum level in tubotympanic chronic suppurative otitis media. *Int J Otolaryngol*. 2018 May 22;2018:6178159. doi: 10.1155/2018/6178159. PMID: 29951099; PMCID: PMC5987288.
- [20] Hong LY, Head K, Richmond P, Snelling T, Schilder AGM, Burton MJ, Brennan-Jones CG. Systemic antibiotics for chronic suppurative otitis media. *Cochrane Database Syst Rev*. 2018(6). doi: 10.1002/14651858.CD013052. PMCID: PMC6513622.
- [21] Kuo CL, Yang TH, Cheng PW, et al. Updates and knowledge gaps in cholesteatoma research. *Biomed Res Int*. 2015; 2015:145010. doi: 10.1155/2015/145010.
- [22] Chavada PS. Middle ear cholesteatoma: A study of correlation between HRCT temporal bone and intraoperative surgical findings. *Int J Otorhinolaryngol Head Neck Surg*. 2018;4(5):1212-1219. doi: 10.18203/issn.2454-5929.ijohns20182425.
- [23] Varshney S, Gupta P, Kumar S, Mohanty A, Jha M. Chronic suppurative otitis media: A microbiological review of 20 years. *Indian J Otol*. 2020;26:59-67. doi: 10.4103/indianjotol.INDIANJOTOL\_141\_19.
- [24] Heine PA. Anatomy of the ear. *Vet Clin North Am Small Anim Pract*. 2004 Mar;34(2):379-95. PMID: 15062612.
- [25] Luers JC, Hüttenbrink KB. Surgical anatomy and pathology of the middle ear. *J Anat*. 2016;228(2):338-53. doi: 10.1111/joa.12319.
- [26] Alberti PW. The anatomy and physiology of the ear and hearing. *Occup Exposure Noise Eval Prev Control*. 2001;1:53-62.

- [27] Nuutinen J, Kärjä J, Karjalainen P. Measurement of mucociliary function of the eustachian tube. *Arch Otolaryngol.* 1983;109(10):669-72.
- [28] Thompson H, Ohazama A, Sharpe PT, Tucker AS. The origin of the stapes and relationship to the otic capsule and oval window. *Dev Dyn.* 2012;241(9):1396404.
- [29] Osma U, Cureoglu S, Hosoglu S. The complications of chronic otitis media: report of 93 cases. *J Laryngol Otol.* 2000;114(02):97-100.
- [30] Mozaffari M, Jiang D, Tucker AS. Developmental aspects of the tympanic membrane: Shedding light on function and disease. *Genesis.* 2020 Mar;58(3-4). doi: 10.1002/dvg.23365.
- [31] Hentzer E. Histologic studies of the normal mucosa in the middle ear, mastoid cavities and Eustachian tube. *Ann OtolRhinolLaryngol.* 1970 Aug;79(4):825-33.
- [32] Stenfors LE, Bloom GD, Hellström S. The tympanic membrane. *Acta Otolaryngol Suppl.* 1984;414:28-30.
- [33] Emmett SD, Kokesh J, Kaylie D. Chronic ear disease. *Med Clin North Am.* 2018;102(6):1063-1078. doi: 10.1016/j.mcna.2018.06.008.
- [34] Podoshin L, Margalit A, Fradis M, et al. Cholesteatoma—an epidemiologic study among members of Kibbutzim in Northern Israel. *Ann OtolRhinolLaryngol.* 1986;95(4):365-8.
- [35] Benson J, Mwanri L. Chronic suppurative otitis media and cholesteatoma in Australia's refugee population. *Aust Fam Physician.* 2012;41(12):978-80.
- [36] Syms MJ, Tsai PD, Holtel MR. Management of lateral sinus thrombosis. *Laryngoscope.* 1999;109(10):1616-20
- [37] Raja K, Parida PK, Alexander A, Surianarayanan G. Otogenic Lateral Sinus Thrombosis: A Review of Fifteen Patients and Changing Trends in the Management. *Int Arch Otorhinolaryngol.* 2018 ;22(3):208-213. doi: 10.1055/s0037-1604198. Epub 2017 Jul 14. PMID: 29983756; PMCID: PMC6033598.
- [38] Yuceturk AV, Unlu HH, Okumus M, Yildiz T, Filiz U. The evaluation of eustachian tube function in patients with chronic otitis media. *Clin Otolaryngol.* 1997;22(5):449-52.
- [39] Gulya, J., Minor, L. B., & Poe, D. S. (Eds.). (2010). *Glasscock-Shambaugh's surgery of the ear.* Publisher
- [40] Rosito LPS, Canali I, Teixeira A, Silva MN, Selaimen F, Costa SSD. Cholesteatoma labyrinthine fistula: prevalence and impact. *Braz J Otorhinolaryngol.* 2019 ;85(2):222-227. doi: 10.1016/j.bjorl.2018.01.005.
- [41] Park DC, Hong SM, Cha CI, Kim MG. Bacteriology of chronic suppurative otitis media – a multicenter study. *Acta Otolaryngol.* 2007;127:1062-7.
- [42] Madana J, Yolmo D, Kalaiarasi R, Gopalakrishnan S, Sujatha S. Microbiological profile with antibiotic sensitivity pattern of cholesteatomatous chronic suppurative otitis media among children. *Int J PediatrOtorhinolaryngol.* 2011; 75:1104-8.
- [43] Liu CM, Cosetti MK, Aziz M, Buchhagen JL, Contente-Cuomo TL, Price LB, Keim PS, Lalwani AK. The otologic microbiome: a study of the bacterial microbiota in a pediatric patient with chronic serous otitis media using 16SrRNA gene-based pyrosequencing. *Arch Otolaryngol Head Neck Surg.* 2011;137:664-8..
- [44] Prakash R, Juyal D, Negi V, Pal S, Adekhandi S, Sharma M, Sharma N. Microbiology of chronic suppurative otitis media in a tertiary care setup of Uttarakhand state, India. *N Am J Med Sci.* 2013;5:282-7.
- [45] Mittal R, Lisi C, Gerring R, Mittal J, Mathee K, Narasimhan G, Azad R, Yao Q, Grati M, Yan D, Eshraghi A, Angeli S, Telischi F, Liu XZ. Current concepts in the pathogenesis and treatment of chronic suppurative otitis media. *J Med Microbiol.* 2015; 64:1101-10. doi:10.1099/jmm.0.000155.
- [46] Gross S, Blaiss MS, Herrod HG. Role of immunoglobulin subclasses and specific antibody determinations in the evaluation of recurrent infection in children. *J Pediatr.* 1992;121:516-22.
- [47] Massa HM, Cripps AW, Lehmann D. Otitis media: viruses, bacteria, biofilms and vaccines. *Med J Aust.* 2009;191:44-9.
- [48] Berman S. Otitis media in developing countries. *Pediatrics.* 1995;96:126-31. Available from: <https://pubmed.ncbi.nlm.nih.gov/7596700/>.
- [49] Kumar D, Janat R, Nigam S, Afaq N, Nabi N, Bano F, et al. To study the prevalence and associated risk factors of chronic suppurative otitis media in patients at a tertiary care centre, Uttar Pradesh. *J Popul Ther Clin Pharmacol.* 2024;31(2):262-70. doi:10.53555/jptcp.v31i2.4337.
- [50] Aarhus L, Tambs K, Kvestad E, Engdahl B. Childhood otitis media: a cohort study with 30-year follow-up of hearing (The HUNT Study). *Ear Hear.* 2015; 36:302-8.
- [51] Wiederhold ML, Zajtchuk JT, Vap JG, Paggi RE. Hearing loss in relation to physical properties of middle ear effusions. *Ann OtolRhinolLaryngol Suppl.* 1980; 89:185-9.
- [52] Yorgancilar E, Yildirim M, Gun R, Bakir S, Tekin R, Gocmez C, Meric F, Topcu I. Complications of chronic suppurative otitis media: a retrospective review. *Eur Arch Otorhinolaryngol.* 2013; 270:69-76. doi:10.1007/s00405-012-1924-8.
- [53] da Costa SS, Rosito LP, Dornelles C. Sensorineural hearing loss in patients with chronic otitis media. *Eur Arch Otorhinolaryngol.* 2009; 266:221-4. doi:10.1007/s00405-008-0739-0.
- [54] Cureoglu S, Schachern PA, Paparella MM, Lindgren BR. Cochlear changes in chronic otitis media. *Laryngoscope.* 2004; 114: 622-6. doi:10.1097/00005537200404000-00006.
- [55] Samanta M, Gayen GC, Ray R. Analysis of hearing outcome following canal wall up and canal wall down mastoidectomy in squamous type of chronic suppurative otitis media: A comparative study. *Asian J Med Sci.* 2023 May;14(5):102-7.
- [56] House JW, Cunningham CD III. Otosclerosis. In: Flint PW, Haughey BH, Robbins KT, et al, editors. *Cummings otolaryngology - head and neck surgery.* 6th ed. Philadelphia: Elsevier Health Sciences; 2014. p. 2211-9.
- [57] Mocanu H, Mocanu AI, Bonciu A, Coadă G, Schipor MA, Rădulescu M. Analysis of long-term functional results of radical mastoidectomy. *Exp Ther Med.* 2021;22(5):1216. doi: 10.3892/etm.2021.10650.
- [58] Samanta M, Gayen GC, Ray R. Analysis of hearing outcome following canal wall up and canal wall down mastoidectomy in squamous type of chronic



- suppurative otitis media: A comparative study. *Asian J Med Sci.* 2023 May;14(5):102-7.
- [59] Patil S, Harshitha MC, Girish PB. Clinical profile of chronic suppurative otitis media (CSOM) patients. *J Cardiovasc Dis Res.* 2023;14(6):1770-3.
- [60] Mili MK, Kalita S, Sarmah M, Talukdar S, Goswami S. Complications of chronic otitis media and their management: a study at tertiary care centre. *Int J Res Med Sci.* 2023; 11:4082-7.
- [61] Varshney S, Gupta P, Kumar S, Mohanty A, Jha M. Chronic suppurative otitis media: A microbiological review of 20 years. *Indian J Otol.* 2020; 26:59-67. doi: 10.4103/indianjotol.INDIANJOTOL\_141\_19.
- [62] Mohite AA, Mane RS, Patil BC, Mohanty RM. Complications of chronic suppurative otitis media and their management: five year study at tertiary care centre. *Int J Otorhinolaryngol Head Neck Surg.* 2019; 5:900-5.
- [63] Muqtadir F, Rahul S. A study of clinical profile of patients with CSOM attending tertiary care hospital. *Int J Otorhinolaryngol Head Neck Surg.* 2018;4:68-70.
- [64] Sharma N, Jaiswal AA, Banerjee PK, Garg AK. Complications of Chronic Suppurative Otitis Media and Their Management: A Single Institution 12 Years Experience. *Indian J Otolaryngol Head Neck Surg.* 2015 Dec;67(4):353-60. doi: 10.1007/s12070-015-0836-5. Epub 2015 Feb 13. PMID: 26693451; PMCID: PMC4678280.
- [65] Tadke KR, Lahane VJ, Wakode PT. Role of Impedance Audiometry in Evaluation of Eustachian Tube Function and Its Correlation with Tympanoplasty Surgery Outcome: Our Experience. *IOSR J Dental Med Sci.* 2017;16(6):45-9.
- [66] Magsi PB, Jamro B, Sangi HA. Clinical presentation and outcome of mastoidectomy in chronic suppurative otitis media (CSOM) at a tertiary care hospital Sukkur, Pakistan. *Rawal Med J.* 2012;37(1):50-3.
- [67] Bhat V, Khaja N, Udayashankar S, Venkatesha B, Manjunath D. Clinicoepidemiological study of complicated and uncomplicated chronic suppurative otitis media. *J Laryngol Otol.* 2008;122:442-6. doi: 10.1017/S0022215107000278.
- [68] Nadol JB Jr, Staecker H, Gliklich RE. Outcomes assessment for chronic otitis media: the Chronic Ear Survey. *Laryngoscope.* 2000;110:32-5. doi: 10.1097/00005537-200003002-00009.
- [69] Yueh B, Shapiro N, McLean CH, Shekelle PG. Screening and management of adult hearing loss in primary care: scientific review. *JAMA.* 2003; 289: 1976-85.
- [70] S H C, M M K, Handi P, Khavasi P, Doddmani SS, Riyas M. To Study the Level of Awareness About Complications of Chronic Suppurative Otitis Media (CSOM) in CSOM Patients. *J Clin Diagn Res.* 2014;8(2):59-61. doi: 10.7860/JCDR/2014/8009.4008.
- [71] Hiremath C, Hiremath K, Handi P, Khavasi P, Doddmani SS, Riyas M. To Study the Level of Awareness About Complications of Chronic Suppurative Otitis Media (CSOM) in CSOM Patients. *J Clin Diagn Res.* 2014;8(2):59-61. doi: 10.7860/JCDR/2014/8009.4008.
- [72] Sade J. Ciliary activity and middle ear clearance. *Arch Otolaryngol.* 1967;86:22-9.
- [73] Khaliq N, Ahmad Z, Chandra K, Zubair MY, Md Anas. Clinico-epidemiological study of safe and unsafe chronic suppurative otitis media. *Indian J Community Health.* 2022 Mar 31;34(1):106-10. Available from: <https://www.iapsmupuk.org/journal/index.php/IJCH/article/view/2282>.
- [74] Raushan EA, Kumar J, Kapoor S, Pathak SD. Clinico-Epidemiological Profile of Tubotympanic Type of CSOM. *Ann Int Med Dent Res.* 2016;2(6)
- [75] Maharani D, Ferriastuti W. Chronic suppurative otitis media complicated by subdural and Bezold abscesses: A case report. *Radiol Case Rep.* 2022 Feb 4;17(4):1175-9. doi: 10.1016/j.radcr.2022.01.020. PMID: 35169423; PMCID: PMC8829503.
- [76] Prasad et al., Jaiswal AA, Garg A. Complications of Chronic Suppurative Otitis Media and their Management: A single Institution 12 Years Experience. *Indian J Otolaryngol Head Neck Surg.* 2015;67(4):353-60
- [77] Verma S, Arora A, Jain AK. Assessment of chronic suppurative otitis media patients with cholesteatoma on the basis of gadolinium enhanced T1-T2 weighted images of MRI. *Int J Otorhinolaryngol Head Neck Surg.* 2019; 5:1020-4.
- [78] Parmar B, Jha S, Sinha V, Chaudhury N, Dave G. A study of complications of chronic suppurative otitis media at tertiary care hospital. *Int J Otorhinolaryngol Head Neck Surg.* 2020;6:330. doi: 10.18203/issn.2454-5929.ijohns20200146.
- [79] Kombade SP, Kaur N, Patro SK, Nag VL. Clinico-bacteriological and antibiotic drug resistance profile of chronic suppurative otitis media at a tertiary care hospital in Western Rajasthan. *J Fam Med Prim Care.* 2021;10(7):2572-9.
- [80] Cassano P, Ciprandi G, Passali D. Acute mastoiditis in children. *Acta Biomed.* 2020 Feb 17;91(1-S):54-59. doi: 10.23750/abm.v91i1-S.9259. PMID: 32073562; PMCID: PMC7947742.
- [81] Khaliq, Najam & Chandra, Kamlesh & Zubair, Mohd. Yasir & Anas, Md. (2022). Clinico-epidemiological study of safe and unsafe chronic suppurative otitis media. *Indian Journal of Community Health.* 34. 106-110. 10.47203/IJCH.2022.v34i01.020.
- [82] Petersen C.G., Ovesen T., Pedersen C.B. Acute mastoidectomy in a Danish county from 1977 to 1997 – operative findings and long-term results. *Acta Otolaryngol Suppl.* 2000; 543: 122–126.
- [83] Islam Ferriastuti W. Chronic suppurative otitis media complicated by subdural and Bezold abscesses: A case report. *Radiol Case Rep.* 2022 Feb 4;17(4):1175-1179. doi: 10.1016/j.radcr.2022.01.020. PMID: 35169423; PMCID: PMC8829503.
- [84] Ajalloueyan, Mohammad. (2007). Surgery in Cholesteatoma: Ten years Followup. *Iranian Journal of Medical Sciences.*
- [85] Yusof, A.N.M., Boon, W.J., Ali, A. *et al.* Outcomes of canal wall down mastoidectomy in cholesteatoma: a 5-year experience. *Egypt J Otolaryngol* **39**, 50 (2023). <https://doi.org/10.1186/s43163-023-00409-z>
- [86] Kim BG, Kim HJ, Lee SJ, Lee E, Lee SA, Lee JD. Outcomes of Modified Canal Wall Down Mastoidectomy and Mastoid Obliteration Using

Autologous Materials. Clin Exp Otorhinolaryngol.  
2019;12(4):360-366. doi: 10.21053/ceo.2018.01333.

**Annexure**

**Abbreviations:**

<b>CSOM</b>	Chronic Suppurative Otitis Media
<b>COM</b>	Chronic Otitis Media
<b>EAC</b>	External Auditory Canal
<b>ETD</b>	Eustachian Tube Dysfunction
<b>OM</b>	Otitis Media
<b>IC</b>	Intracranial Complication
<b>EC</b>	Extracranial Complication
<b>CHL</b>	Conductive Hearing Loss
<b>CWUM</b>	Canal Wall Up Mastoidectomy
<b>CWDM</b>	Canal Wall Down Mastoidectomy
<b>AC</b>	Air Conduction
<b>BC</b>	Bone Conduction
<b>LF</b>	Labyrinthine fistula
<b>CT</b>	Computed tomography
<b>HRCT</b>	High-Resolution Computed Tomography
<b>SigA</b>	Secretory Immunoglobulin A
<b>PPD</b>	Purified Protein Derivative
<b>PTA</b>	Pure Tone Audiometry
<b>AMTAS</b>	Automated Method For Testing Auditory Sensitivity
<b>TM</b>	Tympanic membrane