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Intracranial Complications of Paranasal Sinusitis in Children: A Case Report and Review of Literature

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Abstract

Introduction: *Intracranial complications of paranasal sinusitis(ICPS) carry the potential for significant morbidity and mortality. ICPS have become rare due to widespread and early use of antibiotics. ICPS have been reported in 0.5% to 24% of patients hospitalized with sinusitis, with a 3% incidence in pediatric admissions with sinusitis. Potentially life-threatening ICPS include subdural empyema, epidural and intracerebral abscess, meningitis, and sinus thrombosis. Meningitis is the most common intracranial complication of sinusitis. Also paranasal sinusitis can cause orbital cellulitis. In this case report we aimed to present findings of radiological imaging of a patient with paranasal sinusitis causing orbital cellulitis, epidural abscess, menengitis and superior sagittal sinus thrombosis.*

Case: *An 11-year-old female patient admitted to our eye diseases clinic with complaints of swelling and redness in the right eye. Periorbital edema, conjunctival hyperemia and chemosis were observed. Limitation was observed in extraocular muscles in the patient with severe pain and high fever. Paranasal sinusitis and right orbital extraconeal subperiosteal abscess were observed in computerized tomography image of the patient. Orbital magnetic resonance imaging (MRI) and contrast enhanced brain MRI were performed. Pansinusitis, frontal epidural abscess, exophtalmus because of an intraorbital, extraconeal abscess, superior sagittal sinus thrombosis and frontal menengitis were observed in MRI. Diffusion restriction was observed in frontal and orbital abscess in the diffusion-weighted sequences.*

Conclusion: *Orbital complications of sinusitis should further elevate suspicion because they frequently coexist with intracranial complications. Early imaging is critical to establish diagnosis, MRI is most sensitive imaging technique to diagnose complications.*

Keywords: *Sinusitis, Intracranial complications, Orbital cellulitis, Epidural abscess, Sinus thrombosis*

Introduction

Major intracranial complications such as subdural empyema, meningitis, brain abscess and cavernous sinus thrombosis may develop in common sinus infections. The intracranial spread of the infection is mediated through the neighborhood of bone lesions such as thrombophlebitis of the veins, trauma, septic erosion or structural disorders. Early identification of children with complications of sinusitis is crucial since it can cause life-threatening illness by the spread of infection to the orbits and central nervous system. In clinical practice, orbital complications are encountered most frequently (1).

In this case report we aimed to present findings

of radiological imaging of a patient with paranasal sinusitis causing orbital cellulitis, epidural abscess, menengitis and superior sagittal sinus thrombosis with review of literature.

Case

An 11-year-old female patient admitted to our eye diseases clinic with complaints of swelling and redness in the right eye. Periorbital edema, conjunctival hyperemia and chemosis were observed. Limitation was observed in extraocular muscles in the patient with severe pain and high fever. In laboratory examination, white blood cell was 11980 / mm3, hemoglobin was 12.3 gr / dl, platelet count was 310.000 / mm3 and peripheral smear was found in 61.9% neutrophils, 27.5% lymphocytes and 10.5% monocytes. CRP level was observed 110 mg/l.

In non contrast orbit computer tomography; there was soft tissue density consistent with pansinusitis filling all paranasal sinuses. Right bulbus oculi was anterior localized according to interzigomatic line consistent with exophtalmus. Soft tissue thickness was increased in periorbital region. There was a soft tissue density in the superior of right orbita adjacent to the bone structure at a thickness of 11 mm. Also in the medial and inferior parts of the right orbita, a 7 mm thick subperiosteal abscess was observed. Findings were consistent with orbital cellulitis as showed in Figure 1. In the patient whose symptoms didnt decrease, similar findings were found in the contrast-enhanced orbital CT, which was taken 2 days later. Upon this orbital magnetic resonance imaging (MRI), contrast enhanced brain MRI and cerebral venöz MR angiography were performed (Figure 2, 3). In the orbit MR, in the superior medial section of the right orbita, there was a collection which was compatible with the extra-coneal abscess, which was measured as 17 mm in craniocaudal length and there was significant diffusion limitation in the diffusion-weighted sequences with axial diameters of 30*25 mm showing significant peripheral contrast enhancement after contrast agent injection. Exophthalmus was present on the right side for abscess. In the brain MR, difusion weighted MR and serebral venous angiography; In the anterior section of the superior sagittal sinus, there was the presence of thrombus. There was an appearance consistent with epidural abscess in the right frontal lobe and falks cerebri neighborhood and there was extension of the superior sagittal sinus along the 3 centimeter segment from the anterior neighborhood, axial diameters measured as 16*10 mm, making pressure from anterior to the right frontal lobe. In the sequences taken after contrast injection, significant peripheral contrast enhancement and diffusion limitation was observed. There was also an increased contrast enhancement in the bilateral frontal lobes and interhemispheric fissure in the right frontal lobe, anteriorly in the interhemispheric fissure, and in the dura after contrast agent injection. Orbital findings were similar to orbital MRI findings.

As a result, pansinusitis, frontal epidural abscess, exophtalmus because of an intraorbital, extraconeal abscess, superior sagittal sinus thrombosis and frontal menengitis were observed in MRI. Diffusion restriction was observed in frontal and orbital abscess in the diffusion-weighted sequences.

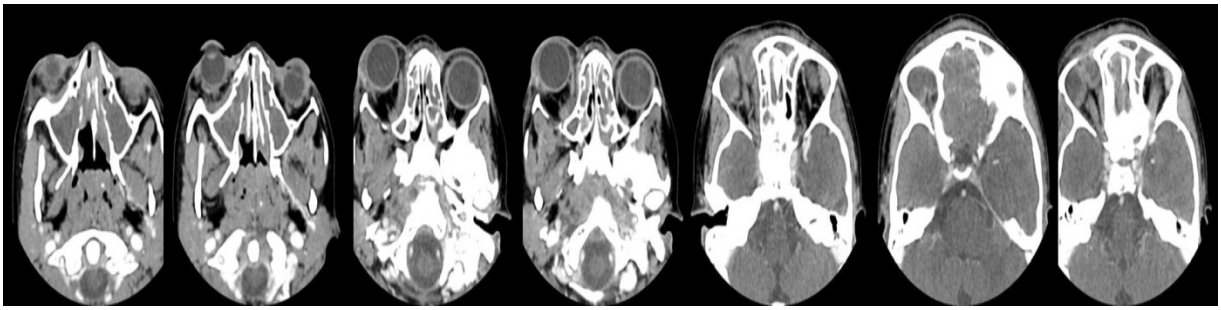

Figure 1. *CT of the patient in axial plans: Right exophtalmus, pansinusitis, in medial and inferior parts of the orbita; subperiostal abscess.*

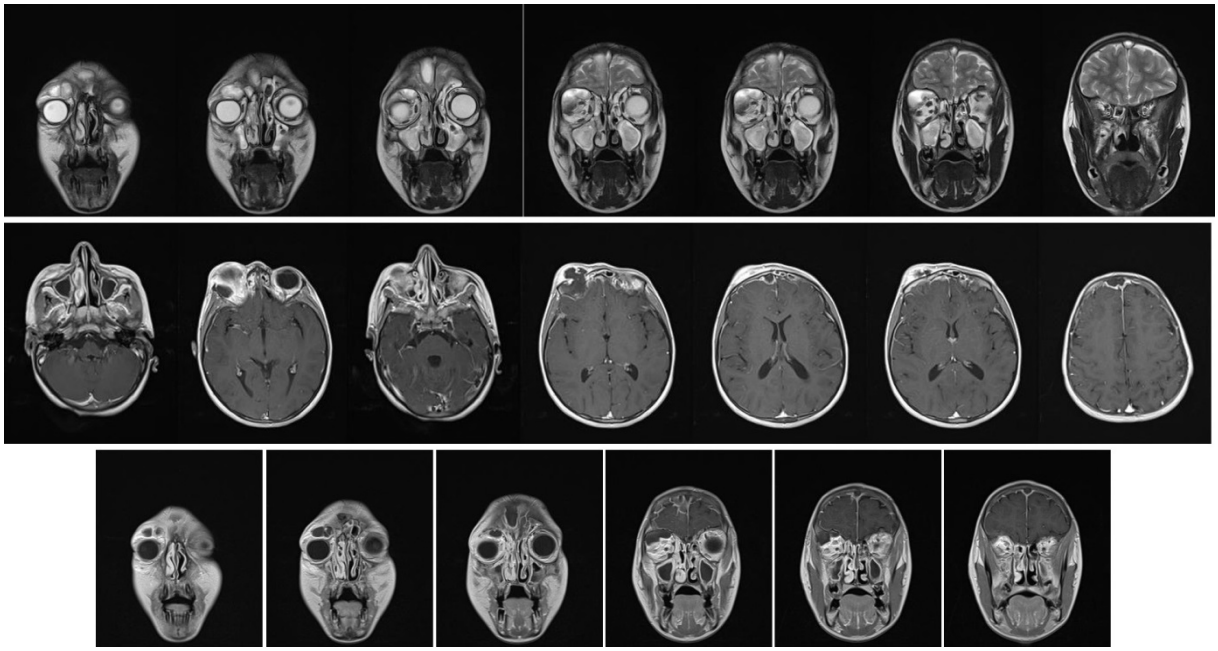

Figure 2. *Cerebral MRI axial and coronal plans show pansinusitis, epidural abscess in the right frontal lobe and after contrast injection there is significant contrast enhancement in orbital and epidural abscess. Meningeal contrast enhancement consistent with meningitis in the frontal lobe. Contrasted coronal sections show a filling defect compatible with thrombus in the superior sagittal sinus.*

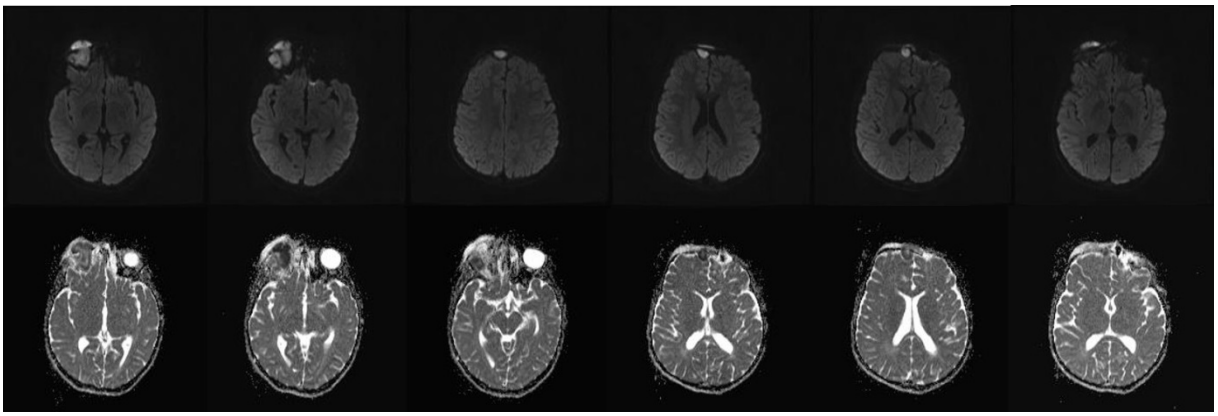

Figure 3. *Diffusion limitation was observed.*

Discussion

Intracranial abscesses include abscess and empyema in the brain parenchyma or in the subdural and epidural space. Infection is caused by haemogenous route, by direct invasion, by adjacent non-neural tissue or by penetration of the pathogen in penetrating wounds and surgeries. Subdural empyema is the collection of pyogenic fluid between the dura and the pia mater, and the cause of 30-65% is sinusitis (2) Although intracranial complications due to sinusitis are rare, early diagnosis and appropriate treatment decreases mortality and sequelae rates. However, subdural empyema related mortality iss reported to be 15-30% in patients who underwent surgical intervention with antibiotic therapy (3). Various etiologies are described in the literature as primary foci of subdural empyema including paranasal sinusitis (4,5). Martines F. et al. presented an unusual case described in literature of a parietal subdural empyema secondary to acute odontogenic sinusitis, resulting from a tooth extraction (6). Mathew T. et al. presented a case of patient suffered from both a subdural empyema and a brain abscess extending from frontal sinusitis (7). Hong P. et al. also reported a patient exhibited contiguous spread of infection from the frontal and ethmoid sinuses, which

led to the formation of an intracranial epidural abscess (8). Infectious spread from the frontal sinus to the fossa cranii anterior results in subdural and epidural empyema. This leads to a fluid collection between the skull and the brain parenchyma. The fluid collections typically show an enhancing rimand also there can be mass effect on the adjacent brain and reactive edema (9).

In the retrospective study of K. Khamasi et al. of the 23 patients with intracranial complications; in all cases, they determined total or partial fronto-ethmoidal filling and assoiclated with filling of the sphenoid sinüs in 4 cases. They have noted osteitis of the frontal sinüs in 13 cases and subperiostal abscess or "Pott's puffy tumour" in 8 cases. Also in 2 case orbital complications with pre or retroseptal cellulitis, Subperiostal abscess (2 cases) ad orbital abscess (2 cases) were determined. Of the 23 intracranial complications; subdural empyema in 11 cases, extradural empyema in 7 cases and brain abscess in 5 cases were determined. In addition they have noted cerebral thromboflebitis in 4 cases (10). İn a retrospective study made in Thailand conducted by Chaiyasate S. Et al; they have determined orbital complications in 16 cases including 5 cases of periorbital cellulitis, 5 cases of orbital cellulitis, and 6 cases of subperiosteal abscess, and intracranial complications including 5 cases of meningitis, 2 cases of meningitis with frontal abscess, 1 case of temporal abscess, 1 case of midbrain abscess and CN VII palsy, and 4 cases of meningitis with other complications (Hydrocephalus, DIC, sepsis, prevertebral abscess, and transverse and sigmoid sinus thrombosis) (11).

Cerebral sinovenous thrombosis in children is a rare condition, but it is more and more common because of clinical awareness, sensitive neuroimaging techniques and survival of children with predisposing lethal diseases (12-14). Etiological causes are infections in about 8% of cases (15). Cranial MRI is more sensitive than CT in the diagnosis of venouse sinüs thrombosis. While catheter angiography was the ideal method in diagnosis, cranial MRI and MR venography are the most basic diagnostic methods (16). In axial, coronal, sagittal planes, T2, T1, FLAIR examinations, we can see whether there is variation in the sinuses or thrombosis without contrast.In our country, the standard 5 mm thick sections made in almost all centers are often sufficient to collect information about the sinuses. MR venography is mostly used to confirm the diagnosis of thrombosis. However, evaluating only by venography can be confusing.If other sequences are not considered, it is very easy to mix atresia / agenesis with thrombosis only if venography is decided. One of the common mistakes is that the arachnoid granulation tissue is thought to be thrombosis (17). In the study of Kamıslı et al. In 16% of patients, they found infections as the etiologic factor and they found superior sagittal sinus with a rate of 28% as the localization of sinus thrombosis (18).

Many studies in the literature reported orbital cellulitis as the most common complication of sinusitis (19, 20). Al-Madini et al. also reported 616 cases of acute sinusitis, of which 36 presented with orbital complications (21). In a retrospective study of Welkoborsky et al. analyzed 49 children with sinusitis. They found 18 orbital complications including 10 preseptal and 8 orbital cellulitis (22).

Diagnosis of meningitis by CT is difficult and should be evaluated with MRI in case of doubt. MRI may be normal in the early stages of the disease. On contrast enhanced images, abnormal meningeal enhancement may be seen of both pachymeninges and leptomeninges. On FLAIR images a high signal extendinginto the sulci may be seen as a result of the thickened,oedematous meninges and arachnoid (23-26).

Complications of acute sinusitis can lead to life-threatening conditions. Knowing the relationship between the paranasal sinuses with the orbital and intracranium and knowing the spread mechanism of infections is very important for the early diagnosis of these complications. In addition, the radiologist should be aware of the specific imaging findings of orbital and intracranial complications of sinusitis, including cerebral sinus thrombosis.

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