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Ophthalmoplegia and Blindness after Septic Cavernous Sinus Thrombosis as Complications of Nasal Furuncle

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ABSTRACT

Cavernous sinus thrombosis (CST) is a rare condition that leads to an increased chance of the delay in diagnosis and treatment. CST results in high mortality and morbidity rates if not treated immediately. A 3-year-old boy with a history of nasal furuncle presented blindness in the right eye and neurological deficits including ophthalmoplegia in both eyes and paraparesis. CST was diagnosed by a history of typical clinical symptoms in the early infection. CT scan examination revealed indirect signs of CST. In the early phase of infection, he received oral medication but inadequate to manage the infection.The cavernous sinus is a vital structure as a pathway for the internal carotid artery and cranial nerves III, IV, V, VI. The most common signs of CST are damage to the nerves that traverse the cavernous sinuses including ptosis, ophthalmoplegia, diplopia, and paresthesia. CST should be diagnosed and treated with aggressive treatment at the early stage of infection. CST is diagnosed by typical clinical manifestations and imaging technologies by direct and indirect signs of CST.Treatment guidelines are challenging to develop because CST is rare.The nasal furuncle may progress toward CST resulting in fatal complications. Early diagnosis and adequate empiric treatment are needed to avoid various complications.

Keywords
Ophthalmoplegia, Cavernous sinus thrombosis, Nasal furuncle.

Introduction

Septic cavernous sinus thrombosis is a rare case[1]. It is a much rarer disease in the post-antibiotics era but it can have a severe and lasting impact. Septic CST is caused by thrombophlebitis in the cavernous sinus as a complication of midfacial infection[2]. In the pre-antibiotic era, it was associated with a high morbidity and mortality rate [3]. In one study, CST incidence was estimated 15% of all cases had cerebral venous thrombosis [4]. The incidence of cerebral venous thrombosis is estimated at 13 cases per 1,000,000 people per year [1]. The danger triangle of the face consists of the area from the corners of the mouth to the bridge of the nose. The facial veins are valveless. It communicates directly with the cavernous sinus through the pterygoid plexus, angular, and ophthalmic veins. Infection of this area can spread intracranially and cause septic cavernous sinus thrombosis [5].

Case Presentation

A 3-year-old boy came to the eye clinic in the tertiary hospital presented drooping of the right upper eyelid and squint in the left eye. His mother also complained about weakness in his lower extremity. He was not on any medications. On initial examination in the tertiary hospital, he was conscious and alert. His vital signs were within normal limits. Visual acuity was no light perception in the right and 20/20 in the left eye. The patient had an abnormal head posture with the face turned to the left. Ophthalmology examination revealed total ophthalmoplegia with

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dilated pupil and absence of light reflex in the right eye. Limited ocular movement in the left eye (limited in abduction, depression, and intortion) was manifesting as squint consistent with multiple cranial nerve palsies, except partial oculomotor nerve (cranial nerve III). He had a sensory loss of the periorbital area on the left side and loss of corneal blink reflex. Other investigations of the anterior segment in both eyes were not remarkable. On fundus examination, the optical disc was pale with clear-cut margins revealed in the right eye. Fundus examination of the left eye was within normal limits. Laboratory tests revealed anemia, thrombocytosis, and leukocytosis. Pediatrician consultation was done to rule out another possible cause of ophthalmoplegia. Further screening tests including the mantoux test and the TORCH test were negative. Another cause of ophthalmoplegia was not found. Another neurological deficit was lower extremity weakness graded 3/5. The pediatrician did not give any therapy for ophthalmoplegia and paraparesis.

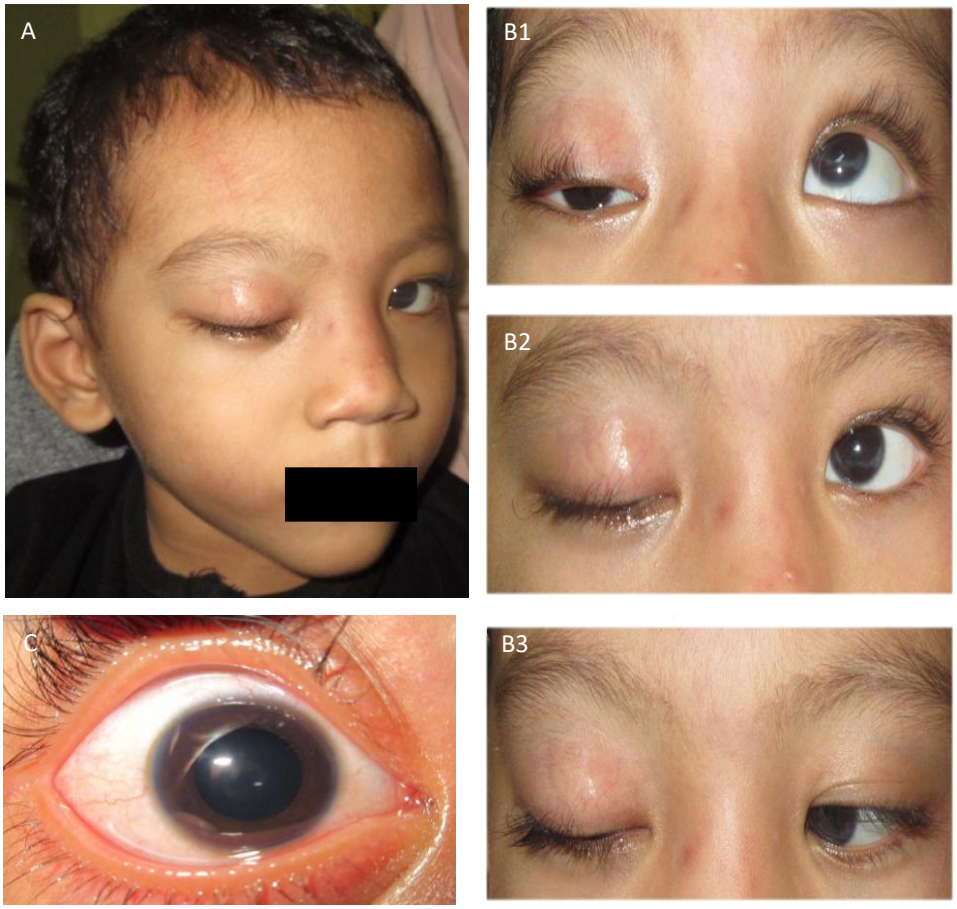

Figure 1. (A) Abnormal head posture: face turned to the left. (B1) Up gaze position, (B2) Primary Position, (B3) Down gaze position showed total ophthalmoplegia in the right eye and limited extraocular movement in the left eye. (C) Total ophthalmoplegia involving the pupil with absence of light reflex in the right eye.

One month prior to the tertiary hospital, a furuncle had developed over the tip of his nose and had extended to involve the surrounding area. The furuncle was accompanied by fever for 3 days without treatment. There was absence cold, flu, cough, or any symptoms related to

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respiratory disease. Then, he was hospitalized in a primary hospital due to high fever, severe headache, and severe infection involved both eyes. It was noted that both eyes were swollen with proptosis, lagophthalmos, chemosis, and periorbital erythema(Fig.2). He was prescribed oral medication including cefixime trihydrate syrup, B complex syrup, acetaminophen syrup, and gentamicin sulfate 0.1% ointment. Five days later after oral medications consumption, the furuncle burst with active purulent discharge draining from the furuncle. Swollen of the eye reduced, but he became increasingly unwell with shortness of breath. He was drowsy and disoriented with a fluctuating state of consciousness.

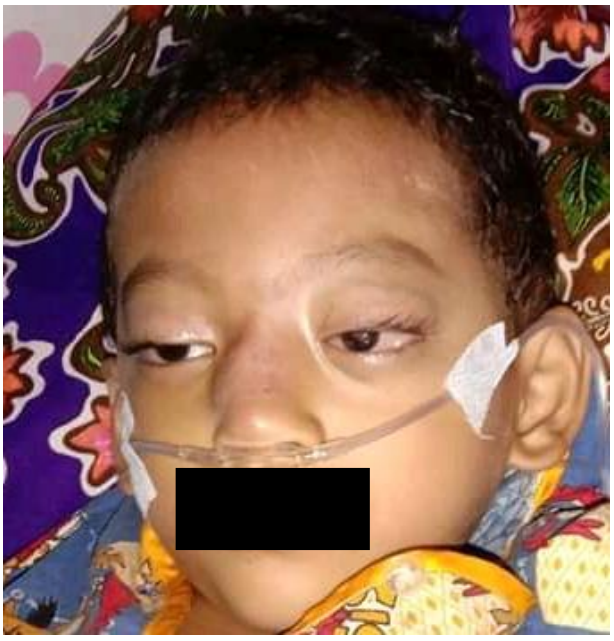

Figure 2. Both eyes were swollen with proptosis, lagophthalmos, chemosis, and periorbital erythema.

He was transferred to the secondary hospital and admitted to the NICU. Non-contrast Computed Tomography (CT) scan of the head showed soft tissue inflammation in both eyes suggestive of orbital abscess and dilatation of Superior Ophthalmic Vein (SOV). This CT also revealed the superior sagittal sinus, straight sinus, and left transverse sinus thrombosis, consistent with bilateral cavernous sinus thrombosis (Fig.3).

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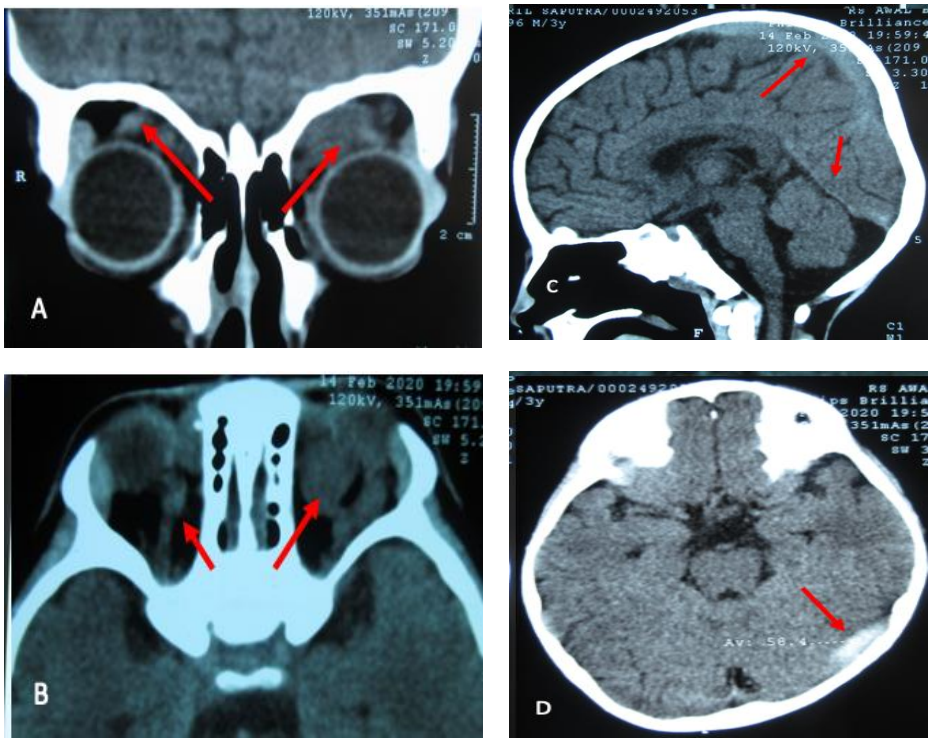

Figure 3.(A,B) Dilatation of the SOV with orbital edema.(C) Superior sagittal sinus and straight sinus thrombosis.(D)Thrombosis of left transverse sinus.

Chest radiography revealed visible an abnormal collection of air in the pleural space between the lung and the chest wall in both lungs suggesting bilateral pneumothorax (Fig.4). After the immediate placement of a chest tube into the left pleural space and administration intravenous antibiotic of which no record was available, his condition gradually improved. All abnormalities resolved except his eyes and paraparesis, which were unchanged. His eyes presented drooping from the right eyelid and squint in the left eye.

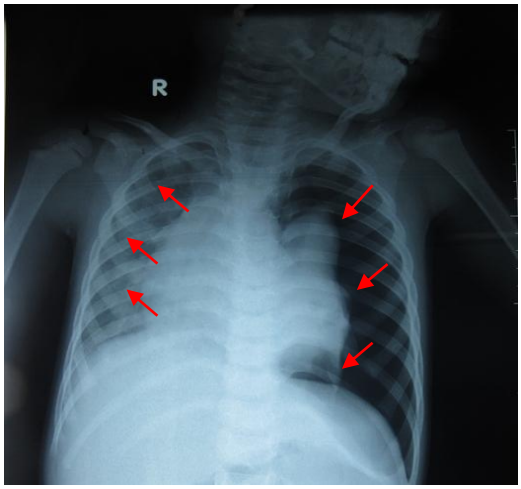

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Figure 4. Chest radiography of the patient showed bilateral pneumothorax with air in bilateral pleural spaces (arrow).

The diagnosis of septic cavernous sinus thrombosis due to the retrograde spread of infection from nasal furuncle was made with ophthalmoplegia and blindness as the complications.

Discussion

Septic cavernous sinus thrombosis (CST) was first described by Duncan in 1821. It is a rare infective disease. It has up to 80% mortality and 75% residual morbidity in the pre-antibiotic era. Mortality (13.6%) and morbidity (23%) of CST have remained high in the modern era due to delay in diagnosis [6].

The cavernous sinus is a vital structure as a pathway for the internal carotid artery and cranial nerves III, IV, V, VI [7]. The most common signs of CST are related to damage of the nerves that traverse the cavernous sinuses including the parasympathetic and sympathetic nerves accompanying the oculomotor nerve and the internal carotid artery [8]. Thus, any infection or thrombosis in this area could be followed by a group of clinical manifestations including ptosis, ophthalmoplegia, diplopia, and paresthesia around the orbital cavity due to involvement of the eye motor nerves and impairment in the ophthalmic and maxillary branches of the trigeminal nerve (cranial nerve V) [7]. CST in our patient manifested as blindness, ophthalmoplegia, dilated pupil, and sensory loss of the periorbital area on the left side. These clinical manifestations in our patient support the diagnosis of CST.

Patients with septic thrombosis of the cerebral venous system are almost always acute. The patients usually very sick, toxic, febrile, and have features of facial infection [4]. Acute progression in our patient occurred in 8 days from arising the nasal furuncle until becoming increasingly unwell with a fluctuating state of consciousness.

A nasal furuncle is believed to be the most common cause of CST (50%), followed by sphenoidal or ethmoidal sinuses (30%), and dental infections (10%). The complex anastomosis of the cavernous sinus communicates between the facial veins and the cavernous sinus, which is located very close to it [7]. The location of cavernous sinus is vulnerable to septic thrombosis resulting from infection at multiple sites. Intercavernous sinus connections could be a logical reason for the appearance of orbital symptoms on both sides, or the opposite side[8]. The patients usually have the triad of orbital manifestations including chemosis, proptosis (due to orbital venous congestion), and ophthalmoplegia [4]. The triad also showed in our patient at the early stage of infection, but was not recognized as signs of CST.

Ophthalmology examination in the right eye revealed total ophthalmoplegia and ptosis. The symptoms were caused by the abnormality of cranial nerves III, IV, and VI at the right cavernous sinus. Surprisingly, the trigeminal nerve was not affected in the right eye. In the left eye, he had partial external ophthalmoplegia which was thought due to the abnormality of cranial nerves IV, VI, and partial cranial nerve III (partial third nerve palsy). Numbness or paresthesia

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around the left eye and loss of corneal blink reflex were caused by the abnormality of the trigeminal nerve (cranial nerve V).

The pupil can be dilated (due to parasympathetic involvement). It can be smaller and immobile (due to both parasympathetic and sympathetic dysfunctions)[4]. In our patient, pupillary involvement in the right eye can be explained by the damage of the parasympathetic fibers.

Papilledema is seen in some patients of CST [1]. Decreased visual acuity in CST is reported in less than 50% of the cases[4]. Blindness reported in 8% to 15% of cases[9]. The etiology of primary optic atrophy in cavernous sinus thrombosis is not known[10]. Optic atrophy in our patient was probably secondary due to compression of the optic nerve or atypical retrobulbar optic neuritis which was unresolved. It causes the blindness sequence in this patient.

CST is diagnosed by typical clinical manifestations and imaging technologies such as Computed Tomography (CT), Magnetic Resonance Imaging (MRI), or cerebral angiography [9]. Direct radiographic signs include expansion of the cavernous sinus, the convexity of the normal concave lateral wall, abnormal irregular filling defects, and asymmetry of the cavernous sinus. Indirect signs relate to venous obstruction, dilatation of the SOV, exophthalmos, soft-tissue edema, and thrombi visualized in the veins and sinuses tributary to the cavernous sinus [9]. MRI is much sensitive to detect CST than CT [6]. Cerebral angiography can be used for the definitive assessment of conditions detected on CT scan or MRI [9]. We can diagnose CST in our patient by indirect signs including dilated SOV, orbital edema, and thrombosis in the superior sagittal sinus, straight sinus, and left transverse sinus. In our patient, MRI examination was not performed due to undiagnosed CST at the early stage of infection. Pulmonary manifestation, spontaneous pneumothorax is not a common manifestation of CST. The main etiology of spontaneous pneumothorax is not known.

Treatment guidelines are challenging to develop because CST is rare. Intravenous antibiotic therapy has significantly improved the prognosis of CST. Commonly implicated pathogens include *Staphylococcus aureus*, other gram-positive organisms, and anaerobes. While awaiting culture results, empiric antibiotic regimens should be initiated based on the common pathogens. The regiments consist of a third-generation cephalosporin as broad-spectrum antimicrobial agents, nafcillin to treat infections caused by gram-positive bacteria, and metronidazole for coverage the anaerobes. Vancomycin can be substituted for nafcillin, if the risk of methicillin resistance is high. Antibiotics should be used for an extended period beyond clinical resolution to treat the possibility of sequestration within the thrombus[11]. Intravenous antibiotics are continued until the patient shows significant improvement. It should be continued up to 3–4 weeks [12].

Anticoagulation therapy for CST is generally recommended. Although prospective clinical trials have not been performed, retrospective reviews have demonstrated reduced morbidity and mortality with the use of anticoagulation therapy and corticosteroid in CST[13]. However, inadequate initial treatment and late diagnosis of CST in our patient impact complications including blindness and ophthalmoplegia. Another case of CST caused by the nasal furuncle was reported by Budiman et al. from Indonesia in 2017. CST was diagnosed by typical clinical symptoms and indirect signs of CT Scan. CST was diagnosed and treated with

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aggressive treatment at the early stage of infection. In the end, this patient had only cranial nerve VI palsy in the left eye without visual acuity impairment as sequences[14] (Fig.5).

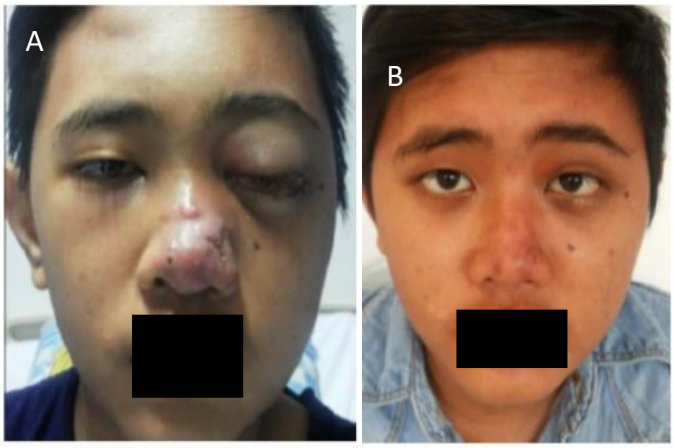

Figure 5. (A) Another case of CST due to nasal furuncle was reported from Indonesia in 2017: a 13-year-old boy presented the nasal furuncle and the triad of orbital manifestations: chemosis, proptosis, ophthalmoplegia in the left eye. (B) After giving adequate antibiotics for 3 weeks, the result is good, but there is paralytic esotropia in the left eye as a sequel without visual impairment.
Source : B. J. Budiman, D. Irfandy, E. Huriyati, and D. Y. Lestari, "Cavernosal Sinus Thrombosis Due to Complications of Nasal Furculosis," Andalas Health Journal, 2017.

The difference outcome occurred between two cases affected by timing diagnosis and treatment. Diagnosis in the early stage of CST can avoid various complications. Early diagnosis and treatment of CST has reduced the mortality rate to less than 20%. However, significant morbidity and long-term complications such as loss of function, hemiparesis, and blindness may still occur[11]. Typically, death is due to sepsis or central nervous system (CNS) infection. Morbidity remains high, and complete recovery is rare. Roughly, one-sixth of patients are left with some degree of visual impairment, and one half have cranial nerve deficits[8],[9]. Based on consultation with the pediatrician, another cause of ophthalmoplegia was not found, but it was found paraparesis graded 3/5. The abnormalities were not given any therapy and only observed by the pediatrician. Meanwhile, the central nervous system (CNS) involvement as experienced by the patient is less frequent in CST. Paraparesis, as seen in our case, may also occur as a result of venous obstruction leading to the sudden development of edema inside the closed compartment of the cranial cavity, the mass effect behaving like an intracranial space-occupying lesion or local effects caused by the venous obstruction, consequent ischemia, infarction or hemorrhage [15].

This case report had several limitations. First, we had limited access to prior medical treatment and laboratory examinations in the secondary hospital. Second, we cannot perform any additional diagnostic examinations such as MRI, cerebral angiography, and blood culture due to the patient came with sequel condition with resolve infection.

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Conclusion

We present rarity and fatality complications of CST. Through this case, we demonstrate the potential for the primary nasal furuncle to progress becoming CST and resulting in ophthalmoplegia and blindness. Furthermore, we demonstrate the importance of considering the possible occurrence of CST in the nasal furuncle. Early diagnosis and adequate treatment are needed to avoid various complications.

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