

STUDY OF INTRACRANIAL COMPLICATIONS OF CHRONIC OTITIS MEDIA

Sinha Summy¹, Sangma R.² and Chatterjee Rahul³

¹Third Year Post Graduate Trainee, Department of Ent, Assam Medical College And Hospital

²Professor And Head of The Department, Department of Ent, Assam Medical College and Hospital

³Third Year Post Graduate Trainee, Department of Ent, Assam Medical College and Hospital

Corresponding Author

Dr. Rahul Chatterjee

rahul.crock.chatterjee@gmail.com

Abstract

Background: Mortality due to complications of chronic otitis media in recent times has reduced significantly after the advent of antibiotics and better diagnostic techniques. Despite a reduction in the incidence of complications following chronic otitis media, mortality still lingers among the population of developing nations owing to poor socio-economic conditions, negligence and less awareness about the disease.

Aim: to study the prevalence, clinical presentation, age and sex distribution, and organism commonly involved in intracranial complications of chronic otitis media in a tertiary care centre, in Assam.

Methods and Materials: it is a retrospective study including patients of chronic otitis media with intracranial complications presenting to the out patient department, and all admitted cases of intracranial complications in the department of Otorhinolaryngology, Assam Medical College and Hospital, from August 2017 to August 2023. After thorough confirmation by high resolution computed tomography, Magnetic resonance imaging and microbiological assessment, a total of 50 cases were included in the study.

Results: male patients with intracranial complications were more in number with 60% as against female patients with 40%, with a male to female ratio of 1.5:1. 48% of the patients were in the age group of 21-40 years. Intracranial abscess form the most common complication with maximum number of Temporal lobe abscess cases with 32% followed by Cerebellar abscess patients with 20% of total complication rate. Meningitis cases were 24%, and Lateral Sinus Thrombophlebitis were 8%. Most common clinical presentation among the patients were Headache with 84% followed by Fever with 70%. Ear discharge was seen in 50% of patients. 12(24%) of the patients underwent Modified Radical Mastoidectomy with Tympanoplasty, 38(76%) of the patients went through Radical Mastoidectomy and in 4(8%) out of them Facial

nerve Decompression was done. In 21(42%) of the patients with intracranial abscess, drainage was undertaken by the Neurosurgery Department. Rest 13(26%) of intracranial abscess patients were treated conservatively by intravenous antibiotics.

Conclusion: There was a male preponderance of patients over females with maximum patients belonging to the middle age group. Temporal lobe abscess was the most common intracranial complication followed by cerebellar abscess. Headache was the most common presentation followed by fever among the patients presenting with intracranial complications. Gram negative Pseudomonas and Gram positive Staphylococcus aureus were the most common organism isolated. With advent of antibiotics and better diagnostic tactics and prompt surgical intervention, mortality and morbidity due to intracranial complications is a thing of the past.

Keyword- Chronic otitis media, Intracranial complications, Assam Medical College and Hospital, High resolution computed tomography, Microbiological assessment.

INTRODUCTION

Chronic suppurative otitis media (CSOM) is defined as chronic ear discharge for more than 3 months period through a perforated tympanic membrane. The cycle of infection, inflammation, granulation tissues, polyp and cholesteatoma formation continues, destroying surrounding bony margins and soft tissues and ultimately leading to the various complications of CSOM¹. Chronic suppurative otitis media (CSOM) is still a commonly encountered disease in developing country and difficult to treat at times. Different complications can develop in spite of availability of higher class of antibiotics. In preantibiotic era, complications of ASOM and CSOM were very common and lead to high mortality²⁻⁶. Prior to antibiotic era, intracranial (IC) complication of CSOM occurred in 2.3–4 % cases. With antibiotic and new surgical techniques, the complication rate have been greatly reduced to 0.15–0.04 %. Mortality due to complications decreased from 25 to 8 %⁵. However, nowadays, intracranial complications of CSOM still represent a situation of risk given that mortality rate is high, reaching 36%⁷. Cholesteatoma was first described by Duverney JG in 1683, and defined by Abramson M et al., in 1977^{8,9}. Cholesteatoma, thus formed, harbors in it infectious microorganisms in 61.9%-72% of patients^{10,11}. Patients with Cholesteatoma usually present with persistent ear discharge with multiple attempts of treatment by Topical antibiotics. Repeated use of different topical antibiotics causes drug resistance in the microorganisms. Cholesteatoma, due to its osteolytic activity, provides an easy pathway for these micro-organisms to gain entry into the cranial cavity. The complications of CSOM has been divided into extracranial or intracranial. Extracranial complications are further divided into intratemporal and extratemporal. Intratemporal complications of CSOM are labyrinthitis, petrositis, mastoiditis, mastoid subperiosteal abscess, facial nerve paralysis and extratemporal complications are those of postauricular abscess, Zygomatic abscess, Bezold's abscess, meatal (Luc's) abscess, Citelli's abscess, parapharyngeal and retropharyngeal abscess. Intracranial complications includes extradural abscess, subdural abscess, brain abscesses which are mainly Temporal lobe abscess and cerebellar abscess, sigmoid and lateral sinus thrombophlebitis,

meningitis, and otitic hydrocephalus. The pathways of extracranial and intracranial complications are formed by progressive retrograde thrombophlebitis of the venules of the adjoining cranial bones, bone erosion by pressure or action of enzymatic actions, preformed pathways, and by haematogenous spread^{3,6}. The most common ICC are meningitis, cerebral abscess, extradural abscess and thrombophlebitis of lateral sinus¹². Such complications can also result from Acute Suppurative Otitis Media and to some extent from malignancy of the temporal bone and middle ear system. In this study, we are specifically addressing complication due to chronic infection of the middle ear cleft extending to the cranial cavity and the presentation of patients with respect to age, sex, clinical features and organism behind the cause.

AIMS AND OBJECTIVES

1. To assess the prevalence and clinical presentation of various intracranial complications of Chronic Otitis Media
2. To assess the distribution of Intracranial Complications of Chronic Otitis Media with respect to age and sex, organism involved and management protocol undertaken.

METHODS AND MATERIALS:

A total of 50 patients with intracranial complications of chronic otitis media admitted in the ward of the department of Otorhinolaryngology, Assam Medical College and hospital, Assam, between August 2017 to August 2023 were included in the retrospective study. Data of detailed local and systemic examination, audiological tests, radiological investigations like X-ray mastoid (Schuller's view), HRCT Temporomastoid, MRI brain and NECT brain and microbiological test for detection of organism behind causation of intracranial complications were obtained from hospital files. Examination of the central nervous system with special stress on pattern of fever, neck rigidity, Kernig's sign, Babinski's sign, fundus examination and eye movements was done. These signs helped us to assess the intracranial complications clinically. If meningitis is suspected during evaluation, lumbar puncture is performed and cerebrospinal fluid is collected and cultured. Definitive management constituting first line broad regimen of IV antibiotics given in TRIPLE THERAPY regimen consisting of Piperacillin-Tazobactam, Ceftriaxone with sulbactam/tazobactam, Metronidazole infusion and gentamycin / amikacin / tobramycin for 2-3 weeks before surgical intervention. Fungal organism isolated were treated with Liposomal Amphotericin B for a period of 2 weeks. Complications like brain abscess first went through neurosurgical intervention like abscess drainage by burr hole followed by primary ENT mastoid surgery for evacuation of rest of the disease.

Inclusion criteria:

1. Patient of any age and sex having history of ear discharge more than 3 months with either (one or more) intracranial complications diagnosed clinically and radiologically.

Exclusion Criteria:

1. Intracranial complications due to diseases of ear other than chronic suppurative otitis media.
2. Patients with extracranial complications of Chronic Otitis Media.
3. Patients with incomplete records were excluded

RESULTS:

Table 1: distribution based on age and sex

Age group	Male(N%)	Female(N%)	Total(N%)
1-20 years	8(57.14%)	6(42.86%)	14(28%)
21-40 years	16(66.67%)	8(33.33%)	24 (48%)
41-60 years	6(50%)	6(50%)	12(24%)
TOTAL	30(60%)	20(40%)	50(100%)

According to the above statistics, male patients with intracranial complications were more in number with 60% as against female patients with 40%, with a male to female ratio of 1.5:1. Maximum patients with intracranial complications were in the age group of 21-40 years, with 48 % prevalence followed by 1-20 years age group with 28% prevalence . In 41-60 years group prevalence of intracranial complications was 24%.

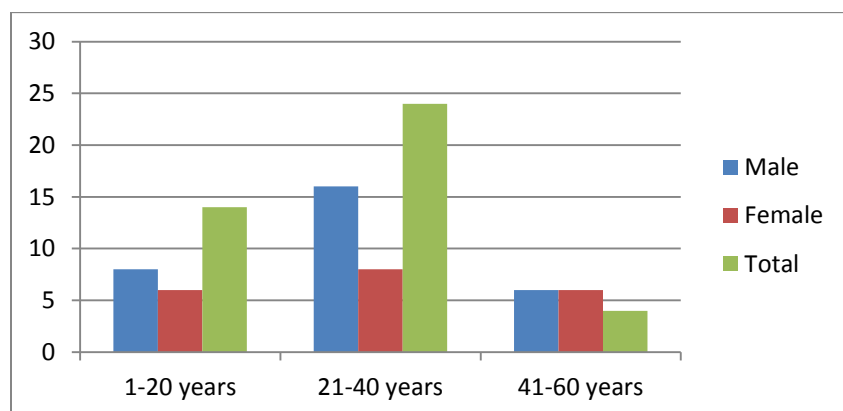


Fig-1

Table 2: based on distribution of intracranial complications

Intracranial complications	Number (%)
Meningitis	12(24%)
Brain abscess	
Cerebellar	10(20%)
Temporal	16(32%)
Extradural abscess	5(10%)
Subdural abscess	3(6%)

Lateral sinus thrombophlebitis	4(8%)
Otitic hydrocephalus	0
TOTAL	50(100%)

It is seen from the above table that intracranial abscess form the most common complication with maximum number of Temporal lobe abscess cases with 32% followed by Cerebellar abscess patients with 20% of total complication rate. Meningitis cases were 24%, and Lateral Sinus Thrombophlebitis case were 8%. Intracranial abscess was detected with the help of High Resolution Computed Tomography Images of the Temporomastoid region and MRI was used better delineate the perilesional soft tissue pathology.

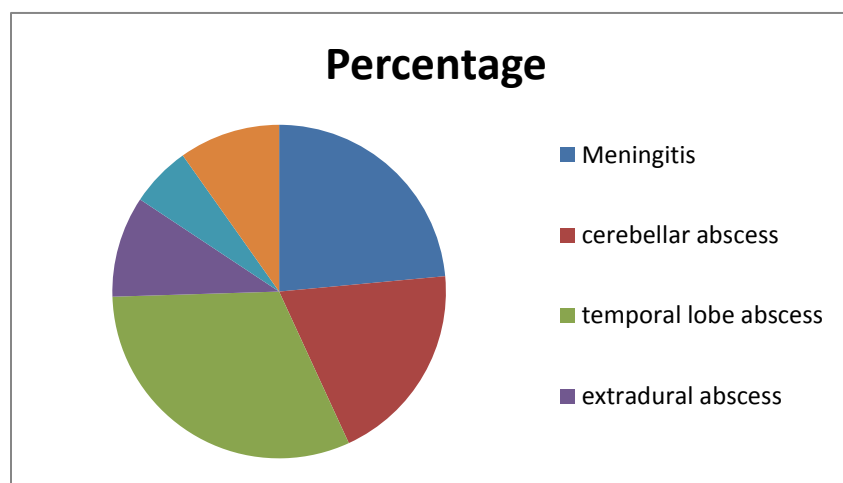


Fig-2

Table 3: based on distribution of Clinical features

Clinical Presentation	Complications						Total
	Meningitis	Cerebellar Abscess	Temporal lobe Abscess	Extradural Abscess	Subdural Abscess	Lateral Sinus Thrombophlebitis	
Headache	10	8	16	4	2	2	42(84%)
Fever	12	6	11	1	1	4	35(70%)
Ear Discharge	5	4	10	3	2	1	25(50%)
Altered		4	7				11(22%)

Sensorium							%)
Seizures		2	1				3(6%)
Vomiting		3	12				15(30%)
Earache	4	2	1			1	8(16%)
Blurring of Vision		3	2			1	6(12%)
Kernig's Sign	10						10(20%)
Brudzinski Sign	12						12(24%)
Cranial nerve palsy (7 th Cranial nerve)	2	3	8			4	17(34%)
Cholesteatoma	10	9	12	3	2	3	39(78%)
Granulation	7	5	6	2	3	4	27(54%)

From the above statistics, most common clinical presentation was Headache with 84% followed by Fever with 70%. Ear discharge was seen in 50% of the patients which hindered the accurate degree of audiological assessment of hearing loss. Hearing loss was complained by all of the patients. Cholesteatoma in the middle ear and cavity and some extending to the aditus and mastoid antrum was noticed intraoperatively in 78% of the patients. Granulation tissue was noted in 54% patients. Perforation of Tympanic membrane was noted in all the cases with intracranial complications of chronic suppurative otitis media with no noticeable retraction pockets. Cranial nerve palsy noted in the patients were mainly Facial Nerve palsy of various grades divided by the House-Brackmann Grading System.

Table 4: based on organisms isolated from culture of swab from different sites

Intracranial complications	Site from which culture was done					
	Ear Swab	N	Pus from abscess	_N	CSF fluid	N
Meningitis	Gram -ve				Gram -ve	
	Pseudomonas aeruginosa	7			Pseudomonas aeruginosa	7
	Klebsiella pneumoniae	4			Proteus mirabilis	1
	Gram +ve				Gram +ve	

	Staphylococcus aureus	1			Staphylococcus aureus	1
					Sterile	3
Temporal lobe abscess	Gram -ve		Gram -ve			
	Pseudomonas aeruginosa	4	Pseudomonas aeruginosa	4		
	Klebsiella pneumoniae	5	Klebsiella pneumoniae	5		
	Enterococcus	1	Enterococcus	1		
	Gram +ve		Gram +ve			
	Staphylococcus aureus	3	Staphylococcus aureus	3		
	Mycobacterium tuberculosis	1	Mycobacterium tuberculosis	1		
	Fungal		Fungal			
	Candida albicans	2	Candida albicans	2		
Cerebellar abscess	Gram -ve		Gram -ve			
	Pseudomonas aeruginosa	3	Pseudomonas aeruginosa	3		
	Klebsiella pneumoniae	2	Klebsiella pneumoniae	2		
	Enterococcus	2	Enterococcus	2		
	Gram +ve		Gram +ve			
	Staphylococcus aureus	1	Staphylococcus aureus	1		
	Propionibacterium	1	Anarobic organism			
	Fungal		Bacteroids fragilis	1		
	Candida albicans	1	Fungal			
		Aspergillus fumigatus	1			
Extradural abscess	Gram -ve		Gram -ve			
	Pseudomonas aeruginosa	2	Pseudomonas aeruginosa	2		

	Klebsiella pneumoniae	1	Klebsiella pneumoniae	1		
	Gram +ve		Gram +ve			
	Staphylococcus aureus	1	Staphylococcus aureus	1		
	Propionibacterium	1	Propionibacterium	1		
Subdural Abscess	Gram -ve		Gram -ve			
	Pseudomonas aeruginosa	1	Pseudomonas aeruginosa	1		
	Enterococcus	1	Klebsiella pneumoniae	1		
	Gram +ve		Gram +ve			
	Staphylococcus aureus	1	Staphylococcus aureus	1		
Lateral Sinus Thrombophlebitis	Gram -ve					
	Pseudomonas aeruginosa	1				
	Klebsiella pneumoniae	1				
	Gram +ve					
	Staphylococcus aureus	1				
	Mycobacterium tuberculosis	1				

Ear swab samples, pus samples after drainage of abscess and CSF samples were sent for microbiological analysis. Ear swab samples were sent for all the cases. Abscess drained pus samples were sent for 34 cases and CSF fluid analysis done for 12 cases of Meningitis. The above table shows results of organism isolated according to the complication associated. Most common organism isolated from both Ear swab and pus sample was gram negative Pseudomonas aeruginosa followed by Klebsiella pneumoniae. Mycobacterium tuberculosis was isolated from ear swab sample and pus sample of one Temporal lobe abscess patient and ear swab of one Lateral Sinus Thrombophlebitis patient. Most commonly detected gram positive organism was Staphylococcus aureus. Fungal organisms detected were Candida albicans from 2 ear swab samples of Temporal lobe abscess and 1 ear swab sample of Cerebellar abscess and Aspergillus fumigatus from 1 pus sample of Cerebellar Abscess. Samples with multiple organisms or patients

in which the ear and pus sample showed different organisms, were again sent for repeat analysis and all organisms analysed separately for antibiotic sensitivity.

Table 5: based on management

Management	Number of patients (%)
Conservative	50(100%)
Modified Radical Mastoidectomy with Tympanoplasty	12(24%)
Radical Mastoidectomy	38(76%)
Radical Mastoidectomy with Facial Nerve decompression	4(8%)
Neurosurgical intervention (drainage of abscess)	21(42%)
Temporal lobe abscess	10
Cerebellar Abscess	6
Extradural Abscess	3
Subdural Abscess	2
Abscess treated conservatively	11(22%)

As seen from the above table , all the 50(100%) patients, were started on conservative treatment, i.e., broad spectrum intravenous antibiotics. Meningitis and Lateral Sinus Thrombophlebitis cases were treated conservatively by IV antibiotics. 12(24%) of the patients underwent Modified Radical Mastoidectomy with Tympanoplasty, 38(76%) of the patients went through Radical Mastoidectomy and in 4(8%) out of them Facial nerve Decompression was done. In 21(42%) of the patients with intracranial abscess, Neurosurgical team was consulted for drainage of abscess by Craniotomy and Burr Hole, after which patients were shifted to the Neurosurgery department. In 10 of the Temporal lobe abscess, 6 of Cerebellar abscess, 3 extradural abscess and 2 subdural abscess, drainage was done by Neurosurgery team. Rest 11(22%) of intracranial abscess patients were treated conservatively by intravenous antibiotics, for the resolution of abscess as it has not formed a capsule.

Table 6: based on follow-up post management

Management protocol	Total	Recovery	Recurrence
Modified Radical Mastoidectomy with Tympanoplasty	12	10(83.33%)	2(16.67%)
Radical Mastoidectomy	38	37(97.37%)	1(2.63%)
Radical Mastoidectomy with Facial Nerve decompression	4	4(100%)	0
Abscess drained by			

Craniotomy and Burr hole			
Temporal lobe abscess	10	10(100%)	0
Cerebellar Abscess	6	5(83.33%)	1(16.67%)
Extradural Abscess	3	3(100%)	0
Subdural Abscess	2	2(100%)	0
Abscess treated conservatively	11	11(100%)	0
Meningitis	12	12(100%)	0
Lateral sinus thrombophlebitis	4	4(100%)	0

From the above table it can be seen that , out of total 12 Modified Radical Mastoidectomies with tympanoplasty 10(83.33%) had uneventful recovery while 2(16.67%) cases followed with reperforation of the Tympanic Membrane with collection in middle ear and mastoid.For these cases Radical Mastoidectomy was undertaken thereafter. One case of Radical Mastoidectomy with Cerebellar Abscess had recurrence where reexploration of ear had to be done. All other cases had uneventful recovery. There were 2 cases of mortality , one of Temporal Lobe abscess and one of Cerebellar abscess patients while being admitted in the ward before proper investigations could be done and proper treatment could be initiated.

DISCUSSION:

It is a retrospective study including 50 patients with Chronic Otitis Media with intracranial complications presenting to the department of Otorhinolaryngology , Assam Medical College and Hospital, Assam between August 2017 to August 2023.

In this study , it was found that almost half the patients, i.e., 48% were in the age group of 21-40 years. This is similar to other studies where otogenic ICC was found to be more frequent in children and young adults¹³⁻¹⁶. Majority of patients were less than 30 years with male predilection of 1.5:1 consistent with the studies of Scnnaroglu L. et al¹⁴ & Yen P.T. et al¹⁵. Majid,Khan et al¹⁶ too in their study found majority of the patients presented in the second and third decade of life. Most common intracranial complication was brain abscess, temporal lobe abscess(32%) being most common which was similar to study done by Sharma et al. (52%), Kurein et al. 26% [16], Pennybacker et al. [17] 42.5%, Bento et al. [18], Majdin et al. [19] . Headache, fever and ear discharge were the most common clinical features as suggested by data. Similar findings were noted in the study counducted by Wu JF et.al.,(20) and Dubey SP et.al.,(6) This can be considered as a golden triad to look out for when treating a patient with cholesteomatous disease. Pus culture exhibited gram negative organisms predominantly. Isolated bacteria included Gram negative Pseudomonas, Klebsiella, Gram positive Staphylococcus aureus and fungal organism like Candida and Aspergillus. Similar pathogens were detected in chronic

suppurative otitis media study causing intracranial complications by Perrido Nde O. et al(21). Of all causes of brain abscess, otogenic etiology constitutes 40%-80% (Jovanovic M B et al)(22).

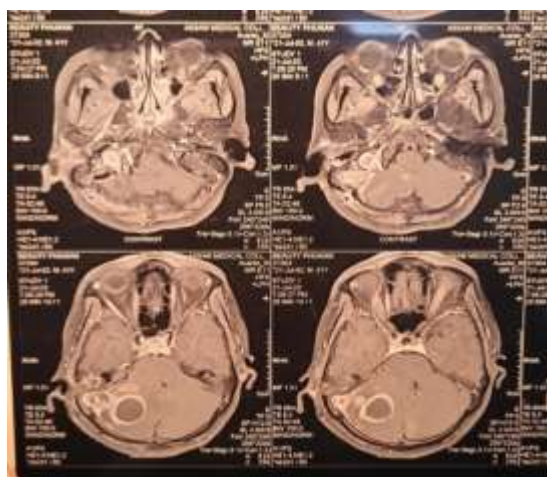
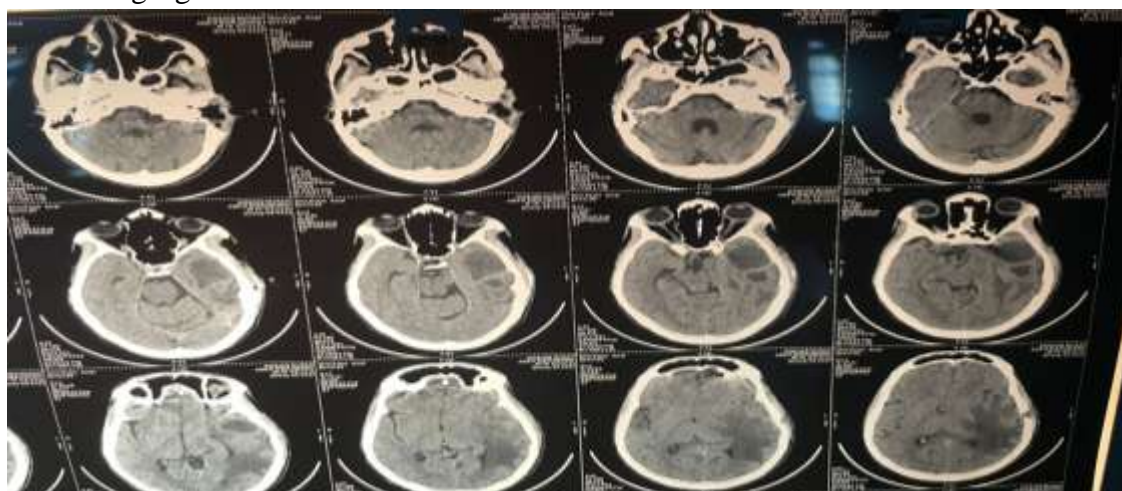


Fig:3 MRI brain (axial section) showing right cerebellar abscess



Fig:4 MRI brain(coronal section) abscess



Fig; 5 CT brain (axial scan) showing left temporal lobe abscess

All the patients were subjected to 2-3 weeks regimen of higher antibiotics. 12(24%) patients went through Modified Radical Mastoidectomy and in 38(76%) patients Radical Mastoidectomy was done. Radical Mastoidectomy with Facial nerve decompression was done in 4 patients. Intracranial abscess was treated first in the Neurosurgery department following which the primary ear surgery was done in a second sitting in 21(42%) of the abscess patients, which included 10 temporal lobe abscess, 6 cerebellar abscess, 3 Extradural Abscess and 2 Subdural Abscess. Rest of the patients with intracranial abscess were given antibiotics for the resolution of abscess and Surgery for the ear disease was done thereafter. Meningitis was resolved by use of IV broad spectrum antibiotic like Piperacillin+Tazobactam, Meropenem, Vancomycin or

Clindamycin. Cases in which fungal organisms were isolated were treated by IV Antifungal Liposomal Amphotericin B. In case of Lateral Sinus Thrombophlebitis, lateral sinus was not opened in this study to excavate the thrombus. As intraoperatively, the consistency of the Lateral Sinus was soft and there was no thrombus palpable. Patient was continued on post operative antibiotics and repeat MRI brain and angiography done to see the extent of resolution of the Thrombophlebitis Patients with Facial Nerve Palsy were prescribed oral corticosteroids in tapering dosage along with oral Methylcobalamine postoperatively during the follow-up period during which improved House- Brackmann Grading of Palsy was noted. Patient were discharge after administration of 10 days of post-operative antibiotics and were followed up at 1 month, 3 months and 6 months and every yearly thereafter for 5 years. One case of Radical Mastoidectomy with Cerebellar Abscess had recurrence where reexploration of ear had to be done. Out of 12 cases of Modified Radical Mastoidectomy with Tympanoplasty 2 cases followed with recurrent perforation and discharge which were then treated by Radical Mastoidectomy. Recovery was uneventful in rest of the patients. In 1 out of 17 patients there was permanent Facial Nerve Palsy. In There were 2 cases of mortality, one of Temporal Lobe abscess and one of Cerebellar abscess patients while being admitted in the ward before proper investigations could be done. The mortality rate was found to be 4% in our study which is similar to the studies conducted by Neeta S et al⁵, and Osma et al²³.

CONCLUSION

In this study, there was a male preponderance with 1.5:1 ratio. temporal lobe abscess was the most common intracranial complication followed by cerebellar abscess. Headache was the most common presentation followed by fever. Gram negative Pseudomonas was the most common organism isolated. Intracranial complications of Chronic Otitis Media and the mortality associated with it can be dealt effectively with the proper approach of timely diagnosis by detailed history, local systemic and neuro-otological examination, relevant investigations and prompt treatment in collaboration with neurosurgical team.

REFERENCES

1. Slattery WH. Pathology and clinical course of inflammatory diseases of the middle ear. In: Glasscock ME, Gulya AJ, editors. Glasscock-Shambaugh surgery of the ear. 5th ed. Ontario: BC Decker Inc 2003: 422-33.
2. Midak V, Chavan V, Borade V, et al. Intracranial complications of otitis media: in retrospect. Indian J Otolaryngol Head Neck Surg. 2005;57:130-5.
3. Bansal M. Disease of Ear Nose and Throat- Mohan Bansal, 1st edition. Jaypee; 2013: 216-226.
4. Yorgancılar M, Yıldırım R, Gün S, Bakır R, Tekin C, Gocmez F, et al. Complications of chronic suppurative otitis media: a retrospective review. Eur Arch Otorhinolaryngol. 2013;270:69– 76.

5. Neeta S, Ashwin J, Praveer B, Amrish G. Complications of Chronic Suppurative Otitis Media and Their Management: A Single Institution 12 Years Experience. *Indian J Otolaryngol Head Neck Surg.* 2015;67:353-60.
6. Dubey S, Larawin V. Complications of chronic suppurative otitis media and their management. *Laryngoscope.* 2007;117:264-7.
7. Teichgraeber JF, Per-Lee JH, Turner JS Jr. Lateral sinus thrombosis: a modern perspective. *Laryngoscope* 1982 Jul; 92(7 Pt 1): 744- 51.
8. Duverney JG. *Traité de l'Organe de l'Ouïe.* Paris: E. Michaillet,1683.
9. Abramson M, Gantz BJ, Asarch RG, Litton WH. Cholesteatoma pathogenesis. Evidence for the migration theory, in, McCabe BF, Sade J, Abramson M (eds): *Cholesteatoma - First International Conference.* Birmingham, Alabama, Aesculapius, 1977: 176.
10. Likus W, Siemianowicz K, Markowski J, Wiaderkiewicz J, Kostrzb-Zdebel A, Jura-Szołtys E, et al. Bacterial infections and osteoclastogenesis regulators in men and women with cholesteatoma. *Arch Immunol Ther Exp (Warsz).* 2016;64(3):241-47.
11. Mahajan T, Dass A, Gupta N, Chander J, Saini V, Pol SA. Bacteriological profile in attic-antral type of chronic suppurative otitis media. *Indian J Otolaryngol Head Neck Surg.* 2019;71(Suppl 2):1412-21.
12. Samuel J, Fernandes CM, Steinberg JL. Intracranial otogenic complications: a persisting problem. *Laryngoscope* 1986 Mar; 96(3): 272-8.
13. Mustafa A, Heta A, Kastrati B, Dreshaj Sh. Complications of chronic otitis media with cholesteatoma during a 10-year period in Kosovo. *Eur Arch Otorhinolaryngol.* 2008;265(12):1477-82.
14. Sennaroglu L, Sozeri B. Otogenic brain abscess: review of 41 cases. *Otolaryngol Head Neck Surg.* 2000;123(6):751-55.
15. Yen P.T., Chan S T, Huang T S – Brain abscess: with special reference to otolaryngologic sources of infection. *Otolaryngology Head and Neck Surgery* 1995 July; 113(1): 15-22.
16. Kurein MS, Job A, Mathew J et al (1988) Otogenic intracranial abscess. *Arch Otolaryngol Head Neck Surg* 124:1353–1356.
17. Pennybacker J (1961) Discussion on intracranial complications of otogenic origin. *Proc R SocOtol* 54:309–320.
18. Bento R, de Brito R, Ribas GC (2006) Surgical management of intracranial complications of otogenic infection. *Ear Nose Throat J* 85(1):36–39.
19. Hafdin MA, Keogh I, Walsh RM, Walsh M, Rawluk D (2006) Otogenic ICC: A 7 year retrospective review. *Am J Otolayngol* 27:390–395.
20. Wu JF, Jin Z, Yang JM, Liu YH, Duan ML. Extracranial and intracranial complications of otitis media: 22-year clinical experience and analysis. *Acta Otolaryngol.* 2012;132(3):261-65.
21. Perrido Nde O, Borin A, Iha L C, Suguri V M, Onishi E, Fukuda Y, Cruz O L. Intracranial complications of otitis media: 15 years experience in 33 cases. *Otolaryngology Head and Neck Surgery:* 2005 Jan; 132(1): 37-42.

22. Jovanovic MB, Jovanovic MD, Vidojevic M, Berisavac I, Milenkovic S, a double abscess of the cerebellum of otogenic origin. *Srp Arh Celok Lek* 2001, Nov-Dec:129(11- 12) : 300-3.
23. Osma U, Cureoglu S, Hosoglu S. The complications of chronic otitis media: report of 93 cases. *J Laryngol Otol.* 2000;114:97-100.