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OTOLOGY

Complications of chronic suppurative otitis media: a retrospective review

E. Yorgancılar · M. Yıldırım · R. Gun · S. Bakır · R. Tekın · C. Gocmez · F. Merıc · I. Topcu

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Abstract The purpose of this study was to review our patients with complications of chronic suppurative otitis media (CSOM) and compare with literature. This retrospective study was performed over 10 years in our tertiary referral university hospital. During this period 4,630 patients with CSOM were admitted to the department and 906 patients underwent a surgery. From the records of the 4,630 patients, 121 patients (2.6%) with complications were identified. Of the 906 CSOM patients that underwent a surgery, 511 had cholesteatoma, and 395 had granulation and/or polyp tissue. Ninety-four of 511 (18.4%) patients with cholesteatoma and 27 of 395 (6.8%) patients with granulation and/or polyp tissue had a complication. Of the 121 complicated CSOM patients, 57 extracranial (47.1%) and 37 intracranial (30.6%). Multiple combined complications were occurred in 27 (22.3%) patients. The mastoid abscess was the commonest extracranial complication (28.3%); it was followed by labyrinthitis (9%), facial nerve paralysis (8.4%), and Bezold's abscess (1.3%). The most common intracranial complication was lateral sinus thrombophlebitis (19.5%), followed by perisigmoid sinus abscess (13.5%), meningitis (9%), brain abscess (6.5%), and extradural abscess (4.5%). Most frequent intraoperative finding of complicated CSOM patients was cholesteatoma, with the exception of patients with facial nerve paralysis. There was no mortality in any of our patients. The additional morbidities were recorded in 25 patients (20.6%). In this study, we emphasize the importance of an accurate and early diagnosis, followed by adequate surgical therapy and a multidisciplinary approach.

Keywords Chronic otitis media · Suppurative · Complications · Intracranial · Extracranial

Introduction

Chronic suppurative otitis media (CSOM) is a very common disease that should be carefully treated, as severe complications can develop. Despite the significantly decreased incidence of CSOM-related complications since the introduction of antibiotics, this clinical problem has not been eliminated [1, 2]. CSOM remains a serious concern, particularly in developing countries and socioeconomically poor regions [3]. There continue to be reports of CSOM-related complications as life-threatening [1–6].

Complications of CSOM can be classified as extracranial (EC) or intracranial (IC) [5, 7]. Extracranial complications include mastoid abscess, petrositis, labyrinthitis, facial nerve paralysis (FNP), and Bezold's abscess. Intracranial complications comprise intracranial abscess, including extradural, epidural, subdural, perisigmoid sinus, and brain abscesses; lateral sinus thrombophlebitis (LST), meningitis, and otitic hydrocephalus. The pathophysiology of complications of CSOM remains somewhat of a mystery. Owing to the rarity of complications, few systematic studies have

E. Yorgancılar (✉) · M. Yıldırım · R. Gun · S. Bakır · F. Merıc · I. Topcu
Department of Otorhinolaryngology, Dicle University School of Medicine, Diyarbakir 21280, Turkey
e-mail: edzyrg@hotmail.com

R. Tekın
Department of Infectious Diseases, Dicle University School of Medicine, Diyarbakir, Turkey

C. Gocmez
Department of Neurosurgery, Dicle University School of Medicine, Diyarbakir, Turkey

been performed. The pathways of EC and IC complications include thrombophlebitis of the venules of the adjoining cranial bones, bone erosion by pressure or enzymatic actions, preformed pathways, and hematogenous spread [4].

Here, we review the complications of CSOM in patients presenting to a tertiary care university hospital. As our hospital is a tertiary referral center for neurootological and neurosurgical patients and serves a population of more than 4 million in our region, the incidence of complications of CSOM can be estimated accurately. In addition, we compare our findings to those of other investigators.

Materials and methods

The study was approved by the local research and ethics committee of the Dicle University Faculty of Medicine (246/20.10.2011). Between January 2000 and July 2011, patients with CSOM were diagnosed and treated in the Department of Otolaryngology of the Dicle University Faculty of Medicine in Diyarbakir, Turkey. CSOM patients who were admitted to our hospital were identified by searching a computerized hospital database, using the following International Classification of Diseases, 10th Revision (ICD-10) codes: H.66.1 chronic tubotympanic suppurative otitis media, H.66.2 chronic atticoantral suppurative otitis media, and H.66.3 other chronic suppurative otitis media. We also retrospectively reviewed the clinical notes and follow-up data of all patients who underwent a mastoidectomy as a minimum intervention for treatment of CSOM. The charts of patients presenting with a diagnosis of otogenic complications of CSOM were reviewed. Patients with complications of CSOM were classified as EC (mastoid abscess, petrositis, labyrinthitis, FNP and Bezold's abscess) or IC (intracranial abscess, including extradural, epidural, subdural, perisigmoid sinus, and brain abscesses; lateral sinus thrombophlebitis; meningitis; and otitic hydrocephalus), as previously described [5, 7]. All patients were underwent radiological studies including at least a contrast-enhanced computed tomography (CT). A contrast enhanced magnetic resonance imaging (MRI) and magnetic resonance venography were done to detect intracranial complications of CSOM and to confirm lateral sinus thrombosis. Pure tone audiometry could be performed only in conscious patients. The operation theater log books were examined to identify intraoperative findings of patients with complications of CSOM. Patients with complications of acute suppurative otitis media, and tympanoplasties without mastoidectomy were excluded.

Of 4,630 CSOM patients, 121 patients with complications of CSOM (56 females and 65 males) were included in this study. The demographics, chronological distribution, etiology, symptoms on admission, bacteriology, radiology, treatments, intraoperative findings, duration of hospital stay, complications, and outcomes of patients were reviewed and analyzed. Evaluated outcomes included postoperative clinical findings, morbidity, and mortality. Follow-up was limited to the duration of the hospital stay and any readmissions or clinical return visits.

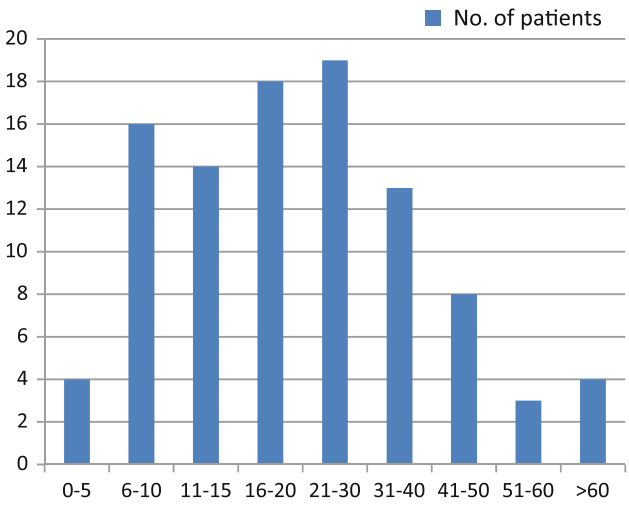

Fig. 1 The age distribution of complications of chronic suppurative otitis media

All data were analysed using the SPSS software (ver. 15.0; SPSS, Chicago, IL, USA). The number of patients in each complication group was compared using the Chi-square test. Values of P less than 0.05 were deemed to indicate statistical significance.

Results

During the period from January 2000 to July 2011, 4,630 patients were diagnosed with CSOM, and 906 patients underwent a mastoidectomy as a minimum intervention for treatment of CSOM. From the records of the 4,630 patients, 121 patients with complications were identified (2.6%), and all of them underwent a mastoidectomy. Of the 906 CSOM patients that underwent an operation, 511 had cholesteatoma, and 395 had granulation and/or polyp tissue. Of the 511 patients with cholesteatoma, 94 (18.4%) had a complication. Of the 395 patients with granulation and/or polyp tissue, complications were identified in 27 patients (6.8%).

The male to female ratio was 1.16. The patients with complications of CSOM ranged in age between 4 and 72 years, with an average age of 24 ± 15 years (Fig. 1). The chronological distribution of the patients is shown in Figs. 2 and 3. Since 2006, there has been an upward trend in the number of presented patients.

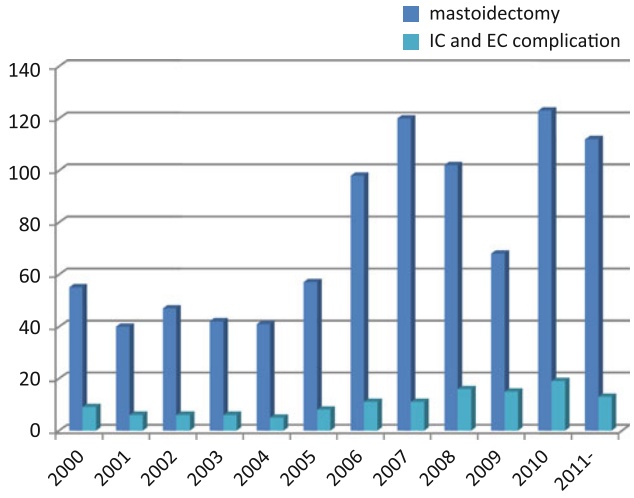

Fig. 2 The chronological distribution of mastoidectomy and extracranial (*EC*), intracranial (*IC*) complications of chronic suppurative otitis media

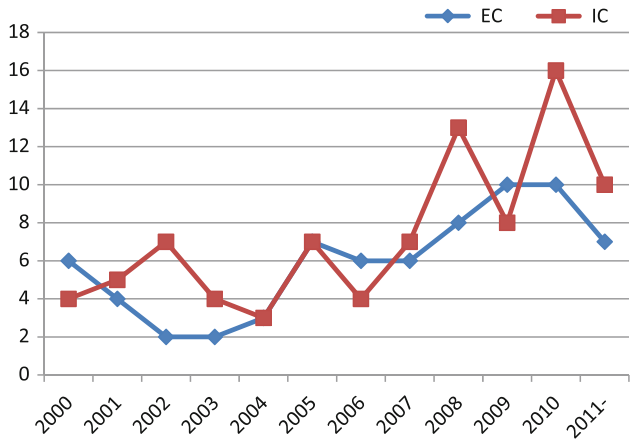

Fig. 3 The chronological distribution of extracranial (*EC*) and intracranial (*IC*) complications of chronic suppurative otitis media

Table 1 Presenting symptoms of 121 patients with complications of suppurative chronic otitis media

Symptom	No. of patients	Percentage (%)
Otorrhoea	115	95
Headache	97	80
Meningeal sign	54	41
Fever	74	61
Vertigo	65	53
Postauricular swelling	44	36
Cranial nerve paralyses	13	10

One hundred and fifteen (95%) patients complained of otorrhoea and 97 (80%) patients had headache as their main symptoms. The distribution of symptoms is shown in Table 1.

Table 2 The occurrences of EC and IC complications in 121 patients

Complication	Occurrence of complication
Extracranial	
Mastoid abscess	44 (28.3%)
Labyrinthitis	14 (9%)
Facial nerve paralysis	13 (8.4%)
Bezold's abscess	2 (1.3%)
Intracranial	
Lateral sinus thrombophlebitis	30 (19.5%)
Perisigmoid sinus abscess	21 (13.5%)
Meningitis	14 (9%)
Brain abscess	10 (6.5%)
Extradural abscess (including epidural abscess and subdural abscess)	7 (4.5%)
Otitic hydrocephalus	0
Total	155 (100%)

Several patients had more than one complication

An EC, IC, or combined EC and IC complication occurred in 57 (47.1%), 37 (30.6%), or 13 (10.75%) patients, respectively. In addition, more than one IC complication or more than one EC complication occurred in 13 (10.75%) patients or one (0.8%) patient, respectively. Details of the 155 CSOM-related complications in the 121 patients are presented in Table 2.

A mastoid abscess was the most common EC complication (28.3%) in our series, followed by labyrinthitis (9%), FNP (8.4%), and Bezold's abscess (1.3%). The most common IC complication was LST (19.5%), followed by perisigmoid sinus abscess (13.5%), meningitis (9%), brain abscess (6.5%), and extradural abscess (4.5%) (Fig. 4). In patients with multiple complications, a combination of mastoid abscess and perisigmoid sinus abscess occurred most frequently, followed by a combination of mastoid abscess and LST.

Of 121 patients with 155 CSOM-related complications, 36 had an IC abscess (29.7%). A perisigmoid sinus abscess was the most common intracranial abscess (21 of 155) (13.5%). A temporal lobe abscess was found in eight (5.1%), extradural abscess in seven (4.5%), cerebellar abscess in one (0.6%), and occipital abscess in one patients (0.6%), respectively (Fig. 5). Two of the 36 patients had a combination of perisigmoid sinus abscess and extradural abscess. Eight (22%) of the 36 patients with an IC abscess had concomitant LST. We did not diagnose any otitic hydrocephalus in our patients.

All patients had a CT scan. For 107 patients, MRI had to be included to reach a definitive diagnosis. Only six patients underwent magnetic resonance venography, which confirmed LST (Fig. 6).

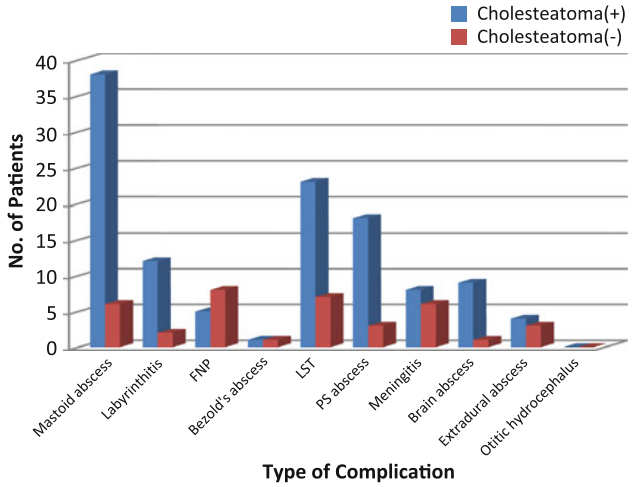

Fig. 4 The distribution of complications according to pathologies (*FNP* facial nerve paralysis, *LST* lateral sinus thrombophlebitis, *PS abscess* perisigmoid sinus abscess)

Fig. 5 Magnetic resonance imaging of a patient with right temporal lobe brain abscess

The results of bacterial cultures were available for only 47 (38.8%) of the 121 patients. The most common bacterial organisms were *Staphylococcus aureus*, *Proteus mirabilis*, *Streptococcus pneumoniae*, and *Pseudomonas aeruginosa.* Parenteral antibiotics in different combinations were administered to patients immediately upon admission to the hospital.

Considering the clinical evolution and imaging results, all patients with complications of CSOM were surgically treated. All patients with EC complications were treated by a canal wall-down mastoidectomy. All 13 patients with FNP underwent a canal wall-down mastoidectomy and

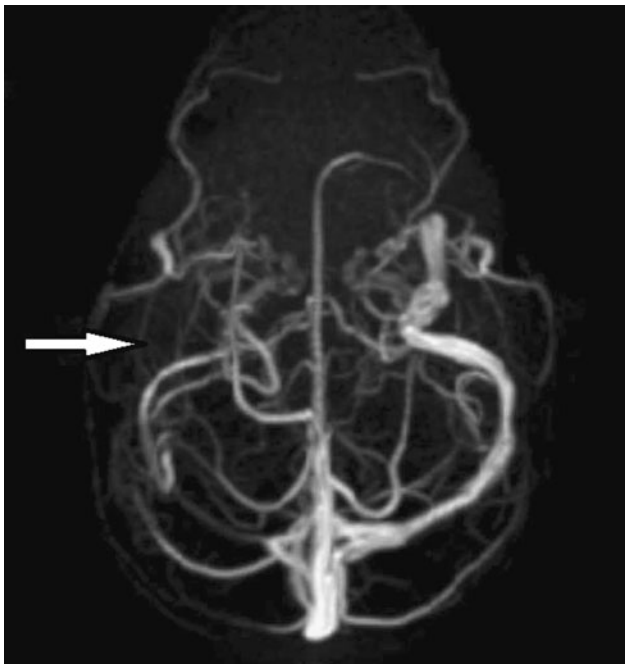

Fig. 6 Magnetic resonance venography image demostrating loss of signal and lack of flow in the right lateral sinus indicative of thrombus (*white arrow*)

facial nerve decompression. Patients with IC complication were surgically treated by a radical mastoidectomy. With the exception of FNP patients, cholesteatoma was the most frequent intraoperative finding. There is no any statistically significance difference between cholesteatomatous and non-cholesteatomatous patients in the terms of complications with the exception of FNP ($p > 0.05$) (Table 3).

Surgical treatment of LST was performed without the need for neurosurgical intervention. Our surgical management to LST as follows; after a mastoidectomy, a confirmatory needle aspiration to lateral sinus was performed. If free blood was aspirated then no further intervention was performed. If there was no return of blood, the outer wall of the thrombosed sinus was incised, and the infected thrombus was suctioned. The evacuation of thrombosed sinus was performed in 12 patients. In the remaining 18 patients, only a needle aspiration was performed, with no further intervention. One patient with severe visual loss was treated with anticoagulants include intravenous heparin followed by oral warfarin. The internal jugular vein did not ligated in any of patients. We did not performed revision surgery for recurrent or progressive thrombosis in any of our LST patients.

Eleven of 16 patients with extradural or brain abscess underwent drainage of the abscess before a mastoidectomy was performed by the neurosurgery team.

The duration of hospitalization ranged from 5 to 32 days (mean 11.5 days), with 87% of the patients being discharged during the first 10 days after admission.

Table 3 The pathologies of each complication group

Complication	Cholesteatoma(+) ($n = 511$)	Cholesteatoma(−) ($n = 395$)
Extracranial		
Mastoid abscess	38 (7.4%)	6 (1.5%)
Labyrinthitis	12 (2.4%)	2 (0.5%)
Facial nerve paralysis	5 (1%)	8 (2%)[a]
Bezold's abscess	1 (0.2%)	1 (0.2%)
Intracranial		
Lateral sinus thrombophlebitis	23 (4.6%)	7 (1.8%)
Perisigmoid sinus abscess	18 (3.2%)	3 (0.7%)
Meningitis	8 (1.6%)	6 (1.5%)
Brain abscess	9 (1.8%)	1 (0.2%)
Extradural abscess (including epidural abscess and subdural abscess)	4 (0.8%)	3 (0.7%)
Otitic hydrocephalus	0	0
Total	118 (23%)	37 (9.1%)

Several patients had more than one complication

[a] Statistically significant ($P < 0.05$)

There were no mortalities caused by complications of CSOM. Additional morbidity was recorded in 25 patients (20.6%). Twelve patients suffered additional sensorineural hearing loss and five had facial nerve paralysis. In patients with lateral sinus thrombophlebitis, one patient had severe visual loss and one had severe balance problem after surgery. In patients with brain abscess, three had postoperative hemiparesis, one had cerebellar ataxia. Two patients had a recurrent brain abscess. Of the two patients with a recurrent brain abscess, one had bilateral cholesteatomatous CSOM, and an operation was first performed on the right side, followed 1 week later by an operation on the left side.

Discussion

Several reports have documented a decrease in the incidence of patients with complications of CSOM. However, we observed an increase in the incidence of patients with complications of CSOM since 2006, which is in contrast to recent improvements in medical care. This trend prompted our review, but we found no explanation for the increase, other than the population increase in the region. Our study contributes new data to the current literature on this topic. In 2000, Osma et al. [5] reported 93 cases of CSOM complications during the period from 1990 to 1999 in the Department of Otolaryngology of the Dicle University Faculty of Medicine. Here, we reported CSOM complications during the last decade. No other reported study compares CSOM complications of the last two decades. Our study is unique in that it includes a large number of patients and compares data between the last two decades at the same center [2, 7–9].

The age distribution showed that most of our patients were young and middle-aged. According to literature, these complications are more frequent in young and middle-aged adults [5, 8, 9]. For unknown reasons, complications of CSOM occur predominantly in males, which was noted in our study as well [10, 11].

The most frequent symptoms of our patients were otorrhoea, headache, and fever which were similar to other reports [2, 8, 9]. Early diagnosis is the key to minimizing the effects of CSOM complications. The physician should be suspicious of complications when there is fever associated with chronic perforation, increased otorrhea, an inferolaterally displaced pinna, retroorbital pain on the side of an infected ear, vertigo or nystagmus in a patient with an infected ear, facial paralysis on the side of an infected ear, headache or lethargy, papilledema, meningismus, or focal neurological signs or seizures.

Previous studies of large series of patients have shown CSOM complication rates similar to the rates in our series. Kangsanarak et al. [2] reviewed 17,000 patients with suppurative otitis media and found 102 cases with IC and EC complications; they calculated the prevalence of complications as 0.69% among the population with suppurative otitis media. In another series of 24,321 otitis media patients from a 13-year period, Kangsanarak et al. [8] reported 87 cases with 140 IC complications, representing a prevalence of 0.36% for IC complications. Mustafa et al. [9] found that among 1,803 patients with chronic otitis media with cholesteatoma during a 10-year period (1994–2004) in Kosovo, 91 patients (5%) had complications. From our center, Osma et al. [5] reviewed 2,890 chronic otitis media patients during a 9-year period (1990–1999) and found 93 patients (3.22%) with complications. We calculated the prevalence of CSOM complications as 2.6% in the patients we reviewed. Our study demonstrated that, complications of CSOM still remains a serious concern.

Although IC complications were more frequent than EC complications in our previous study in 2000 [5], EC complications occurred more often than IC complications in the present study, as also reported by others [2, 9]. In the present study, 10.75% of patients had a combination of IC and EC complications. Mastoid abscesses and perisigmoid sinus abscesses were the most common associated complications. We believe that any possibly associated complication should be examined carefully when a complication is present.

Similar to other reports, mastoid abscess was the most common EC complication in the present study. The distribution of EC complications was similar between our study

and that of Osma et al. [5]. However, the distribution of IC complications appeared to differ. In our study, LST was the most common IC complication, followed by perisigmoid sinus abscess and meningitis. While mastoid abscess was the most common EC complication reported by Osma et al. [5], meningitis was the top IC complication at our center in 2000. The present study draws attention to the increased incidence of LST and perisigmoid sinus abscess as IC complications in our region.

In our institution, CT is a proven diagnostic method of choice for evaluating inflammatory diseases of the temporal bone. MRI is the study of choice for locating otogenic intracranial complications. CT may be limited in differentiating soft tissue density in acute infection. In cases of intracranial infection, MRI may improve the diagnostic accuracy, with increased sensitivity and specificity [12]. Due to high occurrence of multiple complications, a combination with CT scanning and MRI was recommended in every complicated CSOM patients to exclude other coexisting intracranial complications [13]. Magnetic resonance venography are said to be the most definitive method of demonstrating LST. However, it is an invasive procedure and carry a risk of stroke or dislodging the thrombus [14]. In our patients, MR venography was performed only in limited patients with indeterminate radiologic examinations suspicious for but not diagnostic of LST.

The bacteriological findings of our study were very similar to those of recent reports [2, 6, 9]. Only 24 patients (19.8%) had a positive bacterial culture. As antibiotics are commonly used for CSOM, cultures are often negative, as noted in previous studies [15–17].

Previously reported surgical findings have implicated the presence of a cholesteatoma as the most frequent surgical finding of both EC and IC complications. Kangsanarak et al. [2] found that 80% of patients had complications associated with a cholesteatoma due to chronic otitis media. Osma et al. [5] reported that 78.5% of patients had a cholesteatoma, while 21.5% had granulation. This was also evident in our study. With the exception of FNP, cholesteatoma was the most common operative finding in the middle ear and mastoid cavity in patients with complications of CSOM.

In most studies, mastoid abscess was the most common EC complication [5, 9, 18]. In the present study, a mastoid abscess was observed in 44 (27.8%) patients, all of whom were given antibiotic treatment and underwent drainage of the abscess. A mastoidectomy was indicated in CSOM patients who underwent surgical treatment for a mastoid abscess.

Only a few studies have reported the incidence of FNP [5, 19–21]. According to these studies, the frequency of FNP in CSOM ranges from 0.16 to 14.3%. In our study, the incidence was 8.2%. Altuntas et al. [19] reported that 70% of FNP patients with CSOM have a cholesteatoma. We found granulations to be more common (61%) than cholesteatomas, demonstrating that granulation tissue is as important as a cholesteatoma in the etiology of FNP due to CSOM. FNP is possibly a result of the inflammatory response within the fallopian canal leading to the infection. Djeic and Savic [21] have proposed that FNP in otitis media develops when inflammation involves the facial nerve. Spread of the infection along the nerve tissue, rather than compression atrophy, may be the major factor in most cases of FNP resulting from CSOM [22]. Our findings are in accordance with those of previous studies. The tuberculous otitis media is a rare cause of FNP [23]. During surgery the presence of abundant granulation tissue in the middle ear and mastoid air cells in a patient with FNP may suggestive of tuberculosis. The presumptive diagnosis of tuberculous otitis media is often made on the histopathology of granulation tissue [24]. In our patients, preoperative clinical findings, radiologic examinations, and laboratory tests were negative for tuberculosis. Moreover, no postoperative histopathological examination was reported as tuberculosis in any of our patients.

The incidence of labyrinthitis was higher in our patients with cholesteatoma than in our patients without cholesteatoma. All patients with labyrinthitis were given antibiotic treatment before surgery.

LST is generally considered the third or fourth most common IC complication and is frequently associated with other IC and EC complications [7, 8, 25]. However, in our study, LST was the most common IC complication. Mostafa et al. [3] also reported LST as the most common IC complication. Osma et al. [5] found only one patient with LST among 93 patients with complications of CSOM at our center from 1990 to 1999. The apparent increase in the incidence of LST in patients with intracranial complications of CSOM in our region may be the result of better detection owing to technological improvements in the radiology equipment at our center. In our study, patients with LST exhibited very different clinical symptoms. Only six of 30 patients reported fever within 24 h prior to admission. In our experience, current treatment patterns and the classical presentation of spiking fever and headache are only partially correct. Most of our cases progressed daily, and a diagnosis of thrombosis was established. Surprisingly, two patients progressed to confusion, tremor, and fever within hours. Thus, a high index of suspicion is needed to avoid a missed diagnosis or delayed treatment that may potentially have catastrophic consequences. Clinicians must remain alert for clinical signs and symptoms that indicate the onset of this potentially serious complication. When diagnostic modalities confirm LST, surgery should be immediately scheduled to verify the diagnosis by surgical exploration of the sinus plate. The dilemma faced intraoperatively is the

management of the thrombosed sinus [11, 13, 25]. Options range from needle aspiration to removal of the thrombosed sinus. Most studies support incision of the lateral sinus and evacuation of the thrombus [11, 13, 15]. Seven et al. [7] found no difference in outcome between patients who underwent only confirmatory needle aspiration and those in whom the thrombus was removed. Recent reports have shown that when the surrounding granulation tissue and inflammation are removed through a mastoidectomy, the lateral sinus will recannalize without clot evacuation [7, 25]. However, removal of all infected tissue is mandatory for effective treatment. We remove the infected thrombus from the lateral sinus whenever possible because we believe that this prevents systemic hematogenous spread of infection and thereby improves the prognosis. The routine use of anticoagulation for septic otogenic lateral sinus thrombosis is controversial. Most authors agree that anticoagulants have no place in the management of lateral sinus thrombosis [26–28]. Anticoagulation has been advocated to prevent extension of the thrombus to distal sinuses [15]. Risks of anticoagulation include releasing septic emboli from clot breakdown, and uncontrollable haemorrhage at the surgical site [11]. The indications of anticoagulation treatment in septic otogenic LST include evidence of thrombus progression, neurologic changes, persistent fevers, and embolic events [29]. In our study, only one patient with severe visual loss was treated with anticoagulants.

Perisigmoid sinus abscess was the most common IC abscess, followed by temporal lobe, epidural, cerebellar, and occipital abscesses. This distribution of IC abscesses is comparable to that presented by previous studies [5, 8, 30]. A perisigmoid sinus abscess was often associated with LST in our study. Meningitis was the most frequent concurrent complication in our patients with an IC abscess.

In our center, the time of surgical decision-making in CSOM patients with IC complications was based on an emergency mastoidectomy within 24 h. A full treatment plan included a canal wall-down mastoidectomy. A concise definition of the appropriate neurosurgical procedure in patients with IC complications remains elusive. Our treatment method is based on the preferences of our neurosurgical colleagues.

The current mortality rates in patients with intracranial complications of CSOM have dropped to a range of 0–25% [2, 8, 9]. Greenberg and Manolidis [31] studied 90 patients who had undergone surgery for complications of CSOM during a 2-year period (1997–1999), and observed no mortalities. The decrease in mortality in our clinic from 16.1% as reported by Osma et al. [5] to 0% in the present study may be attributable to improvements in surgical techniques, advances in critical care, close cooperation among clinics, training of doctors at peripheral hospitals to recognize the seriousness of this complication, and early referral of patients to either the otolaryngology or infectious diseases and neurosurgical departments.

Conclusion

Although the incidence of complications of CSOM has decreased in recent decades, it remains too high. Excessive use and misuse of antibiotic treatments may cause masked presentations, thereby reducing the diagnosis. It is critical that clinicians remain alert for clinical signs and symptoms that may indicate the onset of these potentially serious complications and be prepared to examine patients for the presence of more than one complication.

Conflict of interest None.

References

1. Dubey SP, Larawin V (2007) Complications of chronic suppurative otitis media and their management. Laryngoscope 117:264–267
2. Kangsanarak J, Fooanant S, Ruckphaopunt K, Navacharoen N, Teotrakul S (1993) Extracranial and intracranial complications of suppurative otitis media: report of 102 cases. J Laryngol Otol 107:999–1004
3. Mostafa BE, El Fiky LM, El Sharnouby MM (2009) Complications of suppurative otitis media: still a problem in the 21st century. ORL J Otorhinolaryngol Relat Spec 71(2):87–92
4. Dubey SP, Larawin V, Molumi CP (2010) Intracranial spread of chronic middle ear suppuration. Am J Otolaryngol 31(2):73–77
5. Osma U, Cureoglu S, Hosoglu S (2000) The complications of chronic otitis media: report of 93 cases. J Laryngol Otol 114:97–100
6. Sennaroglu L, Sozeri B (2000) Otogenic brain abscess: review of 41 cases. Otolaryngol Head Neck Surg 123:751–755
7. Seven H, Coskun BU, Calis AB, Sayin I, Turgut S (2005) Intracranial abscesses associated with chronic suppurative otitis media. Eur Arch Otorhinolaryngol 262(10):847–851
8. Kangsanarak J, Navacharoen N, Fooanant S, Ruckphaopunt K (1995) Intracranial complications of suppurative otitis media: 13 years' experience. Am J Otol 16(1):104–109
9. Mustafa A, Heta A, Kastrati B, Dreshaj Sh (2008) Complications of chronic otitis media with cholesteatoma during a 10-year period in Kosovo. Eur Arch Otorhinolaryngol 265(12):1477–1482
10. Singh B, Maharaj TJ (1993) Radical mastoidectomy: its place in otitic intracranial complications. J Laryngol Otol 107:1113–1118
11. Samuel J, Fernandes CM (1987) Lateral sinus thrombosis (a review of 45 cases). J Laryngol Otol 101(12):1227–1229
12. Dobben GD, Raofi B, Mafee MF, Kamel A, Mercurio S (2000) Otogenic intracranial inflammations: role of magnetic resonance imaging. Top Magn Reson Imaging 11(2):76–86
13. Ooi EH, Hilton M, Hunter G (2003) Management of lateral sinus thrombosis: update and literature review. J Laryngol Otol 117(12):932–939
14. Irving RM, Jones NS, Kendall B, Hall-Craggs MA (1991) CT and MR imaging in lateral sinus thrombosis. J Laryngol Otol 105:693–695
15. Kaplan DM, Kraus M, Puterman M, Niv A, Leiberman A, Fliss DM (1999) Otogenic lateral sinus thrombosis in children. Int J Pediatr Otorhinolaryngol 49:177–183

16. Ghosh PS, Ghosh D, Goldfarb J, Sabella C (2011) Lateral sinus thrombosis associated with mastoiditis and otitis media in children: a retrospective chart review and review of the literature. J Child Neurol 26(8):1000–1004
17. Hafidh MA, Keogh I, Walsh RM, Walsh M, Rawluk D (2006) Otogenic intracranial complications. A 7-year retrospective review. Am J Otolaryngol 27(6):390–395
18. Rupa V, Raman R (1991) Chronic suppurative otitis media: complicated versus uncomplicated disease. Acta Otolaryngol 111(3):530–535
19. Altuntas A, Unal A, Aslan A, Ozcan M, Kurkcuoglu S, Nalca Y (1998) Facial nerve paralysis in chronic suppurative otitis media: ankara numune hospital experience. Auris Nasus Larynx 25(2):169–172
20. Yetiser S, Tosun F, Kazkayasi M (2002) Facial nerve paralysis due to chronic otitis media. Otol Neurotol 23(4):580–588
21. Savic DL, Djeric DR (1989) Facial paralysis in chronic suppurative otitis media. Clin Otolaryngol 14:515–517
22. Harker LA, Pignatari SS (1992) Facial nerve paralysis secondary to chronic otitis media without cholesteatoma. Am J Otol 13:372–374
23. Kahane J, Crane BT (2009) Tuberculous otitis media. Otol Neurotol 30(6):865–866
24. Vital V, Printza A, Zaraboukas T (2002) Tuberculous otitis media: a difficult diagnosis andreport of four cases. Pathol Res Pract 198:31–35
25. Viswanatha B, Naseeruddin K (2010) Lateral sinus thrombosis in otology: a review. Mediterr J Hematol Infect Dis 2(3):e2010027
26. Kuczkowski J, Mikaszewski B (2001) Intracranial complications of acute and chronic mastoiditis: report of two cases in children. Int J Pediatr Otorhinolaryngol 60(3):227–237
27. Jun HL, Seong JC, Keehyun P, Yun-Hoon C (2009) Managements for lateral sinus thrombosis: does it need the ligation of internal jugular vein or anticoagulants? Eur Arch Otorhinolaryngol 266:51–58
28. Shah UK, Jubelirer TF, Fish JD, Elden LM (2007) A caution regarding the use of low-molecular weight heparin in pediatric otogenic lateral sinus thrombosis. Int J Pediatr Otorhinolaryngol 71(2):347–351
29. Bradley DT, Hashisaki GT, Mason JC (2002) Otogenic sigmoid sinus thrombosis: what is the role of anticoagulation? Laryngoscope 112:1726–1729
30. Kulali A, Ozatik N, Topcu I (1990) Otogenic intracranial abscesses. Acta Neurochir 107:140–146
31. Greenberg JS, Manolidis S (2001) High incidence of complications encountered in chronic otitis media surgery in a U.S. metropolitan public hospital. Otolaryngol Head Neck Surg 125:623–627