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Our 14 Years of Clinical Experience in Otitis Media Complications

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ABSTRACT

Background: This study aims to present our experiences regarding otitis media (OM) complications in a tertiary hospital and discuss them in light of the literature.

Methods: In our study, the demographic information, findings at admission, radiological examinations, treatment approaches, and follow-up periods of the patients treated for OM complications at Dokuz Eylül University Hospital Ear Nose and Throat Clinic between January 2010 and January 2024 were retrospectively analyzed. Complications were grouped as acute otitis media (AOM), chronic otitis media (COM), and extracranial and intracranial complications.

Results: In the study, 74 complications were observed in 67 patients, 44 of which were due to AOM and 30 due to COM. Thirty-nine patients were male (58.2%) and 28 were female (41.8%). The mean age was 28.7 years (2 months-78 years). Twenty-eight of the COM complications were extracranial, and 2 were intracranial. Extracranial complications consisted of 14 perilymphatic fistula (PLF), 11 cases of peripheral facial paralysis (PFP), 2 subperiosteal abscesses, and 1 Citelli abscess. There was a temporal lobe abscess and a sigmoid sinus thrombosis as intracranial complications. More than 1 complication was observed in 3 patients. A patient treated for temporal lobe abscess underwent radical mastoidectomy along with neurosurgery and intracranial abscess drainage. In 14 patients with PLF, the fistula was repaired with bone pates and soft tissues after the appropriate removal of the cholesteatoma. We managed to preserve hearing in all of these patients. While complete recovery was observed in 6 of the 11 PFP patients who underwent surgery, 3 patients had grade 2 PFP and 1 patient had grade 3 PFP according to the House–Brackmann staging system at the last follow-up. One patient voluntarily lost follow-up after the first month of the operation. Modified radical mastoidectomy and medical treatment were applied to the patient who was diagnosed with sigmoid sinus thrombosis. At the second-month follow-up, it was observed that the thrombosed segment in the sinus was recanalized.

Forty-four AOM complications were treated in 40 patients. Extracranial complications were listed as 14 subperiosteal abscesses, 10 cases of mastoiditis, 6 cases of labyrinthitis, and 4 PFP. Among the intracranial complications, sigmoid sinus thrombosis was observed in 6 patients, epidural abscess was observed in 3 patients, and otitic hydrocephalus was observed in 1 patient. All patients with subperiosteal abscesses underwent abscess drainage and a ventilation tube in addition to intravenous antibiotic therapy. Patients with PFP and labyrinthitis were treated with a ventilation tube, and patients were also given antibiotics and oral steroids. Intravenous antibiotics, abscess drainage, mastoidectomy, and anticoagulant treatment were applied to patients presenting with epidural abscess and sigmoid sinus thrombosis. Another remarkable situation is that after the emergence of the COVID-19 pandemic, AOM was the increase in complications. Eleven cases of AOM

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complications in 10 years before the pandemic. Thirty-three cases of AOM complications were observed after the emergence of the pandemic. Three of these 33 cases were diagnosed during the period when pandemic measures were implemented, including curfew, personal hygiene, wearing masks, and closing schools, while 30 were diagnosed after September 2021, when schools reopened after the pandemic and the measures were reduced. It is attractive.

Conclusion: Otitis media complications are pathologies in which significant morbidity and mortality can be prevented thanks to early diagnosis and treatment. In addition, these complications increased after the COVID-19 pandemic. For this reason, early diagnosis and treatment are important, as they are lifesaving.

Keywords: Acute otitis media, cholesteatoma, chronic otitis media, complication, COVID-19

Introduction

Otitis media (OM) is one of the most common infectious diseases worldwide, with more than 80% of children experiencing acute otitis media (AOM) at least once by the age of 3. Otitis media can occur at any age; however, it is mostly seen between 6 and 24 months. It is one of the leading causes of hospital admissions worldwide, and its complications are a significant cause of preventable hearing loss, especially in developing countries.[1-5]

The incidence of AOM, which is usually a self-limiting disease, is 10.9%. Chronic otitis media (COM) is more challenging to diagnose and treat, with an incidence of 4.8%.[6-10]

The severity and complications of OM have been known since ancient times, first noted in 460 BC. Hippocrates said about this disease, "Acute earache with persistent high fever should be feared because the patient may die."[11] Today, complications secondary to OM are observed in approximately 1 in every 2000 children treated for OM in developed countries and 4 in every 100 children in developing countries.[12,13]

Otitis media complications are divided into extracranial and intracranial. Extracranial complications include tympanic membrane perforation, acute mastoiditis, subperiosteal abscess, peripheral facial paralysis (PFP), labyrinthitis, and perilymphatic fistula (PLF). Intracranial complications include meningitis, cerebral abscess, lateral sinus thrombosis, epidural abscess, subdural empyema, encephalitis, and otitic hydrocephalus.[8,14,15]

Otitis media complications are a common problem in developing countries, and the factors responsible for them are socio-economic and socio-cultural status, and inadequate treatment, immunosuppression. In developed countries, antibiotic resistance, masking symptoms by antibiotics, and changes in the virulence of causative organisms can lead to complications.[16-18]

MAIN POINTS

- *Despite the widespread use of antibiotics, otitis complications are still a significant cause of morbidity and mortality today.*
- *With the COVID-19 pandemic, acute otitis media complications have increased significantly, particularly when pandemic measures were reduced.*
- *The treatment of some otitis media complications requires a multidisciplinary approach involving otolaryngologists, pediatricians, infectious disease specialists, and neurosurgery specialists.*
- *Although they are life-threatening complications, if detected early, these complications can mostly be cured without sequelae.*

This study aims to present our experiences regarding OM complications in a tertiary hospital and discuss them in the light of the literature.

Material and Methods

Charts of patients treated due to OM complications in our department between January 2010 and January 2024 were retrospectively analyzed.

The patients' documents were reviewed in our department and written informed consent was obtained from patients or the patients' conservator.

Approval for the study was received from the Dokuz Eylül University Non-Interventional Research Ethics Committee (No.: 2023/06-19, Approval date: 01.03.2023)

Patients demographics, cause of complication (AOM/COM), type of complications (intracrainal/extracranial), received treatments, patients pre and posttreatment hearing status and patients prognosis were analyzed.

Results

Seventy-four OM complications were encountered in 67 patient in this time period. Seven patients (10.4%) had more than 1 complication.

Thirty-nine patients were male (58.2%) and 28 were female (41.8%). The mean age was 28.7 years (2 months-78 years).

Forty-four AOM complications were observed in 40 patients. Four patients had more than 1 complication. Twenty-three patients were male (57.5%), and 17 were female (42.5%). The average age was 13 years (2 months-78 years). The distribution of age groups with AOM complications is given in Figure 1.

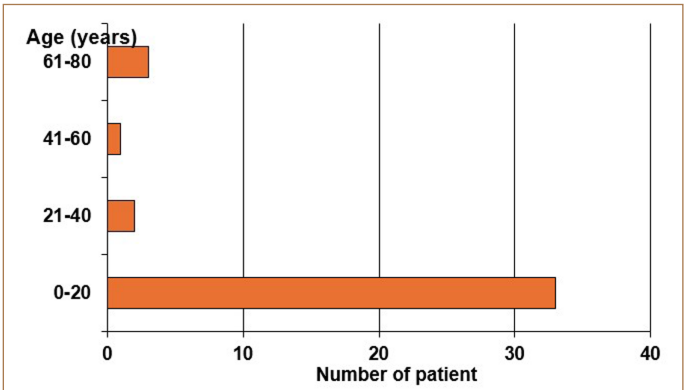

Figure 1. Distribution of AOM complications by age groups (n = 40).

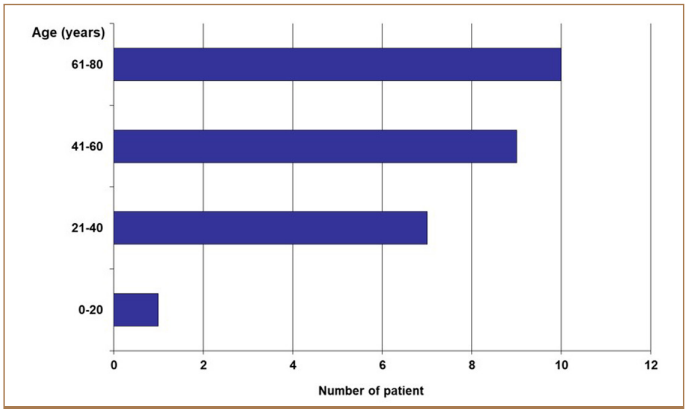

Figure 2. Distribution of chronic otitis media complications by age groups (n = 27).

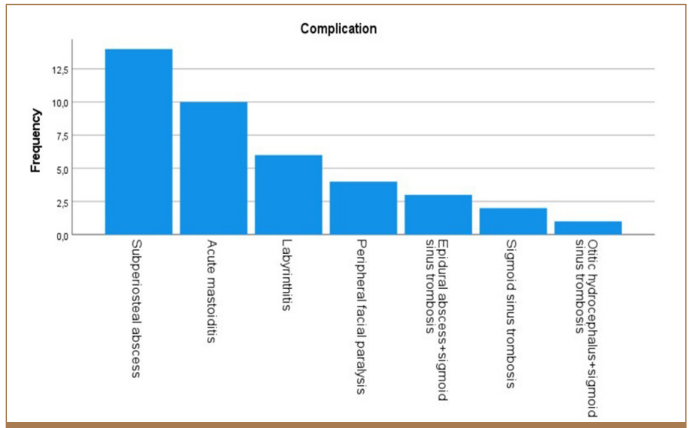

Figure 3. Distribution of acute otitis media complications (n = 40).

There were 30 COM complications in 27 patients, in 3 patients more than 1 complication occurred. Sixteen of the patients were male (59.3%), and 11 were female (40.7%). The average age was 50 (10-74 years). The distribution of age groups with COM complications is given in Figure 2.

Acute Otitis Media Complications

Of the 44 AOM complications, 34 were extracranial, and 10 were intracranial complications. The most common extracranial complication caused by AOM was subperiosteal abscess, followed by acute mastoiditis. The most common intracranial complication caused by AOM was sigmoid sinus thrombosis. The average time from the onset of OM symptoms to the occurrence of complications was 7.1 days (1-21 days). The mean follow-up period of these patients was 12 months (3-40 months).

Most of the middle ear fluid cultures taken due to complications of AOM showed no growth (in 26 out of 40 patients) The most frequently occurring agent was *Streptococcus pneumoniae* (5 patients) and isolated microorganisms were *Streptococcos pyogenes* (4 patients), *Prevotella intermedia* and *Streptococcus constellatus* (2 patients), *Fusobacterium necrophorum* (1 patient) and *Escherichia coli* (1 patient).

We have treated 24 patients with subperiosteal abscess and acute mastoiditis, which occurred due to AOM. All patients with subperiosteal abscesses (14 patients) underwent abscess drainage, a ventilation tube placement, and intravenous antibiotic therapy. A ventilation tube was applied to all patients with mastoiditis (10 patients), along with intravenous antibiotics (Figure 3). Additionally, cortical mastoidectomy with ventilation tube placement was performed on 1 patient with mastoiditis, as there was significant coalescence on computed tomography imaging. The mean follow-up period of this group was 6 months (3-24 months).

There were 4 patients which were treated due PFP caused by AOM. All patients were operated (ventilation tube placement) and started to receive the medical treatment (methylprednisolone was given intravenously at 1 mg/kg at a time and antibiotics) on the same day of admission to hospital. The mean time from the onset of PFP to the hospital admission was 7 hours (2-10 hours). Of those, 1 patient was grade 2, 2 patients were grade 3, and 1 patient was grade 6. Complete recovery was observed in all patients after treatment. The mean follow-up of this group was 17 months (2-40 months).

We have encountered 6 patients with labyrintihis caused by AOM. Patients were treated with a ventilation tubes, all were given oral steroids (1 mg/kg methylprednisolone was given orally as a single dose for 6 days. Then, the treatment was terminated by gradually decreasing the dose over the next 4 days) in addition to intravenous antibiotic therapy. The average bone conduction hearing threshold was 54 dB (5-100 dB) in the audiological evaluations of these patients before the operation and treatment. After the treatment, bone conduction hearing thresholds returned to normal levels, except for 1 patient (the patient died due to other comorbidities). The mean follow-up of this group was 14.5 months (4-40 months).

Regarding intracranial complications, a 7-year-old patient with double and blurred vision and sigmoid sinus thrombosis underwent ventilation tube application and cortical mastoidectomy. Medical treatment for the patient was meropenem and vancomycin; Acetazolamide was given for 4 months for increased intracranial pressure, and low molecular weight heparin (LMWH) was given for 3 months for thrombosis. In the patient's third month of postoperative imaging, it was observed that the thrombosed segment disappeared. No pathology, including in the vision examination, was detected at the ninth-month postoperative follow-up.

In 2 patients with epidural abscess and sigmoid sinüs thrombosis we performed a cortical mastoidectomy, drainage of the abscess via mastoid cavity and ventilation tube placement. No additional procedure was performed on by neurosurgery for either patient. Cefepime, vancomycin, and metronidazole were given as antibiotics. The patient underwent LMWH for 3 months after the operation, and no pathology was detected in the third month of postoperative control and for both patients sigmoid sinus were re-canalized.

In a 3-year-old patient with an epidural abscess and sigmoid sinus thrombosis, abscess drainage via a burr hole and ventilation tube was performed in collaboration with the neurosurgery department. The patient was given ceftriaxone, metronidazole, and vancomycin as antibiotics. No pathology was detected in the first year of control of the patient, who received LMWH for 1 year.

A 9-year-old patient with sigmoid sinus thrombosis underwent ventilation tube application and cortical mastoidectomy. The patient was given diazomide for 1 month due to increased intracranial pressure. The patient was administered meropenem and vancomycin as antibiotics and used LMWH for 2 months after the operation. No pathology was detected at the patient's 1-year follow-up.

A 7-year-old patient with sigmoid sinus thrombosis and autistic hydrocephalus, who presented with vision loss in both eyes, underwent ventilation tube application and cortical mastoidectomy. In the examinations, factor V Leiden heterozygous and MTHFR (A1298C) homozygous mutation were detected in the patient. Due to high intracranial pressure, the patient underwent a lumbar puncture and was administered acetazolamide for 1 month and dexamethasone for 3 months. Due to optic nerve compression, the patient underwent optic nerve decompression twice by ophthalmologists. The patient, who was administered meropenem and vancomycin as antibiotics, was found to have continued vision loss in both eyes at the 1-year postoperative follow-up. The patient continues to receive LMWH due to his genetic background (Table 1).

We have noticed that there was a significant increase in AOM complications, especially since the end of year 2021. With the start of the COVID-19 pandemic in March 2020, schools in Türkiye largely switched to online education, and then, as the effect of the pandemic decreased, the normal education process started again in September 2021. During the period when pandemic measures were reduced, many upper respiratory infection complications were encountered, especially in children, due to COVID-19 and non-COVID factors. The distribution of AOM complications before and after the pandemic is given in Table 2.

Chronic Otitis Media Complications

All of the complicated COM patients were cholesteatoma cases. Among the 30 COM complications observed, 28 were extracranial, and 2 were intracranial. The mean follow-up period of these patients was 14 months (1-93 months). The distribution of COM complications given in Figure 4.

The most common extracranial complication caused by COM was PLF. According to the Dornhoffer and Milewski classification, 10 patients had type 1 and 2 patients had type 2 PLF. In all PLF cases, fistula repair was done in a single stage. After cleaning the cholesteatoma in the fistula region, the fistula was repaired with bone dust and temporal fasia in type 1 fistulas, while temporal fascia, fat tissue, and/or cartilage were used to repair type 2 fistulas. In all fistula patients, we were able to preserve the preoperative bone conduction hearing levels. The mean follow-up period of these patients was 18 months (3-86 months).

In 11 PFP cases, total recovery was observed in 6 patients, while 3 patients showed improvement with grade 2, and 1 with grade 3 PFP. One patient was lost to follow-up by not coming to the follow-up after the first month of the operation. The mean follow-up period of these patients was 26 months (1-93 months). Information about PFP patients is given in Table 3.

Table 1. Distribution of the Time from the Onset of Otitis Media Symptoms Until Complications Occur, According to Acute Otitis Media Complications

Complications	Time from First Symptom to Complication (Days)
Otitic hydrocephalus	14
PFP	12.2
Subperiosteal abscess	7.7
Epidural abscess + sigmoid sinus thrombosis	7.3
Labyrinthitis	6.8
Acute mastoiditis	4.4

PFP, peripheral facial paralysis.

Table 2. Distribution of Acute Otitis Media Complications Before and During the COVID-19 Pandemic (n = 44)

Complication	Before the COVID-19 Pandemic	After the COVID-19 Pandemic
Subperiosteal abscess	4	10
Acute mastoiditis	2	8
Labyrinthitis	2	4
PFP	1	3
Sigmoid sinus thrombosis	1	5
Epidural abscess	1	2
Otitic hydrocephalus	0	1
Total	11 (25%)	33 (75%)

PFP, peripheral facial paralysis.

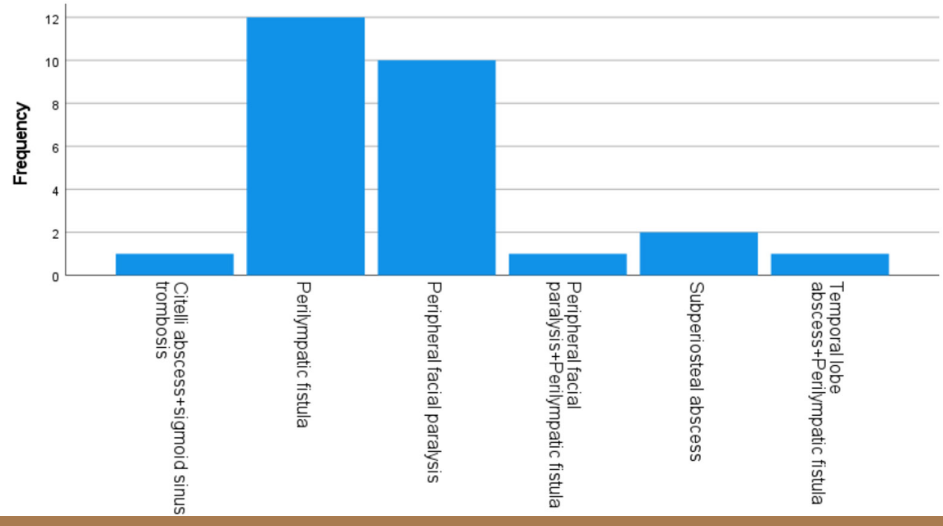

Figure 4. Distribution of chronic otitis media complications (n = 27).

Table 3. Data of COM Patients with Peripheral Facial Paralysis (n = 11)

Age	Diagnosis	PFP (Before Treatment)	Surgical Procedure	PFP (After Treatment)
22	CCOM	2	Inside out mastoidectomy	2
31	CCOM	3	Modified radical mastoidectomy	1
35	CCOM	3	Cortical mastoidectomy	3
49	CCOM	4	Modified radical mastoidectomy	1
53	CCOM	2	Modified radical mastoidectomy	1
60	CCOM	3	Radical mastoidectomy	Lost to follow-up
64	NCOM	4	Radical mastoidectomy	1
67	CCOM	3	Modified radical mastoidectomy	1
69	CCOM	4	Radical mastoidectomy	2
72	CCOM	6	Radical mastoidectomy	2
74	CCOM	5	Radical mastoidectomy	1

In addition to the surgical procedure, intravenous antibiotic therapy and oral methylprednisolone (1 mg/kg methylprednisolone was given orally as a single dose for 6 days. Then, the treatment was terminated by gradually decreasing the dose over the next 4 days) treatment were discontinued in all cases.
CCOM, chronic otitis media with cholesteatoma; COM, chronic otitis media; NCOM, non-cholesteatoma chronic otitis media; PFP, peripheral facial paralysis.

We had 1 patient diagnosed with sigmoid sinus thrombosis and Citelli abscess due to cholesteatoma. A modified radical mastoidectomy was perfomed and abscess drainage was performed in this patient. All the granulation tissues around the thrombosed sinus was removed using a diamond drill. The patient received intravenous antibiotics for 1 month and anticoagulant treatment for 2 months. At the 2-month follow-up, it was observed that the thrombosed segment in the sinus was recanalized.

A 68-year-old woman which was diagnosed with temporal lobe abscess due to cholesteatoma was operated in a single stage. During the surgery, the abscess was drained out via craniotomy by the neurosurgery team, and we performed a radical mastoidectomy. The patients received intravenous meropenem and vancomycin for 6 weeks and discharged without any sequelae (Figure 5).

The average follow-up period of the patients after treatment was 22 months in COM and 9.7 months in AOM. There were no death due to OM complications during follow-up. Audiological examinations performed after treatment showed that preoperative bone conduction hearing thresholds was preserved in all patients.

Discussion

Complications of OM are an essential health problems in both developing and developed countries despite the widespread use of antibiotics and improved healthcare services. Dongol et al[18] reported that AOM complications were most common in the population under the age of 20 (48.28%). Additionally, they reported that 74% of intracranial complications occurred in patients younger than 20 years old. In their study Osma et al[19] claimed that 58% of the patients who developed OM complications were under 20 years of age. In our study, 50% of the complications were observed in people under 20, and 83% of intracranial complications were observed in this age population. In this respect, our findings are compatible with the literature.

One should be careful about multiple complications. Dongol et al[18] reported that 15 of 164 patients (9%) had more than 1 complication simultaneously. Wu et al[20] reported more than 1 complication in 10% of their patients. In our study, this rate was 10.2% and is compatible with these studies. Conversely, Mostafa et al,[7] in their study of 422 patients, reported 2 complications in 54% of the patients and 3 or more complications in 44.7%. Therefore, we believe that for complicated OM cases, it is important to see enhanced temporal and brain CTs in order to rule all possible complications.

Wu et al,[20] in their 22-year study conducted in 2011, reported that while the percentage of extracranial complications gradually increased over the years, the percentage of intracranial complications decreased. Singh and Maharaj,[21] in a 1993 study of 268 patients, reported that 32% of the complications were extracranial, 56% were intracranial, and 12%

Figure 5. Axial (A) preoperative magnetic resonance image shows the patient with temporal lobe abscess caused by COM. Axial (B) postoperative computed tomography (CT) images of the same patient show that the abscess has disappeared.

were both extracranial and intracranial.[21] Dongol et al,[18] in their study in 2020, reported that 80% of the complications were extracranial and 11% were intracranial. In our study, 88.2% of the patients had extracranial complications, 8.8% had intracranial complications, and 3% had extracranial and intracranial complications. The decrease in intracranial complications may be due to the early use of broad-spectrum antibiotics and ventilation tubes and early detection of cholesteatoma cases.

The most common complications in our study were subperiosteal abscess, PLF, and PFP. This finding is consistent with Dongol et al[18] and Osma et al[19] It is compatible with studies. Wu et al while labyrinthitis was reported as the most common extracranial complication in their study, Maranhao et al studied that the most common extracranial complication was PLF, and the second most common was mastoiditis.[20-22]

In every case of cholesteatoma, the presence of an PLF should be considered. Before planning the operation, the patient's history, examination findings, and radiological imaging should be carefully examined. According to our study, type 1 and type 2 fistulas, according to the Dornhoffer and Milewski classification, have a good prognosis, and hearing thresholds are successfully preserved after surgery.

Peripheral facial paralysis was one of the most common complications in our study. Peripheral facial paralysis associated with COM is primarily due to erosion of the facial canal by granulation tissue or cholesteatoma and disruption of nerve function by inflammatory mediators through "suppurative neuropraxia."[23] In AOM, bone erosion and compressive phenomena are thought to be less likely due to a shorter progression period, and neural ischemia occurs due to thrombosis occurring in the vasa nervorum through inflammatory mediators.[22] Smith et al, in a study conducted on AOM, found that PFP in children was often incomplete, appeared suddenly, and had a good prognosis. It has been reported that PFP caused by COM occurs slowly and has a worse prognosis.[23] In our study, the cause was COM in 11 of 15 patients with PFP, while AOM was the cause in 4. Two of the patients with AOM had grade 3 PFP before treatment; 1 each had grade 2 and grade 6 PFP, and these patients recovered without sequelae after treatment. One of the 11 PFP patients due to COM was lost to follow-up because he did not come for follow-up visits. Six patients recovered without sequelae, 3 with grade 2 and 1 with grade 3 PFP.

According to many studies in the literature, bacterial meningitis is the most common intracranial complication caused by AOM and COM.[11,24-26] While meningitis in children is caused by bacteremia caused by AOM, in adults, it is more often caused by COM.[24,27] In their study, Dongol et al[18] found brain abscess to be the most common intracranial complication. Our study observed sigmoid sinus thrombosis as the most common intracranial complication. We did not observe meningitis in any patient. We think the reason behind this is the fact that in recent years, our country has started a comprehensive vaccination program against possible microorganisms that are likely to cause meningitis in children.

Another interesting finding of our study is the relationship between the COVID-19 pandemic and AOM complications. The COVID-19 pandemic has been going on for more than 3 years and has also changed daily life. On March 11, 2020, WHO declared COVID-19 a pandemic and implemented various measures to prevent its spread, including personal hygiene measures such as wearing masks and washing hands. Social distancing was also strongly recommended, and schools and businesses were closed in many countries. These changes in daily life have reduced close contact between people, which has changed the incidence and course of many diseases.[28]

A study analyzing data from children aged 0-17 in Massachusetts, USA, reported that social distancing reduced the incidence of many infectious diseases, including AOM. This study compared the incidence of infectious diseases before social distancing and during the period when social distancing was implemented. During social distancing, upper respiratory tract and respiratory infections such as bronchiolitis, colds, croup, flu, pharyngitis, pneumonia, sinusitis, and AOM decreased significantly.[29] In another study, the impact of COVID-19 quarantine on the onset of AOM was analyzed using data collected from 6 centers in Paris, France. This study, which included data from 871 543 children, reported that the incidence of AOM decreased by more than 70% due to the lockdown. However, given the potential for caregivers to avoid going to the hospital for fear of contracting COVID-19, these results may not accurately reflect the true incidence of infectious diseases in children.[30] In parallel with these studies, studies on OM complications during the pandemic showed a significant decrease in complications.[31,32] In our study, while 11 AOM complications were seen in the 11 years before the pandemic, 33 AOM complications were seen after the emergence of the pandemic. It is noteworthy that while 3 of these 30 cases were diagnosed during the period when pandemic measures were implemented, including curfew, personal hygiene, wearing masks, and closing schools, 30 of them were encountered after September 2021, when schools were reopened after the pandemic and the measures were reduced. This may be due to the immune system not reaching sufficient maturation in the pediatric age group due to restrictions and social distance measures during the pandemic and the immunomodulation effects of the COVID-19 virus.

Although OM complications do not appear to be very common, the increase in AOM complications seen especially after the COVID-19 pandemic is remarkable. Symptoms may have been suppressed due to increased use of antibiotics. For this reason, early diagnosis and treatment are essential as they are lifesaving. However, it should be remembered that more than 1 complication may occur in a patient, and the treatment and follow-up process should be managed accordingly.

Data Availability Statement: *The data that support the findings of this study are available on request from the corresponding author.*

Ethics Committee Approval: *This study was approved by the Ethics Committee of Dokuz Eylül University (Approval no: 2023/06-19 Date: 01.03.2023).*

Informed Consent: *Written informed consent was obtained from the patients and their conservators who agreed to take part in the study.*

Peer-review: *Externally peer-reviewed.*

Author Contributions: *Concept - E.C.Ö., Y.O., E.A.G.; Design - E.C.Ö., Y.O., E.A.G.; Supervision - E.C.Ö., Y.O., Ö.S., A.Ç.Ç., E.A.G.; Resources - ; Materials - E.C.Ö., Y.O., Ö.S., A.Ç.Ç., E.A.G.; Data Collection - E.C.Ö., Y.O., Ö.S., A.Ç.Ç., E.A.G.; Analysis and/or interpretation - E.C.Ö., Y.O., Ö.S., A.Ç.Ç., E.A.G.; Literature search - E.C.Ö., Y.O., Ö.S., A.Ç.Ç., E.A.G.; Writing - E.C.Ö., Y.O., Ö.S., A.Ç.Ç., E.A.G.; Critical review - E.C.Ö., Y.O., Ö.S., A.Ç.Ç., E.A.G.*

Declaration of Interests: The authors have no conflict of interest to declare.

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