CASE REPORT

Septic Cavernous Sinus Thrombosis Complicated by Narrowing of the Internal Carotid Artery, Subarachnoid Abscess and Multiple Pulmonary Septic Emboli

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Abstract

A 56-year-old woman was admitted because of a high fever, right ptosis, chemosis, proptosis and ocular muscle palsy. Cranial MRI revealed a cavernous sinus thrombosis and a subarachnoid abscess. Carotid angiogram demonstrated marked stenosis as well as aneurismatic formation of the right internal carotid artery at the intracavernous portion. Chest radiograph showed bilateral multiple pulmonary nodules, some of which contained a cavity. Blood culture was positive for Streptococcus constellatus. She was diagnosed with septic cavernous sinus thrombosis complicated by narrowing of the internal carotid artery, subarachnoid abscess and multiple pulmonary septic emboli. She recovered with partial ocular sequelae as a result of seven weeks of intravenous antimicrobial therapy.

Key words: septic cavernous sinus thrombosis, narrowing of the carotid artery, external ophthalmoplegia, subarachnoid abscess, pulmonary septic emboli, magnetic resonance imaging

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Introduction

Septic cavernous sinus thrombosis (CST) is thrombophlebitis in the cavernous sinus. It is a rare complication of facial infection (1, 2), paranasal sinusitis (3-5), otitis media (2) and, less often, pharyngitis (6) and dental infection (3, 7). Septic CST is apt to be underdiagnosed as a local eye infection despite the fact that it is potentially lethal with various complications including meningitis (8), subdural abscess (5, 9), stroke (9) and pituitary insufficiency (5), because the basic clinical concept of this disorder is not widely recognized among clinicians.

We encountered a case with septic cavernous sinus thrombosis complicated by subarachnoid abscess and multiple pulmonary septic emboli. Although it was difficult for us to make an early diagnosis due to the lack of knowledge of septic CST, the patient fortunately recovered with partial ocular sequelae as a result of long-term antimicrobial therapy. Here, we report the important considerations in the management of septic CST as well as the clinical features of this case. We hope this report can provide the necessary knowledge of septic CST for clinicians and subsequently lead to appropriate management of this disorder.

Case Report

A 56-year-old woman without contributory medical history was admitted to our hospital with the complaints of a high fever, right-sided headache, and swelling of the right eye. Seven days before admission, she developed a fever of above 38°C and sore throat. She took commercial cold remedies that relieved pharyngeal pain but the high fever persisted. Two days later, painful eye swelling developed in the right side and she visited our hospital. On physical examination, the temperature was 40.5°C, the pulse was 90 beats/min and the blood pressure was 112/56 mmHg. She was alert and oriented. The neurologic examination, including nuchal rigidity, showed normal findings. Her right eyelid presented with marked swelling, redness and ptosis accompanied by hemorrhagic conjunctival hyperemia and exophthalmos. When her eye was passively opened, the eye...
ball turned out to be fixed in midposition and completely immovable (Fig. 1). On ophthalmologic examinations, the direct pupillary light reflex, visual acuity, intraocular pressure and ophthalmoscopic findings were normal. The rest of the physical examination including the skin, chest and lymph nodes, was unremarkable.

Laboratory examinations revealed leukocytosis of 21,000/μl with a leftward shift (92.5% neutrophil), elevated C-reactive protein of 28 mg/dl and coagulation abnormalities including elevated D-dimer of 28.5 μg/ml and fibrin degradation products of 29.2 μg/ml, while platelet count, fibrinogen level and prothrombin time were within normal limits. Orbital plain computed tomography (CT) showed chemosis, extraocular muscular thickening and ocular proptosis in the right side, while paranasal sinusitis was absent and abnormalities in the cavernous sinus were not obvious (Fig. 2). Chest CT demonstrated bilateral multiple pulmonary nodules, some of which contained a cavity (Fig. 3). With the diagnosis of orbital cellulitis, intravenous administration of sulbactam/ampicillin 9 g/day was begun after blood cultures were performed. Given the ocular inflammation and coexisting pulmonary nodules, vasculitis syndrome such as Wegener’s granulomatosis or pulmonary mycosis were considered in the differential diagnosis, but anti-neutrophil cytoplasmic antibodies including both myeloperoxidase and proteinase 3, β-D glucan, Aspergillus antigen and cryptococcal antigen were negative in serologic tests. Blood culture was positive for Streptococcus constellatus that is a normal constituent of oropharyngeal flora. Transthoracic echocardiography showed no valvular involvement. Sensitivity test showed that the Streptococcus constellatus detected by blood culture was not a penicillinase-producing strain but the administration of sulbactam/ampicillin was continued without switching to penicillin G or ampicillin because we considered that the

Figure 1. When her eye was passively opened, the eye ball turned out to be fixed in midposition and completely immovable.

Figure 2. Orbital plain CT showed chemosis, extraocular muscular thickening and ocular proptosis in the right side, while paranasal sinusitis was absent and abnormalities in the cavernous sinus were not obvious.

Figure 3. Chest CT demonstrated bilateral multiple pulmonary nodules, some of which contained a cavity.
Figure 4. Cranial plain CT on the 10th hospital day showed that the right ophthalmic vein was markedly dilated (arrow), which was suggestive of venous congestion.

Figure 5A. T1-weighted MRI with gadolinium enhancement revealed that the enlarged right cavernous sinus was occupied with a low signal intensity area suggestive of a thrombus (arrow). Meanwhile, the opposite site of the cavernous sinus was normally contrast-enhanced except for the internal carotid artery visualized as a black spot due to the flow void effect.

Figure 5B. The same MRI showed enhanced subarachnoid space between the middle cranial fossa and Sylvian fissure, which indicated a subarachnoid abscess.

Figure 5C. MR angiography demonstrated narrowing of the right internal carotid artery at the intracavernous portion (arrow).

Contribution of multiple bacteria could not be ruled out. She became afebrile and C-reactive protein returned to normal by the 10th hospital day. Chemosis, conjunctival hyperemia and exophthalmos disappeared by the 20th day, but ptosis, external ophthalmoplegia and right-sided headache associated with trigeminal neuralgia persisted. Septic CST was first suspected when cranial plain CT on the 10th hospital day showed that the right ophthalmic vein was markedly dilated, which was suggestive of venous congestion (Fig. 4) and the diagnosis was established by cranial magnetic resonance imaging (MRI) with gadolinium enhancement on the 14th day, which revealed that the enlarged right cavernous sinus was occupied with a low signal intensity area suggestive of a thrombus on the T1-weighted image (Fig. 5A). Furthermore, it showed the enhanced subarachnoid space between the middle cranial fossa and Sylvian fissure, which indicated a subarachnoid abscess (Fig. 5B). MR angiography (MRA) demonstrated narrowing of the right internal carotid artery at the intracavernous portion (Fig. 5C). Multiple pulmonary nodules were considered to be septic emboli because follow-up chest radiograph showed that these lesions almost disappeared during the antimicrobial therapy (Fig. 6). Cranial MRI with gadolinium enhancement after the seven-week antimicrobial therapy showed that the enhanced subarachnoid space visualized on the previous MRI had almost disappeared (Fig. 7A), while the low signal intensity area in the cavernous sinus remained unchanged (Fig. 7B). Despite
Figure 6. (left): Chest radiograph on admission showed multiple nodules in both of the lung fields (arrows). (right): Follow up radiograph showed that these pulmonary lesions almost disappeared during the long-term antimicrobial therapy.

Figure 7A. Cranial MRI with gadolinium enhancement after the seven-week antimicrobial therapy showed that the enhanced subarachnoid space visualized on the previous MRI almost disappeared.

Figure 7B. The same MRI showed that the low signal intensity area in the cavernous sinus remained unchanged (arrow).

oral administration of 200 mg/day of cilostazol from the 15th day, right carotid angiography on the 50th day demonstrated aneurismal formation as well as marked stenosis of the right internal carotid artery, which resulted in decreased peripheral blood flow (Fig. 8A). Left carotid angiography demonstrated that right cerebral blood flow was supplied from the left carotid artery via the anterior communicating artery (Fig. 8B), which suggested that the possibility of immediate cerebrovascular events would be low without further intervention. At the time of discharge from the hospital on the 58th day after seven weeks of intravenous administration of sulbactam/ampicillin with no other antimicrobial agents, the ptosis and trigeminal neuralgia improved but the decreased extraocular movements remained unchanged. Except for the lateral gaze palsy, the ocular movements subsequently improved six months later from discharge of our hospital.

Discussion

The cavernous sinus is an intracranial venous sinus positioned just lateral to the base of the sella turcica. Septic CST is thrombophlebitis resulting from a local infection such as facial infection (1, 2), paranasal sinusitis (3-5), otitis media (2) and, less often, pharyngitis (6) and dental infection (3, 7). The venous flow around the orbit runs to the cavernous sinus via the inferior and superior ophthalmic veins. Septic CST is considered to result from hematogenous extension of infection to the cavernous sinus via such a venous system, except in the case of sphenoid sinusitis that can directly spread to the cavernous sinus. This venous system has a predisposition to impaired venous drainage be-
cause it is valveless and the direction of venous flow depends on the venous pressure gradient. Exophthalmos and chemosis in this case were thought to result from congestion of the ophthalmic veins. In addition, the cavernous sinus has a fine, irregularly shaped structure that acts as a sieve to trap bacteria, and this condition explains the risk of thrombophlebitis of the cavernous sinus. The present case had no evidence of facial infection, paranasal sinusitis, otitis media, odontogenic infection but did have a history of upper respiratory tract infection, which may have hematogenously spread to the cavernous sinus from the pterygoid plexus via the ophthalmic veins. The oculomotor nerve, the trochlear nerve, the ophthalmic and maxillary branches of the trigeminal nerve, the abducens nerve and the internal carotid artery are susceptible to inflammatory damage because they transcend the cavernous sinus. External ophthalmoplegia, trigeminal neuralgia, and the narrowing of the internal carotid artery in this case reflect these anatomical features.

The reported abnormal findings of the internal carotid artery in septic CST include stenosis (10), occlusion (11) and aneurysmal formation (4, 12-14) at the intracavernous portion. Septic pulmonary emboli in the present case were considered to result from hematogenous dissemination via the right side of the heart. After a literature search of the PubMed database, this appears to be the first English language report of the case of septic CST accompanied by septic pulmonary emboli.

Septic CST can be difficult to differentiate from orbital cellulitis because both diseases have common symptoms including periorbital edema, proptosis, chemosis and external ophthalmoplegia. However, clinical manifestations such as visual loss, papilledema, trigeminal neuralgia increase the probability of septic CST. Bilateral eye involvement can occur in case of septic CST because bilateral cavernous sinuses are connected by intercavernous sinuses. Cerebrospinal fluid (CSF) examination is useful diagnostic measure, since most cases with septic CST have abnormal CSF findings compatible with acute meningitis or parameningeal reaction (8). Regrettably, CSF examination was not performed in this case because meningeal irritation sign was not noted. However, if it had been performed, the result should have indicated CSF pleocytosis, which would have led to an early diagnosis. Through our experience, we would like to stress that CSF examination is needed in patients presenting with the symptoms of orbital cellulitis to differentiate local eye infection from spread of infection to the central nervous system.

The diagnosis was confirmed by imaging studies. In the present case, plain CT was useful because it provided the following information: The common primary sites of infection such as paranasal sinusitis were ruled out; the secondary changes associated with septic CST such as ocular proptosis, swelling of the orbital tissues and enlarged ophthalmic vein were clearly visualized; hemorrhagic central nervous system involvement associated with the extension of thrombophlebitis was ruled out. However, recognition of a thrombus on plain CT is generally difficult without contrast agents, by which it can be detected as an irregular filling defect within a widened enhancing cavernous sinus (15). MRI has recently received attention as a new imaging technique (16, 17). On MRI with gadolinium enhancement, the normal cavernous sinus is contrast enhanced, while the internal carotid artery tracking through the cavernous sinus is visualized as a black spot due to the flow-void effect (Fig. 5A). In the acute phase of septic CST, a thrombus is visualized as a low signal intensity area in a widened enhancing cavernous sinus (16). In the present case, these contrast imaging studies were delayed because vasculitis syndrome, which might be involved in both ocular and pulmonary lesions, rather than dissemination of septic thrombophlebitis was initially considered in the differential diagnosis. Moreover, it took time for us to persuade the patient to undergo these contrast studies because she was worried about the risks of morbidity. As previously described,
contrast-enhanced CT is also a useful examination to diagnose septic CST (18). However, contrast-enhanced MRI was considered preferable for the following reasons. First, MR contrast agents, chelates of gadolinium, have very few side effects and are safer to use than iodinated contrast agents in unstable patients as this case (19). Second, this study is helpful in visualizing lesions near the sella turcica surrounded by bone without artifacts. Third, it readily allows rounded by bone without artifacts. And, in the present case, contrast-enhanced MRI contributed a great deal to making the definitive diagnosis because it clearly revealed the abnormalities of the cavernous sinus and the subarachnoid space that were difficult for plain CT to detect. Accordingly, it is suggested that MRI with gadolinium enhancement should be performed early in cases in which septic CST is suspected.

The predominant pathogens in septic CST is similar to that found in the primary sites of infection. Gram-positive cocci including Staphylococcus aureus and streptococcal species are the most common causes (8) but only one case associated with Streptococcus constellatus infection other than this case has been described in the literature to date (20).

Empiric therapy is early institution of a beta-lactamase resistant penicillin or cephalosporin that have antimicrobial effects on these organisms. There is no therapeutic criterion for the duration of antimicrobial therapy. In this case, the long-term antimicrobial treatment of seven weeks was necessary because radiographic improvement of the subarachnoid abscess was considered to be an index of discontinuance of antimicrobial therapy.

Retrospective analysis suggests that anticoagulation may reduce mortality in selected cases (8, 21). In this case, considering her hemorrhagic conjunctival hyperemia, the use of anticoagulants was discouraged. Corticosteroids may alleviate the inflammatory damage under appropriate antibiotic coverage (1), whereas the use of corticosteroids in this patient was avoided due to concern about worsening of the subarachnoid abscess. The overall mortality rate associated with septic CST is 30 percent (8, 22). An additional 30 percent of patients have long-term sequelae including external ophthalmoplegia (8), blindness (5, 23), pituitary insufficiency (5). Especially, in cases of septic CST secondary to sphenoid sinusitis, the clinical course can be serious because this infection is initially less recognizable unlike other primary sites of infection, which result in uncontrolled infection at the time of presentation (8, 24). Thus, depending on the mode of onset, once cavernous sinus infection develops, it often progresses to fatality in spite of appropriate antibiotic therapy. Fortunately, the present case had neither a poorly controlled primary site of infection nor contributory underlying diseases causing immunocompromised state, and the antimicrobial treatment was begun in time for the possibility of her recovery. Consequently, the worst outcome was avoided despite the delay in the definitive diagnosis.

References

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