Neurotologic Complications of Chronic Otitis Media with Cholesteatoma

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Neurotologic Complications of Chronic Otitis Media with Cholesteatoma

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Abstract: Chronic suppurative otitis media, infection of the middle ear, is a common disease in the developing countries and the complications associated with it still pose a major problem in the developing countries. The proximity of the middle ear cleft and mastoid air cells to the extracranial and intracranial compartments places structures located in these areas at increased risk of infectious complications. Complications are seen more in the rural population than in urban population. Despite the fact that incidence of chronic suppurative otitis media related complications has significantly decreased since the introduction of antibiotics this clinical problem has not been eliminated yet. The neurotologic complications of chronic suppurative otitis media remains a serious concern, particularly in developing countries and socioeconomically poor regions.

Chronic suppurative otitis media is broadly classified into tubotympanic (otitis media without cholesteatoma) and atticoantral (otitis media with cholesteatoma) types. The complications of chronic suppurative otitis media are divided into extracranial complications and intracranial complications. Neurotologic complications are more common in patients having otitis media with cholesteatoma than in patients with otitis media without cholesteatoma. Many researchers have shown that majority of subjects who had neurotologic complications due to chronic suppurative otitis media were found to have cholesteatoma.

This prospective study was undertaken to study the neurotologic complications of chronic suppurative otitis media with cholesteatoma.

Keywords: Neurotologic, complication, chronic otitis media, cholesteatoma.

INTRODUCTION

The complications of chronic suppurative otitis media are divided into extracranial complications and intracranial complications. Complications are more common in patients having atticoantral type of otitis media than in patients with tubotympanic type of otitis media.

Neurotologic complications of chronic otitis media include the following:

1. Cerebral abscess
2. Cerebellar abscess
3. Lateral sinus thrombosis
4. Otitic hydrocephalus
5. Meningitis
6. Subdural abscess
7. Extradural abscess
8. Facial nerve palsy
9. Lateral rectus palsy
10. Sensorineural hearing loss

MATERIAL & METHODS

Study type: Prospective study

Study design: Descriptive study

Net sample size: 72

This was a prospective descriptive study undertaken in a tertiary care medical college hospital from 2005 to 2012. This institute caters to both urban and rural population and it is a referral centre in the state.

In this study there were 72 patients with 100 neurotologic complications. All cases of atticoantral ear disease with complications were included in this study. All these patients underwent otoscopy, ear swab for culture and sensitivity and high resolution CT scan of the temporal bone. Histopathological examination of the middle ear cholesteatoma/granulation tissue was also done. Pure tone audiometry was done for many cases that were fit and in others it was done later. All the patients were started on combination of broad spectrum antibiotics. The commonly used combination was ceftriaxone 1gm iv bd or cefotaxime 1gm iv tid along with gentamycin 80mg iv bd and metronidazole 500mg iv tid. In required cases antibiotics were

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changed according to culture and sensitivity report. Cases with intracranial complications neurosurgical intervention was done first in required cases. Mastoid exploration was planned as soon as the general condition of the patient improved. Surgical clearance of sigmoid sinus thrombosis through the transmastoid route was undertaken immediately. All patients underwent canal wall down mastoidectomy. The entire patients were followed up for minimum period of three months.

The following observations were recorded in each patient.

1. Age
2. Gender
3. Socio economic status/Domicile of the patient
4. Literacy status
5. Pre disposing focus nose/throat
6. Symptoms
7. Microbiology of ear discharge
8. Intraoperative findings
9. Pathology in the ear
10. Type of complications

1. Age

Age of the patients ranged from 5 years to 65 years. Most of the complications occurred below the age of 20 years. Majority of complications were seen in older children and in young adolescents (Table **1**).

Table 1: Showing Age Distribution of the Patients

Age in years	Number of patients (n=72)	%
1-20	36	50.0
21-40	19	26.3
41-60	14	19.4
>60	03	4.1
Total	72	

2. Gender

Disease was predominantly seen in male patients. Out of 72 patients 49 (68.05 %) were male and 23 (31.94%) were female. The male to female ratio was. 2.1:1.

3. Domicile

42 patients (58.3%) were from rural area and 30 (41.6%) patients were from urban area.

4. Literacy

Complications were seen more in the literate patients (55.55%) as compared to illiterate patients (44.44**%**).

5. Socio Economic Status

There were 45 patients (62.5%) from the low socioeconomic group and 27 (37.5%) patients from middle socioeconomic group.

6. Symptoms

Headache (65.2%) and fever (62.5%) were the commonest symptom of complications. Otalgia was present in 38.8% of the patients, giddiness was present in 36.1% of the patients and vomiting was present in 16.6% of patients (Table **2**).

Table 2: Showing Symptoms of the Patients

Symptoms	Number of patients (n=72)	%
Fever		
Absent	27	37.5
Present	45	62.5
Otalgia		
Absent	44	61.1
Present	28	38.8
Headache		
Absent	25	34.7
Present	47	65.2
Vomiting		
Absent	60	83.3
Present	12	16.6
Giddiness		
Absent	46	63.8
Present	26	36.1

7. Bacteriology Study of Ear Discharge

Pseudomonas aeruginosa was isolated in 41.6% of the cases. Nine patients had mixed infections.

Pseudomonas and Proteus combination was more common (Table **3**).

Table 3: Showing Ear Pus Culture Results

Pus for culture	Number of patients (n=72)	%
No growth	18	25
Growth	54	75
1.Pseudomonas aeruginosa	30	41.6
2.Staphylococcus aureus	6	8.3
3.Streptococcus	5	6.9
4.Proteus	6	8.3
5.Peptostreptococcus	7	9.7
6.Klebsiella	2	2.7
7.Escherichia coli	2	2,7
8.Bacterioids	5	6.9

8. Intraoperative Findings

Majority of the patient had ossicular chain erosion with cholesteatoma and granulations. Other operative findings were – facial canal dehiscence, dural plate erosion and labyrinthine fistula and perisinus abscess.

9. Pathology in the Ear

Majority of the patients had both cholesteatoma and granulations and presence of both was found to be significant (Table **4**).

Table 4: Showing Ear Pathology in the Patients

Pathology	Number of patients (n=72)	%
Granulations		
Absent	10	13.8
Present	62	86.1
Cholesteatoma		
Absent	17	23.6
Present	55	76.3

10: Neurotologic Complications

In this study there were 72 patients with atticoantral type of chronic otitis media with neurotologic complications. Number of patients are 72 but complications are 100.This is because many patients had more than one complication (Table **5**).

Table 5: Showing Neurotologic Complications in the Patients

Complication	Number of patients (n=72)	%
Facial nerve palsy	14	19.4
Lateral rectus palsy	4	5.5
Sensorineural hearing loss	12	16.6
Temporal lobe abscess	24	33.3
Cerebellar abscess	12	16.6
Occipital lobe abscess	1	1.3
Lateral sinus thrombosis	16	22.2
Otitic hydrocephalus	9	12.5
Meningitis	4	5.5
Subdural abscess	3	4.1
Extradural abscess	1	1.3
Total	100	

11. Surgical Treatment

Cerebral abscess were drained through craniotomy in 17 patients and through burr hole in 4 patients. In three patients which were less than 1.5 cm in size were managed conservatively. Cerebellar abscess were drained by craniectomy. In 5 patients with otitic hydrocephalus ventriculo peritoneal shunt procedure was required to control raised intracranial pressure.

All patients in the study underwent canal wall down mastoidectomy of which 49 underwent concurrent tympanoplasty as well.

DISCUSSION

Chronic otitis media still prevails as one of the most common otological problems encountered worldwide especially in the developing countries. Due to the penury in these parts of the world, neglect of the disease causes progression to complications. However, the occurrence of chronic suppurative otitis media and its neurotologic complications have reduced considerably with the advent of better antibiotics. Modern high-resolution computed tomographic scans have allowed for earlier diagnosis when signs and symptoms are present. Mortality rates from intracranial complications have also fallen significantly, from 35% to 5% in the same time period, likely owing to these factors. Despite the advent of antibiotics and advancement in our knowledge and skills in managing otitis media, serious complications still exist. The probable reason why these complications are still

encountered may be related to the ignorance about the seriousness of persistent and sometimes offensive ear discharge [1-4].

In the present study there were 72 patients with 100 complications. Out of which 44 (61.1%) patients had single complication and 28(38.8%) patients had more than one complication. This study showed that intracranial complication is frequently associated with another intracranial complication. Earlier studies have shown that the incidence of multiple complications were low [1-4]. In the present study, an increase in the incidence of multiple complications was observed.

In a report published by Yorgancilar *et al*. [2] from Turkey, majority of the patients were in the age group 21-30 years whereas a study by Gandhi *et al*. [5] from India showed that majority of patient (67.8%) were under the age of 15. In a study by Dubey *et al*. [4] in 2007, 22 (31%) patients were in the first decade, 17(24%) patients were in the second, 21(30%) in the third, 5(7%) in the forth, 2(2.9%) in the fifth and one each in sixth, seventh and eighth decade. In the present study there were 36 (50%) patients in the age group 1-20 years. Further analysis showed that the large number of complications (28) occurred in the age group of 15 to 20 yrs. There is a shift in the higher incidence of neurotologic complications associated with chronic suppurative otitis media from paediatric to young adolescent age group.

Studies on the complications of cholesteatoma have found multifarious men-to-women ratios. In a ten years retrospective study by Mustafa *et al*. [3] on complications of otitis media with cholesteatoma, there were 55(60.4%) and 36 (39.6%) women and the difference was statistically significant. Gandhi *et al*. [5] from India in their study showed that male to female ratio was 2.1:1. Yogancilar *et al*. [2] in his study showed a male to female ratio of 1.16:1.Only one study, by Gupta *et al.* from India showed that females were more prone for complications (M: F =1:1.10). In the series by Osma *et al*. [6], the authors found a significant difference in the men-to-women ratio of 2:1. In a retrospective study by Dubey *et al*. [4]**,** male to female ratio was 3:1. In the present study out of 72 patients 49 (68.05%) were male and 23(31.94%) were female. The male to female ratio was 2.1:1.

Mustafa *et al*. [3] did not find significant difference among urban and rural patients. Osma *et al*. [6] found that the complications were more common in rural patients than in urban patients. In study by Vakinpelu *et al*. [7] from Nigeria, most patients were from rural areas and had been previously managed by unlicensed, untrained practitioners. Complications were mostly present in children. In the present study 42 (58.3%) patients were from the rural area were there were no otology surgery facilities and 30 (41.6%) patients were from the urban area. The probable reason why these complications are still encountered more in the rural areas may be due to decreased awareness and ignorance towards the seriousness of persistent and sometimes offensive ear discharge. Shaheen *et al*. [8] revealed statistically significant association of chronic otitis media with yearly income of guardian, maternal education, bathing habit, ear cleaning habit, pattern of primary medical consultation. In the present study complications were seen more in the literate patients (55.55%) as compared to illiterate patients (44.44%), which may be attributed to the shift in literacy patterns in the country.

Mustafa *et al*. [3] found that complications were seen more in young patients from a lower socioeconomic class and without sex preponderance. Lasisi *et al*. [9] were of the opinion that low socioeconomic class, malnutrition, congestion from high number of children in the household and bottle feeding constitute significant risk factor. In the present study 45 (62.5%) patients were from low socio economic group and 27 (37.5%) patients were from middle socio economic group.

Dubey *et al*. [4] the commonest symptoms were otorrhea in 63(90%) patients; fever in 27 (39%).The most frequent symptoms in Yorgancilar's [2] study was otorrhea, headache and fever. Study by Pendio *et al*. [10] showed that persistent fever, headache, and purulent otorrhea were the main symptoms. Kangasanarak [11] stated that purulent malodorous otorrhea, cholesteatoma, headache fever and otalgia were the significant alarming manifestations. According to Huseyin Seven [12] headache (93%), fever (87%) and altered mental status (62%) were the most common presenting symptoms and signs, along with symptoms of chronic otitis media. In study of early neurotologic clinical features of otitis media, Schwaber *et al*. [13] are of the opinion that purulent, malodorous discharge, headache and fever are the significant early signs and symptoms that should raise the index of suspicion. Altered mental status is a late finding and usually indicates established intracranial spread of infection. In the present study otorrhea, Headache (65.2%) and fever (62.5%) were the commonest symptoms associated with complications. Other symptoms were otalgia (38.8%), giddiness (36.1%) and vomiting (16.6%).

Yorgancilar *et al*. [2] reported 12 patients with sensorineural hearing loss. Osma *et al*. [6] in his study observed 5 cases with profound deafness of which 2 were associated with extracranial and other 3 with intracranial complications. They had 5 patients with profound hearing loss in the study group of 93 patients. Leskinen [14] reported permanent hearing loss in 13 (26%) patients. Kasliwal *et al*. [15] suggested that more severe middle ear disease may result in sensorineural hearing loss and they suggested early intervention in cases of chronic suppurative otitis media. Kolo *et al*. [16] found that patients with chronic suppurative otitis media had a significant degree of sensorineural hearing loss. The higher frequencies were more affected. Patient's age and duration of otorrhea seem not to have any correlation with the degree of sensorineural hearing loss. Blakley *et al*. [17] showed a highly significant association between the presence of chronic otitis media and sensorineural hearing loss. In a series by Kaur *et al*. [18], the incidence of sensorineural hearing loss was 24% and particularly it was seen in higher frequencies. Authors also found that the incidence of sensorineural hearing loss progressively increased with the duration of chronic suppurative otitis media.

Of the 72 patients in this study 12 patients had mixed hearing loss of which 2 were associated with extracranial complications 7 with intracranial complications and 4 with both extracranial and intracranial complications. Mixed hearing loss was significantly more with the latter two. All the patients had long history of ear discharge. Both higher and lower frequencies were found to be affected.

In the present study pus culture showed growth in 54 (75%) patients. Pseudomonas aeruginosa was present in 30 (41.6%) patients, Peptostrptococcus in 7(9.7%) and Proteus in 6 (8.3%) patients. Nine patients (12.5%) had mixed infections. Mixed infections were more common in patients with intracranial complication. Pseudomonas and Proteus combination was more common. Peptostreptococci was commonly isolated in young adolescent patients with intracranial abscesses.

In many studies Pseudomonas aeruginosa, Proteus mirabilis, Staphylococcal organisms were the most commonly isolated organisms [3, 6, 13]. In a study by Modak *et al*. [19] the organisms isolated from the 68 cases of abscesses included Staphylococcus coagulase positive (40%), Pseudomonas species (30%), Proteus and Streptococci indicating high virulent strains. Study by Migirov *et al*. [20] showed that cholesteatoma and brain abscess were usually associated with gram-negative bacterial infection. In another study by Hafidh *et al*. [21], anaerobic bacteria were the most commonly isolated organisms followed by Staphylococcus aureus, Proteus mirabilis, and Pseudomonas aeruginosa. In a study of intracranial abscesses by Seven *et al*. [12] gram negative bacilli and anaerobes were the most common organisms cultured from the abscesses. Panda *et al*. [22] stated that anaerobes are responsible for complications in majority of the patients. Similarly in study by Rupa *et al*. [23], culture of cerebrospinal fluid and pus from patients who developed intracranial complications showed mixed flora in majority of cases. Proteus species was the most common isolate and anaerobes were present in 21.3% of specimens.

Some studies have shown that otopathogenic strains of Pseudomonas aeruginosa are capable of forming biofilm and become highly resistant to antimicrobial therapy. Bacterial proliferation and super infection of the accumulated keratin debris form a biofilm that lead to chronic infection and epithelial proliferation. These findings strongly suggest a role of bacterial biofilm in the pathogenesis of cholesteatoma [24].

As known to all modern day otologists CT scan has become an inevitable part of the diagnostic algorithm rendered when a patient with chronic otitis media presents with signs of neurotologic complication, so much so that it has been validated as being a life saving investigative technique for the same. It has the advantage of high resolution imaging, allowing early diagnosis of otological complications, both intracranial and intratemporal. It is non-invasive, rapid and also cost effective. In developing countries taking repeat CT scans routinely after surgery is still financially challenging to most of the patients. This makes it necessary for the surgeon to know the situations during the postoperative period when a repeat CT scan is inevitable and should be asked for. In conclusion it is evident that radiological investigations like CT scans are indicated in cases of cholesteatoma with complications. But the fact remains that radiological investigations cannot replace the clinical suspicion and judgement of the surgeon and that these techniques should be judiciously done to supplement the clinical diagnosis. CT scans helps the surgeon in further planning and management of the disease. It also aids the surgeon in anticipating any difficulties that may arise during the procedure [24-27].

In lateral sinus thrombosis imaging is considered a diagnostic aid, as definitive diagnosis of is made at

surgery. CT and MRI are the investigations of choice in making diagnosis. CT scan is useful in demonstrating the classic 'delta sign' of perisinus dural enhancement and filling defect of the lateral sinus and also can help by ruling out other intracranial complications. In the present study CT detected thrombus only in 50% of the cases. MRI is more sensitive than CT in detecting the thrombus. It shows blood flow, sinus obstruction and subsequent reversal of flow. MRI can show increased signal intensity of the thrombus and detect lateral sinus thrombosis not identified on a routine CT. On gadolinium-enhanced MRI, thrombus appears as soft tissue signal associated with vascular bright appearance of the dural wall – the "delta" sign as seen with gadolinium enhanced MRI. Additionally, MR venography, which can demonstrate the loss of signal and the absence of flow in the sinus, has proven to be more sensitive diagnostic tool in identifying lateral sinus thrombosis. MRI is the investigation of choice, and should be performed in conjunction with CT, there by fully evaluating associated otologic and cerebral pathology [24, 28-31].

A contrasted CT scan or MRI is sufficient to diagnose extradural abscess. Even with a careful evaluation, this diagnosis is often made at the time of surgery. In cases of otitic hydrocephalus, an MRI and magnetic resonance venogram should be performed to evaluate for ventricular enlargement, or coexisting intracranial complications, such as significant sinus thrombosis with obstruction. Magnetic resonance venogram will also confirm the presence of lateral sinus thrombosis, but is not required to make a diagnosis of otitic hydrocephalus [24, 32].

Facial nerve palsy is one of the important complications of chronic suppurative otitis media and should be treated without procrastination. Chronic otitis media with or without cholesteatoma can result in facial paralysis through involvement of a dehiscent nerve, or through bony erosion. Although cholesteatoma can involve the facial nerve at any point through its intratemporal course, the tympanic segment and second genu are involved most commonly. According to Magliulo [33], the site of dehiscence most frequently involved by cholesteatoma was the tympanic segment. The presence of a semicircular canal fistula increases the risk of facial nerve dehiscence. They recommend CT scans for the prediction of facial nerve dehiscence. Djeric [34], in his study on facial palsy in chronic suppurative otitis, suggested that facial paralysis occurs in chronic suppurative otitis when the inflammatory process specifically involves the facial nerve trunk. In a study by Yetiser [35], tympanic segment involvement was present in 14 patients (58.3%) where gradual onset of facial paralysis was the most frequent pattern. Siddiq *et al*. [36] are of the opinion that facial palsy is a rare presenting feature of cholesteatoma. Facial palsy associated with cholesteatoma should be treated as early as possible. Recovery can occur even if treatment is delayed for up to seven months.

In the present study facial palsy was present in 14 (17.2%) of the patients. All patients underwent canal wall down mastoidectomy and following mastoidectomy facial nerve recovered well in all the patients. Surgery is performed to remove the cholesteatoma or granulation tissue that is contacting the facial nerve. The nerve sheath does not have to be incised unless the cholesteatoma has invaded the nerve itself. In the present study tympanic part erosion of the fallopian canal was present in majority of the patient and nerve sheath involvement was not seen in any of the cases. Four patients had lateral rectus palsy. It was due to petrous apicitis in two patients and it was secondary to raised intracranial tension in two patients.

Intra cranial complications seen in this study were temporal lobe abscess (33.3%), cerebellar abscess (16.6%), occipital lobe abscess (1.3%), lateral sinus thrombosis (22.2%), otitic hydrocephalus (12.5%), meningitis (5.5%), subdural abscess (4.1%) and extradural abscess (1.3%).Occipital lobe abscess was seen on the contralateral side. Cerebellar abscess was more common in the patients below 20 years and it was statistically significant.

Brain abscess is a dreaded complication of otitis media and it almost exclusively result from chronic otits media [24, 37]. It commonly affects temporal lobe and cerebellum. Rarely does it occur in the occipital lobe. Brain abscesses are located on the same side as the diseased ear. The temporal lobe and cerebellum are the two locations for otogenic brain abscess [35]. The temporal lobe abscess usually occurs in the middle and basal portions of the temporal lobe, adherent to the dura over the roof of the petrous bone [37]. Rarely abscess occurs in the occipital region and there is a report of occipital brain abscess occurring in the contralateral side [38]. The development of abscess in one hemisphere following infection in the contralateral mastoid can presumably occur from hematogenous spread of organisms.

In a study by Sennaroglu & Sozeri [37], abscess was located in the temporal lobe in 54%, in the

cerebellum in 44%, and in both locations in 2% of the cases. Most patients underwent radical mastoidectomy and evacuation of the abscess through the mastoidectomy (61%). In addition to mastoidectomy, burr hole drainage was used in 20% and craniotomy in 15%. The most common microorganism involved was Proteus. Schwaber *et al*. [13], in their review on early signs and symptoms of neurotologic complication of chronic otitis media found that foul smelling ear discharge, fever, and headache were the significant early signs and symptoms of neurotologic complication of chronic otitis media.

In the present study Pseudomonas and Proteus were the common organisms isolated in cerebral abscess and Peptostrptococci was isolated in majority cases of cerebellar abscess.

The treatment of choice for brain abscess is neurosurgical drainage. Patient must be stabilized before neurosurgical intervention. Neurosurgical drainage is performed, either through an open craniotomy with drainage or excision, or by stereotactic aspiration through a burr hole. After draining otogenic brain abscess, mastoidectomy should be done to remove the source of infection. The appropriate time to perform the mastoidectomy is controversial [24]. Murthy *et al*. [39] stated that first neurosurgical drainage and later ear operation should be done. Morwani & Jayashankar [40] stated that single stage, transmastoid approach to both the chronic ear infection and the intracranial abscess is a safe and effective treatment strategy to decrease the mortality and morbidity arising from this pathology. Syal *et al*. [41] recommend that transmastoid drainage of pus can successfully treat mastoid disease and brain abscess with single surgical intervention. Sinha *et al*. [42] are of the opinion that endoscopic aspiration of brain abscess is a safe and effective alternative method of treatment.

According to Kurien *et al*. [43], craniotomy with concurrent mastoidectomy is not only safe, but also removes the source of infection at the same time the complication is being treated, thus avoiding reinfection while the patients awaiting the ear surgery. In addition, the treatment is completed in single, shorter stay, which is economical for the patient.

It has been conventional teaching that a mastoidectomy is performed in a delayed manner after the patient recovers from the abscess and neurosurgical drainage. Current recommendations, however, are to perform a mastoidectomy at the time of abscess drainage to remove the infectious focus, assuming the patient is stable enough to tolerate this additional surgery [24].

In the present study there were 24 cases of temporal lobe abscess, one case of occipital lobe abscess and 12 cases of cerebellar abscess. Except in three cases of temporal lobe abscess (abscess size less than 1.6cms), all patients underwent neurosurgical intervention for the management of brain abscess. All the patients who underwent neurosurgical drainage of the brain abscess underwent canal wall down mastoidectomy, as soon as they recovered from the abscess and neurosurgical drainage. Three patients with small temporal lobe abscess underwent only canal wall down mastoidectomy. There were no complications during the waiting period. Early mastoidectomy following neurosurgical drainage of the brain abscess is found to be effective in this study.

Postoperative clinical, hematological, and radiological monitoring is mandatory. Periodic neurological follow-up is imperative as intracranial pathology may manifest up to 3 weeks after the mastoid infection has been controlled [39]. After surgical intervention, IV antibiotics should be continued for several weeks and serial CT scans with contrast should be done to assure resolution of the abscess. In the present study one patient developed brain abscess after undergoing surgery for lateral sinus thrombosis.

Morwani and Jayashankar [40] are of the opinion that there is a role for conservative management of brain abscess which are smaller than 1 cm in diameter, with intravenous antibiotics and follow-up CT scans, together with eradication of otogenic septic focus at the earliest stage. They also stated that same concept holds well in the treatment of tiny residual abscess.

In the present study all three patients with small temporal lobe abscess started showing clinical improvement with the commencement of intravenous antibiotics and serial CT scan did not show any increase in abscess size. Neurosurgical intervention was not required. All the three patients underwent canal wall down mastoidectomy. They responded well to medical management. Antibiotic therapy was continued for 6 weeks and post treatment CT scan showed abscess resolution. This study showed that small otogenic brain abscess, which were less than 1.6 cm in size responded to treatment with antibiotics and could be managed by medical therapy. Surgery was required only for the management of atticoantral ear disease [44]. Close collaboration between otologist, neuroradiologists, and neurosurgeons, as well as

adequate surgical interventions and appropriate antimicrobial therapy, remain the cornerstones of effective medical management of small brain abscess secondary to attico antral ear disease.

Lateral sinus thrombosis was present in 16 cases. Association between lateral sinus thrombosis and otitic hydrocephalus was not statistically significant. Culture showed Proteus and Pseudomonas in majority of the cases.

Kaplan *et al*. [30] stated that lateral sinus thrombosis may be difficult to diagnose due to previous antibiotic treatment and overlap of clinical findings with other entities such as meningitis. Despite the value of modern imaging techniques in the investigation of the disease, a high index of suspicion based on the clinical picture is warranted. Many authors recommend a diagnostic needle aspiration of the affected sinus, once it is exposed surgically. If the aspiration reveals normal blood return, then the sinus is left intact; but if the aspiration is negative or reveals frank pus, the sinus is opened and at least a portion of the infected clot is evacuated. However, recent reports have challenged this dictum, and demonstrated that if the surrounding granulation tissue and inflammation are removed through a mastoidectomy, the sinus will recanalize without clot evacuation [24]. Formation of the thrombus is considered as a protective phenomenon [31]. Seven *et al*. [28] are of the opinion that conservative surgical intervention including eradication of all perisinus infection and needle aspiration of the sinus is effective.

In the present study also, in 8 cases sinus was not opened and only surrounding granulation and cholesteatoma were removed. There was difference between the patients who underwent conservative sinus surgery and radical sinus surgery. Anticoagulation was not given to any of our patients and they did not require internal jugular vein ligation.

Otitic hydrocephalus is a rare complication of ear disease. The pathophysiology of this rare condition is unknown. Kangsanarak *et al*. [11] reported that 7 of 87 patients (8%) with otogenic intracranial complications in their series had otitic hydrocephalus. In a 15-year study of intracranial complications of otitis media, Penido *et al*. [10] did not find any case of otitic hydrocephalus. Only three cases of otitic hydrocephalus were seen by Modak *et al*. [19].

In the present study otitic hydrocephalus was present in 9 cases. Although lateral sinus thrombosis is found usually in the presence of otitic hydrocephalus, cases have been reported without thrombosis of the dural sinuses. In the present study the association between otitic hydrocephalus and lateral sinus thrombosis was not statistically significant. All patients underwent canal wall down mastoidectomy for the management of atticoantral disease. Out of 9 cases, medical management was effective in reducing intracranial pressure in four patients while five patients underwent ventriculo peritoneal shunt procedure.

In many earlier studies, meningitis was the common intracranial complications of chronic otitis media [1, 6, 45]. In a study by Samuel *et al*. [1], meningitis was the most common intracranial complication. They found that type 4 pneumococci had a particular predilection for intracranial spread. It was interesting to note that 8 cases with meningitis underwent bilateral mastoidectomy as patient had bilateral discharging ear and the source of infection could not be ascertained with certainty.

In the present study there were 4 cases of meningitis and it was associated with intracranial complication in one case and with extracranial complication in 2 cases. One patient had meningitis with bilateral active atticoantral disease. Clinical examination and CT scans were useful in ascertaining the source of infection. Ear swab culture showed Proteus in two patients, Pseudomonas in one patient and culture was negative in one patient. All patients underwent canal wall down mastoidectomy after stabilisation of their neurological status.

Subdural empyema is the rarest complication of otitis media. Before the introduction of antibiotics, subdural empyema was almost always fatal. Since then, mortality has decreased significantly, and it now ranges from 14 to 28%. In the present study there were 3 patients with subdural abscess. One patient had abscess in the interhemispheric region. Very rarely is it seen in an interhemispheric setting. In a series by Dubey *et al*. [4], out of 70 patients with complications, two had interhemispheric abscess. A subdural empyema in an unusual location can be difficult to manage surgically. In rare circumstances when there are contraindications to surgery or significant surgical risks, conservative treatment is advised [46]. However, if a patient is experiencing rapid neurologic deterioration with medical treatment, surgery can be undertaken as a last resort. In the present study two patients underwent neurosurgical intervention first and later they underwent mastoidectomy. In the present study in one case interhemispheric subdural empyema

was situated in the area of the posterior falx cerebri. The patient's poor general condition precluded any neurosurgical intervention. Patient was treated with antibiotics, and repeat CT scans did not show any increase in the size of the abscess and responded well to antibiotics therapy. After one week patient underwent canal wall down mastoidectomy.

The presence of an extradural abscess can often be insidious in development. These abscesses develop as a result of bony destruction from cholesteatoma or from coalescent mastoiditis.

Because this complication can be subtle in presentation, it is often found incidentally at the time of cholesteatoma surgery or CT scan done for other purposes. The presence of increased otalgia or headache should raise the suspicion for an intracranial complication, and warrants imaging. In a study by Modak *et al*. [19], commonest complication detected was extradural abscess (28%), most of the cases of extradural abscess were silent without any diagnostic features of a space occupying lesion. In the present study extradural abscess was present in one patient. Patient underwent neurosurgical drainage and later canal wall down mastoidectomy was done.

Mustafa *et al*. [3] (2008) performed canal wall down radical tympanomastoidectomy in 86.8% of the patients. Canal wall up procedures were only applied in 13.2% of the patients. Osma *et al*. [47] in his series has done radical mastoidectomy in 59.1%, modified radical mastoidectomy in 6.5% and canal wall up procedures in 21.5%. He recommended radical mastoidectomy for people coming from rural and remote areas advocating it as safe procedure where patient cannot be followed up after treatment.

In a study by Hafidh *et al*. [21], patients with cholesteatoma underwent modified radical or radical mastoidectomy. Two brain abscesses were drained before mastoid surgery; 2 were drained after mastoid surgery and one at the same time as otologic surgery. They recommend that otologic surgery to be performed at the same time as intracranial surgery for patients with mature brain abscesses.

In the present study patients with intracranial complications first underwent neurosurgical intervention (except three patients with small temporal lobe abscess) and later underwent surgery for atticoantral disease. Patients with the diagnosis of lateral sinus thrombosis underwent surgery immediately. All the patients underwent ear surgery, 2 to 9 days after the neurosurgical intervention .There was no reinfection during waiting period for surgery. All patients in the present study underwent canal wall down mastoidectomy of which 39 underwent concurrent tympanoplasty as well.Two patients had facial palsy after surgery which recovered within four weeks. One patient had bilateral complications and she underwent concurrent bilateral canal wall down mastoidectomy.

Mustafa *et al*. [3] reported three deaths in his study: two patients with otogenic meningitis and one with a cerebral abscess, representing a mortality rate of 3.3% among the patients with complications. Osma *et al*. [9] reported a higher incidence with 15 patients dying of intracranial complications in his study group. Overall mortality rate was 16.1% while in patients with intracranial complications it was 26.3%. Dubey *et al*. [4] observed a mortality rate of 13%. 9 patients with otogenic meningitis, one patient with lateral sinus thrombosis and one with interhemispheric abscess died due to the disease. Authors concluded that the prognosis was worse with delayed presentation because of overwhelming intracranial infection due to multiple pathways of extension from chronic otitis media. Studies by Seven*et al*. [17], Pendio *et al*. [10] and Ibrahim [48] have reported mortality. Kurien *et al*. [43], Yorgancilar *et al*. [2] and Hafidh *et al*. [21] on the other hand reported no mortality. The present study also there was no mortality.

Osma *et al*. [9] in his study observed the morbidity of 11.8% among his study group. Among the patients with intracranial complications morbidity occurred in 12.2% cases. The morbidities reported were homonymous hemianopia (1 patient), profound deafness (in 3), diplopia (in 1), epilepsy (in 1), hemiperisis (in 1), cerebellar ataxia (in 1) and one patient had 2 morbidities. In the extracranial complications group 4 patients had sequale of disease, 2 patients had complete facial paralysis and 2 patients had profound deafness. Yorgancilar *et al*. [2] reported morbidities in 25 patients (20.6%).Twelve patients had sensorineural hearing loss and five had facial paralysis. One patient had visual problem and one had severe imbalance. Two patients had recurrent brain abscess. Dubey *et al*. [4] in in his study mentioned 3 patients with otitic facial palsy who failed to regain full facial function despite surgery. Mostafa *et al*. [49] reported morbidity in 3.79% cases. Seven *et al*76 reported neurological sequels in three patients. The morbidity rate was high (71.4%) in a study by Migirov *et al*. [20] and included hearing impairment, hemiparesis,

hydrocephalus, mental retardation, polyneuropathy and epilepsy.

In the present study 12 patients had sensorineural hearing loss, one patient developed brain abscess after undergoing surgery for lateral sinus thrombosis and 5 patients underwent ventriculoperitoneal shunt procedure for the management of otitichydrocephalus.

Recent literature indicates that the complications of otitis media have been decreasing. But, even with the advent of modern antibiotics and latest microsurgical techniques, the mortality and morbidity is still high. The neurotologic complication of atticoantral otitis media is still a problem in developing countries. Antibiotics can alter the classical presentation of the disease. A delay in diagnosis and treatment can lead to increased morbidity and mortality.

Early mastoidectomy following neurosurgical drainage of the abscess was found to be effective in this study. However, specific parameters dictating staged versus simultaneous surgery have not yet been reported or established in literature.

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