



Acute Mastoiditis After the COVID-19 Pandemic: A Single-Center Experience

COVID-19 Pandemisi Sonrası Akut Mastoidit: Tek Merkez Deneyimi

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Abstract

Objective: Acute mastoiditis is one of the most common complications of otitis media in children. Although rare, it can be associated with severe clinical progression and complications. This study examines the clinical findings, laboratory results, and complications of pediatric acute mastoiditis cases that have increased following the coronavirus disease-2019 (COVID-19) pandemic.

Material and Methods: We retrospectively reviewed the medical records of children (aged 0-18) diagnosed with acute mastoiditis between January 2023 and January 2024, focusing on their clinical findings, laboratory results, and complications.

Results: A total of 15 cases were included in the study. Of the patients, 53.3% (n= 8) were male, and 46.6% (n= 7) were female. The median age was 74 months (min: 1.5, max: 169). All cases presented with fever, postauricular erythema, and postauricular tenderness. All patients were hospitalized for treatment, with a median hospital stay of 10 days (min: 7, max: 25). Complications developed in 9 (60%) cases. Three patients had subperiosteal abscess, one had epidural empyema, three had sinus venous thrombosis, one had osteomyelitis extending to the ipsilateral mandible and cervical vertebrae during treatment, and one had an abscess in the left parotid gland. The most common extracranial complication was subperiosteal abscess (n= 3, 20%). Eight patients underwent myringotomy. None of the cases required mastoidectomy. The median duration of antibiotic treatment was 26 days (min: 16, max: 40).

Conclusion: In our study, we aimed to draw attention to the increase in pediatric acute mastoiditis cases following the COVID-19 pandemic. To prevent potentially fatal intracranial complications resulting from

Öz

Giriş: Akut mastoidit, çocuklarda en sık görülen otitis media komplikasyonlarından biridir. Nadir görülse de ciddi klinik seyir ve komplikasyonlarla ilişkili olabilir. Bu çalışmada, koronavirüs hastalığı-2019 (COVID-19) pandemi sonrası artan pediyatrik akut mastoidit olgularının klinik bulguları, laboratuvar sonuçları ve komplikasyonları incelenmiştir.

Gereç ve Yöntemler: Ocak 2023-Ocak 2024 tarihleri arasında akut mastoidit tanısı alan (0-18 yaş arası) çocuk olguları, klinik bulguları, laboratuvar bulguları ve komplikasyonlarını dosya taramasıyla değerlendirdik.

Bulgular: Çalışmamıza toplam 15 olgu dahil edildi. Olguların %53.3 (n= 8)'ü erkek, %46.6 (n= 7)'si kız idi. Ortanca yaş 74 (min: 1.5, maks: 169) aydı. Olguların tamamında ateş, postauriküler eritem ve postauriküler hassasiyet vardı. Tüm olgular hastaneye yatırılarak tedavi edildi. Hastane yatış süresi ortanca 10 (min: 7, maks: 25) gündü. Komplikasyon yönünden incelendiğinde, 9 (%60) olguda komplikasyon gelişti. Üç olguda subperiosteal apse, bir olguda epidural ampiyem, üç olguda sinüs ven trombozu, bir olguda tedavi altında aynı taraf mandibula ve servikal vertebralara uzanan osteomyelit, bir olguda ise sol parotis bezinde apse gelişti. En sık görülen ekstrakraniyal komplikasyon subperiosteal apse (n= 3, %20) idi. Sekiz olguya miringotomi yapıldı. Hiçbir olguda mastoidektomi ihtiyacı gelişmedi. Ortanca antibiyotik tedavi süresi 26 (min: 16, maks: 40) gündü.

Sonuç: Çalışmamızda, COVID-19 pandemisi sonrası artan pediyatrik akut mastoidit olgularına dikkat çekmek istedik. Akut mastoiditin ilerlemesi sonucu ortaya çıkabilecek ölümcül intrakraniyal komplikasyonları

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the progression of acute mastoiditis, timely and effective treatment of the condition is crucial.

Keywords: Mastoiditis, COVID-19, acute otitis media

Introduction

Acute mastoiditis is commonly a complication of acute otitis media. With the discovery of antibiotics, the incidence of acute mastoiditis and the likelihood of progression to dangerous sequelae have decreased. However, if left untreated, mastoiditis can result in life-threatening sequelae such as meningitis, intracranial abscess, and venous sinus thrombosis. Despite advanced imaging techniques, antibiotics, and microsurgical procedures, the mortality rate from mastoiditis complications in children is 10% (1).

Although mastoiditis can occur at any age, the majority of patients are under two years of age, with an average age of 12 months. In the pre-antibiotic era, 20% of acute otitis media cases were complicated by acute mastoiditis and were frequently associated with serious intracranial complications. Although the incidence of mastoiditis has decreased with the widespread use of pneumococcal vaccines, it remains serious (2,3).

The most common pathogen in mastoiditis is *Streptococcus pneumoniae*. Other common pathogens include group A beta-hemolytic streptococci, *Staphylococcus aureus*, *Streptococcus pyogenes*, and *Haemophilus influenzae* (4). Risk factors for mastoiditis include being under two years of age, having an immunocompromised state, recurrent acute otitis media, and incomplete pneumatization of the mastoid process (4,5).

Mastoiditis is a clinical diagnosis. Laboratory and imaging findings can be used when the diagnosis is uncertain or when complications related to acute mastoiditis are suspected. Computed tomography (CT) is commonly used for the radiological evaluation of acute mastoiditis. CT can reveal disruption of bone septation in the mastoid air cells and potential spread of infection. In particular, CT scans in patients with mastoiditis may reveal findings such as fluid and/or mucosal thickening in the middle ear, mastoid densification, loss of bony septa defining the mastoid air cells, destruction of mastoid cortex irregularities, periosteal thickening, periosteal disruption, or subperiosteal abscesses (1,6). Antibiotics are central to the treatment of mastoiditis. A complication rate of 8.5% has been reported with the use of antibiotics alone.

Depending on the severity of the infection, surgical procedures such as myringotomy, tympanostomy tube placement, and mastoidectomy may be required (6,7). In our study, we aimed to evaluate the clinical characteristics, laboratory findings, and complications of patients diagnosed with acute mastoiditis.

önlemek için, hastalığın zamanında ve etkili bir şekilde tedavi edilmesi önemlidir.

Anahtar Kelimeler: Mastoidit, COVID-19, akut otitis media

Materials and Methods

Children diagnosed with acute mastoiditis (aged 0-18 years) who were followed up at our clinic between January 2023 and January 2024 were included in the study. The medical records of the patients were reviewed through a retrospective chart review. The age, sex, physical examination findings, laboratory findings (white blood cell count, C-reactive protein, erythrocyte sedimentation rate), microbiological findings, radiological imaging findings, and complications of the cases included in the study were evaluated. Microbiological findings included blood cultures from all patients. Miringotomy cultures were obtained from patients who underwent miringotomy. Variables were expressed as frequency (n) and percentage (%), while quantitative variables with non-normal distribution were expressed as median.

Results

Our study included 15 cases diagnosed with acute mastoiditis. Fifty-three point three percent of the cases were male (n= 8), and 46.6% were female (n= 7). Median age was 74 months (min: 1.5, max: 169). All cases presented with fever, postauricular erythema, and postauricular tenderness. All patients were hospitalized for treatment. Median hospital stay was 10 days (min: 7, max: 25). When the diagnosis periods of the patients were examined, it was observed that the diagnosis rate increased in the fall season. The clinical and laboratory characteristics of the cases are presented in Table 1. The causative agent was identified as *S. pyogenes* in the blood culture of one patient, *S. pyogenes* in the myringotomy culture of one patient, and *S. pneumoniae* in the myringotomy culture of another patient. The causative agent could not be isolated in the blood or myringotomy cultures of the other patients. When vaccination status was evaluated, two cases were unvaccinated against pneumococcus, and one case was partially vaccinated. No concomitant coronavirus disease-2019 (COVID-19) pathogen was detected in our patients. Nasopharyngeal swab samples were taken from only five patients. No concomitant viral pathogen was detected in these patients.

When examined in terms of complications, complications developed in nine cases (60%). Three cases had subperiosteal abscess, one case had epidural empyema, three cases had sinus vein thrombosis, and one case developed osteomyelitis extending to the mandible and cervical vertebrae on the same side during treatment. Additionally, one case was complicated by an abscess in the left parotid gland during treatment. The most common extracranial complication was subperiosteal abscess (n= 3, 20%). Miringotomy was performed in

Table 1. Clinical and laboratory characteristics of the cases

Case No.	Age (mo)/ Sex	Fever	Otorrhea	Ear Plugging	Retro-Auricular Swelling	Retro-Auricular Erythema	Acute Otitis Media	Leucocyte Count (mm³)	Neutrophil Count (mm³)	Erythrocyte Sedimentation Rate (mm/sa)	C-Reactive Protein (mg/L)	Vaccination Status	Week of Diagnosis
1	26/M	+	-	+	+	+	+	15410	9580	31	74	Complete	40
2	113/F	+	-	-	-	+	+	10490	6670	20	268	Complete	42
3	24/M	+	-	+	+	+	-	22340	18110	83	166	Complete	44
4	3/F	+	-	+	+	+	+	20060	11180	30	25	Incomplete	45
5	74/F	+	-	+	+	+	+	11380	7670	23	31	Complete	43
6	96/F	+	-	+	+	+	+	14700	12640	60	106	Complete	46
7	102/F	+	+	+	+	+	+	26540	18320	45	138	Complete	39
8	85/F	+	-	-	+	+	+	12100	9500	20	22	Complete	48
9	58/F	+	-	+	-	+	-	29950	25600	89	288	Complete	49
10	3/M	+	-	+	+	+	-	23100	11040	4	103	Incomplete	51
11	50/M	+	-	-	+	+	+	23750	19250	25	281	Complete	50
12	75/M	+	+	+	+	+	+	11270	7020	52	164	Complete	6
13	1.5/M	+	-	+	+	+	+	9730	2120	54	81	Incomplete	14
14	84/M	+	+	+	+	+	+	16140	12360	14	164	Complete	17
15	169/F	+	+	+	+	+	+	10770	7320	35	95	Complete	25

eight cases, and no mastoidectomy was required in any case. Hearing tests were performed on all patients, and the results were normal.

The medical history of all patients revealed that they were previously healthy children, except for one patient who had a history of acute mastoiditis on the same side one year prior. Family history was investigated for immunodeficiency, and no abnormalities were detected in any of the patients. Immunoglobulin levels were within the normal range for all patients according to their age. Following the diagnosis of acute mastoiditis, all patients were followed up with intermittent examinations for at least six months, and no additional complications developed.

Prior to diagnosis, nearly all patients had received low-dose antibiotics. Following diagnosis, 12 cases were treated empirically with ceftriaxone and clindamycin, one case with ampicillin-sulbactam, and two cases with ceftriaxone. In post-discharge treatment, 12 patients were given amoxicillin-clavulanate, and the remaining three patients were given cefuroxime axetil. The median antibiotic treatment duration was 26 days (min: 16, max: 40). No antibiotic-related complications developed in any of the patients.

Discussion

Acute mastoiditis is a complication of acute otitis media involving inflammation of the mastoid periosteum and air cells (1). Although mastoiditis can occur at any age, the majority of patients are younger than two years old, with a median age of 12 months. In the pre-antibiotic era, 20% of acute otitis media cases were complicated by acute mastoiditis and were frequently associated with serious intracranial complications (2,3).

COVID-19 is an important pathogen that spreads through droplets and contact with surfaces contaminated with respiratory secretions and can affect children of all ages (8). General protective and hygiene measures implemented during the COVID-19 pandemic significantly reduced the incidence of common respiratory infections and acute mastoiditis. However, an increase in cases of *S. pyogenes*-associated mastoiditis has been observed in children post-pandemic. The relaxation of pandemic measures may have led to a significant increase in the incidence of acute mastoiditis. This situation may be attributed to a general increase in viral respiratory infections and the underdeveloped immune systems of children (9). While we did not have any patients diagnosed with acute mastoiditis during the COVID-19 pandemic at our center, we observed a significant increase after the pandemic. We believe that this may be related to compliance with protective equipment and hygiene rules during the pandemic. In addition, while the literature emphasizes that most cases occur in two-year-old children, our study found that older children were affected. This may also be a consequence of the COVID-19 pandemic.

In a systematic review, 2,109 children with acute mastoiditis were evaluated, and postauricular swelling, erythema, tenderness, and ear pulling were identified as the most common findings. In the review, CT was the most commonly used imaging method, accounting for 68% of cases (39 out of 65 studies and 68% of patients) (10). Laboratory findings included elevated white blood cell counts, inflammatory markers (erythrocyte sedimentation rate and C-reactive protein), and a left shift (5,6). In our study, radiological imaging was performed in all cases, with CT being the most commonly used method. Elevated C-reactive protein, leukocytosis, and increased erythrocyte sedimentation rate were detected in all cases, mostly with neutrophilia.

Two types of complications may develop in acute mastoiditis: intracranial and extracranial. The frequency of complications ranges from 15% to 30% (11,12). Subperiosteal abscess is one of the most common extracranial complications; however, other complications such as hearing loss, facial nerve palsy, Bezold abscess, and temporomandibular joint ankylosis may also occur. Intracranial complications include meningitis, venous sinus thrombosis, and temporal or cerebellar abscess (10-12). In our study, complications occurred in 9 (60%) cases, and subperiosteal abscess was the most common finding, consistent with the literature. However, the high overall complication rate is thought to be due to the small number of cases, the large size of our hospital, and the fact that it is a referral center. The majority of complications that developed in patients were present at the time of diagnosis.

In a review including twenty-one studies covering a total of 564 patients, the cure rates for medical treatment, conservative surgery, and mastoidectomy were reported as 95.9%, 96.3%, and 89.1%, respectively. There is no consensus on the diagnosis and management of acute mastoiditis. The treatment of pediatric acute mastoiditis may vary between hospitals depending on clinical presentation, severity, presence of complications, and the surgeon's expertise. There are significant differences in the rates of conservative and surgical treatment. In particular, the rates of mastoidectomy vary between 9% and 88%. Historically, simple mastoidectomy was the cornerstone of surgical treatment. However, in recent years, there has been a trend toward a conservative approach for acute mastoiditis and its complications. Conservative treatment consists of antibiotic use alone, myringotomy with ventilation tube placement or ventilation tube placement in addition to antibiotics, and abscess drainage (13). In our study, mastoidectomy was not required, and in selected cases, myringotomy and ventilation tube placement were performed in addition to antibiotic therapy. Cases with subperiosteal abscesses were successfully treated with medical therapy without the need for surgical intervention.

The use of anticoagulants in children with thrombosis associated with mastoiditis is controversial. Some studies have

argued that anticoagulant therapy is ineffective in achieving vascular recanalization in children with thrombosis. Other studies have reported that it provides partial benefit in recanalization and recommend the use of low-molecular-weight heparin for at least three months. The risk of serious bleeding associated with anticoagulants has been shown to be low (14,15). In our study, three patients with thrombosis were administered low-molecular-weight heparin for three months, and complete recanalization was achieved.

In conclusion, our study aimed to draw attention to the increasing number of acute mastoiditis cases following the COVID-19 pandemic. Timely and effective treatment of acute mastoiditis is crucial to prevent life-threatening intracranial complications that may arise from its progression. Early diagnosis and treatment, as in many other diseases, can prevent the development of complications in these patients. However, as observed in our study, life-threatening complications may arise during the initial stages of the disease. Mastoidectomy may be the most definitive treatment method; however, as demonstrated in our study, acute mastoiditis cases can be successfully treated with systemic antibiotic therapy and minor surgical intervention. Treatment should be individualized based on the specific case.

Ethics Committee Approval: This study was approved by T.C. Necmettin Erbakan University the Ethics Committee for Non-Drug and Non-Medical Device Research (Decision no: 2024/14835, Date: 01.03.2024).

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