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Case Report

Masked subdural empyema secondary to frontal sinusitis☆

Abstract

Intracranial complications of pediatric sinusitis are rare but potentially life threatening. These complications include cavernous sinus thrombosis, orbital infection, meningitis, and subdural empyema. Children with these complications may experience significant morbidity from their infection. In such cases, delay in diagnosis and treatment may lead to severe brain damage or death. Emergency physicians, pediatricians, and otolaryngologists should maintain a high index of suspicion for this complication of disease when treating patients with sinusitis in the emergency department or outpatient clinic. Early and accurate diagnosis of subdural empyema will lead to prompt treatment and a favorable outcome for the patient. We report a case of subdural empyema secondary to frontal sinusitis in an otherwise healthy immunocompetent adolescent boy.

Subdural or extradural pyogenic collections most commonly arise by direct extension of infection due to meningitis or of the sinuses. Subdural empyema secondary to bacterial meningitis tends to occur in small infants and is usually recognized clinically, readily diagnosed by computed tomography or brain magnetic resonance imaging (MRI), and managed relatively early. Subdural or extradural empyema secondary to sinusitis occurs in older children, predominantly in adolescent and young men, and is responsible for 50% to 70% of all subdural empyemas [1]. The clinical presentation of sinusitis-induced empyema is less well recognized, and the diagnosis is often delayed. The onset may be variable and is often masked by prior antibiotic treatment [2]. It is necessary to diagnose and treat intracranial infections promptly. We report a case of subdural empyema complicating sinusitis in an otherwise healthy boy.

A previously healthy 13-year-old adolescent boy arrived at the pediatric emergency department with complaints of a frontally localized headache that began 2 weeks before admission. The headache was persistent and temporarily disappeared after treatment with paracetamol and decreased appetite but no cough, nausea, or vomiting. The patient received antibiotic (amoxicillin clavulanate) treatment for an upper respiratory tract infection 2 to 3 weeks before admission. He had a history of acute typical symptoms of sinusitis associated with upper respiratory tract infection, but he did not undergo imaging for sinusitis.

On physical examination, the vital signs were as follows: temperature 38°C, pulse 105 beats per minute, respiration 30 breaths per minute, and blood pressure 130/70 mm Hg. His consciousness and neurologic examination were normal. There was no tenderness over the sinuses. The ears were clear. Nasal mucosal congestion was seen at rhinoscopy. Examination of the throat revealed mild erythema and purulent exudates. The pupils were equal and reactive. There was no papilledema. Nuchal rigidity and meningeal signs were absent, and there was multiple cervical microlymphadenopathy. Physical examination of the heart and lungs revealed no abnormality. The abdominal examination was unremarkable. The laboratory results were as follows: white blood cell $15 \times 10^3/\mu L$, Hb 13.7 g/dL, platelets $315 \times 10^3/\mu L$, glucose 81 mg/dL, blood urea nitrogen 30 mg/dL, creatinine 0.8 mg/dL, aspartate aminotransferase 25 U/L, alanine aminotransferase 30 U/L, Na 135 mEq/L, K 4.0 mEq/L, sedimentation rate 35 mm/h, and C-reactive protein 76 mg/L. Computed tomography (CT) demonstrated mucosal thickening and a consolidated area in the left frontal sinus and in both maxillary sinuses (Fig. 1). Cranial MRI revealed frontal subdural empyema and a local edematous appearance suggestive of cerebritis in the brain parenchyma (Fig. 2). After obtaining samples for blood and throat culture, treatment with ceftriaxone (100 mg/kg per day) and metronidazole (30 mg/kg per day) was initiated. After consultation with the departments of neurosurgery and otolaryngology, the patient was taken to the operating room for craniotomy and drainage of the empyema. At the same time, functional endoscopic sinus surgery and left frontal sinusotomy were performed by surgeons with specialized training in otolaryngology. No organism was identified in either purulent material or the blood and throat cultures. The patient was discharged from the hospital 4 weeks after admission and was neurologically

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Fig. 1 A non–contrast CT scan of the head showing sinusitis of the left frontal and maxillary sinuses.

normal at discharge. No residual symptoms were identified upon follow-up at the outpatient clinic.

Subdural empyema is defined as a collection of pus in the potential space between the dura mater and the arachnoid membrane. Sinusitis appears to be the most common antecedent event for subdural empyema. Subdural empyema is a life-threatening complication of sinusitis and is responsible for less than 10% of the intracranial complications [3]. There was a high incidence of morbidity and mortality in patients with intracranial complications, ranging from 3.7% to 11% in previous studies, whereas that of subdural empyema was 25% to 35% [4,5]. The incidence of subdural empyema has been dramatically reduced in the last 2 decades, probably because of the widespread use of effective antimicrobials [6,7]. However, antibiotic treatment does not absolutely prevent the development of subdural empyema [8]. Empyema associated with sinusitis is much more commonly encountered in adolescent and young adult males. The reason for the striking predominance of this disease among males is unclear. Some investigators have suggested that the normal development of the paranasal sinuses in males results in anatomical differences that predispose them to sinusitis [9]. The frontal sinus is the most common sinus associated with intracranial infection, followed by the ethmoid, sphenoid, and maxillary sinuses. Left frontal sinusitis concomitant with bilaterally maxillary sinusitis was diagnosed in our case. When empyema spreads from a case of frontal sinusitis, it is usually by direct extension from the posterior wall of the sinus. Quraishi et al [10] suggest that intracranial complications more commonly arise in the setting of subacute rather than acute frontal sinusitis. Our case had

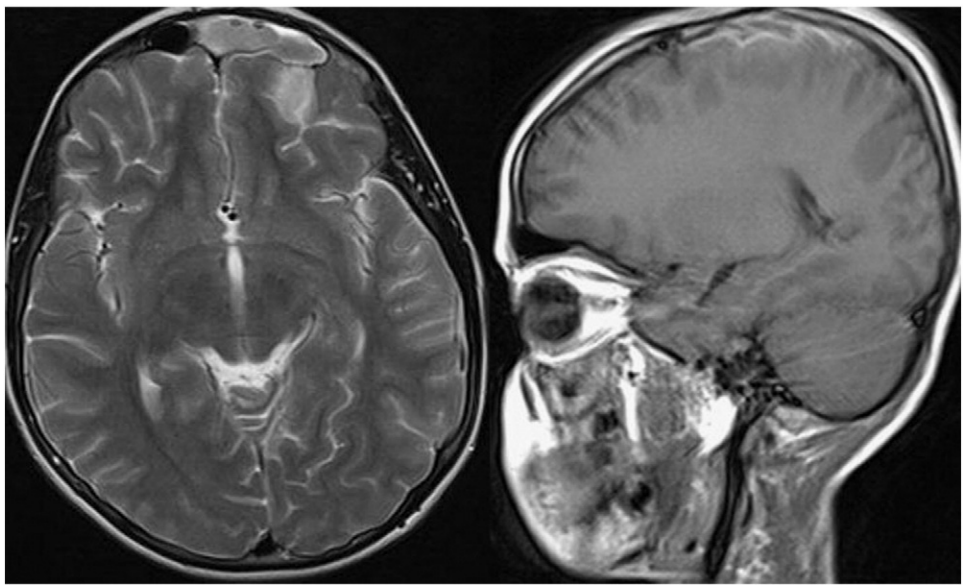

Fig. 2 T2-weighted axial images demonstrating subdural empyema and T1-weighted sagittal views showing cerebritis in the brain parenchyma.

some of acute symptoms and signs of sinusitis such as fever and purulent retronasal discharge on examination. He had laboratory findings of acute inflammation such as leukocytosis or increased C-reactive protein and increased erythrocyte sedimentation rate upon admission. Frontally localized headache was the most prominent symptom in this case. It was sustained, and it could not be attributed to frontal sinusitis in the lack of tenderness over frontal sinus. Brain MRI was indicated in this case.

Subdural empyema was diagnosed in brain MRI. Subdural empyema usually presents as an insidious process. Early symptoms are usually nonspecific. The most common presenting clinical features are purulent rhinorrhea, headache, and fever. Ultimately, the headache may become intractable, and signs of meningitis may be present when the infection reaches the subarachnoid space. The delay in diagnosis is mainly due to the nonspecific initial presenting symptoms and empirical antibiotic treatment [11,12]. The patient experienced a severe complication, despite empirical antibiotic treatment during the acute phase of the sinusitis.

The cultures from frontal sinusitis with complications frequently reveal polymicrobial involvement. Microaerophilic and anaerobic bacteria were the most commonly identified organisms from patients with intracranial abscesses, particularly subdural empyema. Streptococci are the most common organism, and *Bacteroides* and *Staphylococcus aureus* are also causative organisms [2]. Brook [13] demonstrated that anaerobic organisms such as *Prevotella* and *Peptostreptococcus* are more commonly cultured from patients with chronic frontal sinusitis, whereas aerobic organisms such as *Haemophilus influenzae* and *Streptococcus pneumoniae* are usually isolated in cases of acute frontal sinusitis. No organism was grown in either purulent material culture or in the blood culture obtained from our case, which was probably due to the antibiotic treatment that commenced before culture.

Acute or progressive headache is the most important indicator of an intracranial complication [14]. It was also the main symptom in our case. Patients with frontal sinusitis demonstrating a persistent headache and fever warrant radiologic evaluation to look for silent intracranial involvement even in the absence of intracranial signs. Unless diagnosed early, the condition can progress rapidly, leading to neurologic deterioration. We suggest cranial neuroimaging in cases of a persisting headache and fever after upper respiratory tract infection/sinusitis.

Computed tomographic scan and MRI are the diagnostic imaging modality of choice. Cranial MRI allows good determination of the extent of empyema and its association with the cerebral surface. Contrast MRI may provide higher sensitivity [15]. Sinogenic subdural empyema warrants consultation with experts in the field of infectious disease, neurosurgery, and otolaryngology. Treatment of the complications of frontal sinusitis consists of medical and surgical drainage of abscesses as indicated by the clinical situation. Intravenous antibiotic therapy should be initiated. Despite intravenous antibiotic treatment, these infections may progress rapidly and often necessitate surgical drainage. Surgical drainage is probably the single most important factor that determines a favorable outcome [16].

In conclusion, subdural empyema is a rare complication of acute sinusitis, and it is potentially life threatening. A high degree of suspicion is mandatory in patients with a history of prior upper respiratory infection/sinusitis and a persisting headache and fever. Conservative antibiotic treatment may mask the symptoms of subdural empyema. Broad-spectrum antibiotics and emergency surgical drainage of the infected sinus represent the mainstays of treatment. Early recognition and surgical and medical treatment are essential to reduce subsequent morbidity and mortality.

Mustafa Calik MD
Akin Iscan MD
Harran University Faculty of Medicine
Department of Pediatric Neurology
Sanliurfa, Turkey
E-mail address: m.calik80@hotmail.com

Mahmut Abuhandan MD
Ilhan Yetkin MD
Harran University Faculty of Medicine
Department of Pediatrics
Sanliurfa, Turkey

Ferhat Bozkuş MD
Harran University Faculty of Medicine
Department of Otolaryngology
Sanliurfa, Turkey

M. Fuat Torun MD
Harran University
Faculty of Medicine
Department of Neurosurgery
Sanliurfa, Turkey

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