Isolated straight sinus and deep cerebral venous thrombosis: successful treatment with local infusion of urokinase

Case report

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A 23-year-old woman presented with headache and progressive lethargy. The diagnosis of isolated thrombosis of the straight sinus and of the deep cerebral venous system was established using cranial computerized tomography, magnetic resonance imaging, phase-contrast magnetic resonance venography, and cerebral angiography. Because of the rapid deterioration in the patient’s clinical condition, the authors used direct transcatheter infusion of urokinase into the straight sinus. This treatment resulted in a successful outcome.

Key Words • thrombosis • straight sinus • deep vein thrombosis • dural sinus • thrombolysis • urokinase

Deep cerebral venous thrombosis represents a subset of cerebral venous thrombosis that is associated with a significantly worse clinical outcome than dural sinus thrombosis alone. Although limited experience with treatment of dural sinus thrombosis by direct urokinase infusion has been described, our search of the literature showed no reports of selective catheterization and urokinase infusion into the straight sinus for treatment of acute straight sinus thrombus and deep cerebral venous thrombosis. This report describes such a case, which resulted in a favorable outcome.

Case Report

This previously healthy 23-year-old woman presented to another hospital with a 2-day history of severe headache and progressive lethargy. She had no significant medical history or history of trauma, and her only known risk factor for venous thrombosis was the use of oral contraceptives. A cranial computerized tomography (CT) scan obtained at the other facility was interpreted as showing mild hydrocephalus and possible subarachnoid hemorrhage in the posterior interhemispheric fissure. The patient was transferred to our institution for further evaluation and management.

Examination. In the emergency department, the patient was assessed as having a Glasgow Coma Scale (GCS) score of 13 to 14. Subsequent examination by the admitting neurosurgical service yielded a GCS score of 12 to 13 (E2–3, V4, M6). The patient was lethargic, but oriented to person and place and appeared to be in no acute distress. A ventriculostomy catheter was placed on the basis of the other institution’s CT scan showing mild hydrocephalus.

The patient’s mental status continued to deteriorate over approximately 4 hours until she had a GCS score of 9 (E1, V2, M6). A CT scan obtained at that time showed no evidence of subarachnoid hemorrhage, but did show hypodensity and loss of gray–white differentiation involving the deep gray matter nuclei, as well as hyperdensity within the straight sinus, the vein of Galen, and the internal cerebral veins bilaterally, suggesting thrombosis within these structures (Fig. 1 left). These findings were confirmed by magnetic resonance (MR) imaging, which demonstrated high T2-weighted signal within the thalami and basal ganglia bilaterally, which was consistent with edema (Fig. 1 right). No intraparenchymal blood products were identified. A phase-contrast MR venogram demonstrated no evidence of flow within the internal cerebral veins, the vein of Galen, or the straight sinus (Fig. 2). Cerebral angiography demonstrated a lack of opacification of the deep cerebral veins, the inferior sagittal sinus, the vein of Galen, and the straight sinus, which was consistent with thrombosis. The remaining dural sinuses showed normal opacification (Fig. 3 left).

Treatment. Using a transfemoral, coaxial approach, a No. 2.5 French Tracker-18 Soft Stream multiple side-hole microcatheter (Target Therapeutics, Fremont, CA) was
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advanced through the patient’s left internal jugular vein into the thrombosed straight sinus. Injection of contrast material demonstrated the straight sinus to be obliterated by thrombus (Fig. 3 center). The patient was given heparin for therapeutic anticoagulation and a 150,000-U bolus of urokinase was administered into the thrombosed straight sinus. Urokinase was then infused overnight at 100,000 U/hour via the indwelling microcatheter within the straight sinus. Nine hours later, repeated arteriography demonstrated partial recanalization of the straight sinus. The microcatheter was repositioned into the middle portion of the straight sinus, an additional bolus of 150,000 U of urokinase was administered, and infusion was resumed at 100,000 U/hour.

Approximately 20 hours after the initial urokinase infusion, a third diagnostic arteriogram demonstrated further resolution of the straight sinus thrombosis (Fig. 3 right). At this point, patency of the thalamostriate, septal, and internal cerebral veins was demonstrated on the right side, as well as patency of the inferior sagittal sinus and a thin portion of the vein of Galen. However, these structures did not communicate with the straight sinus, suggesting persistent thrombus at the junction of the straight sinus and the vein of Galen (Fig. 4 left). No large deep venous structures were identified on the left side. The microcatheter was advanced to the vein of Galen and the urokinase infusion was continued at a rate of 100,000 U/hour.

On the 2nd day of hospitalization, the patient was no longer dependent on the ventriculostomy and the drainage system was removed. The patient’s GCS score improved to 14.

On the 3rd day of hospitalization, the patient complained of back pain; the pain was accompanied by a drop in her hematocrit level from 29.6 to 20.7. An abdominal CT scan demonstrated a large, spontaneous retroperitoneal and psoas muscle hematoma that was not contiguous with the groin puncture site. At this point, the urokinase infusion was discontinued. A final diagnostic arteriogram obtained 36 hours after the initial infusion of urokinase demonstrated patency of the straight sinus and a portion of the vein of Galen. A small amount of nonocclusive residual thrombus was noted within the straight sinus. The deep venous structures were again identified on the right side, with the internal cerebral vein now draining into the vein of Galen and the straight sinus (Fig. 4 right). Engorged subependymal veins were demonstrated on the right side.
patient’s left side, although the flow was significantly slowed, and these structures drained via collateral branches. There was faint visualization of the left internal cerebral vein. At the completion of the thrombolysis procedure, there was brisk venous flow within the inferior sagittal and straight sinuses.

The patient’s neurological condition continued to improve and eventually returned to baseline, with a GCS score of 15. The retroperitoneal hematoma resolved and her hematocrit level stabilized prior to discharge. Blood tests, including erythrocyte sedimentation rate, antinuclear antibodies, protein C, protein S, antithrombin III (heparin cofactor), plasminogen, anticardiolipin immunoglobulin G and immunoglobulin M antibodies, lupus inhibitor, and Lyme antibody, yielded negative results. A homocysteine level was not measured. The patient was discharged on a daily oral regimen of 2.5 mg warfarin sodium, 100 mg phenytoin, and 150 μg vitamin K.

Postoperative Course. Six months after the patient initially presented, follow-up neurological evaluation showed her to be at her baseline mental status, without focal neurological deficit. An MR image obtained at this time showed residual blood products in the patient’s right frontal lobe at the site at which the ventriculostomy catheter had been placed; otherwise, the MR image was normal (Fig. 5).
Deep cerebral venous thrombosis has been distinguished as a subset of cerebral venous thrombosis that is associated with a significantly worse prognosis than dural sinus thrombosis alone. In a recent series of seven patients with deep cerebral venous thrombosis, five died or were rendered severely disabled. For this reason, an effective treatment would have a significant impact on the morbidity and mortality rates in these patients.

In addition to differences in prognosis, previous reports have described further distinguishing features between dural sinus thrombosis and deep cerebral venous thrombosis. In contrast to patients with dural sinus thrombosis alone, patients with deep cerebral venous thrombosis are more often women, tend to present with altered sensorium and long tract signs, and frequently have a short, more rapidly declining time course. Patients with dural sinus thrombosis more commonly present with papilledema, seizures, and focal neurological deficits that reflect venous cortical infarction. Headache is a feature of both groups.

As a result of both its short time course and its often nonspecific presentation, the diagnosis of deep cerebral venous thrombosis can be difficult and, in the past, was frequently made at autopsy. The widespread use of CT and MR imaging has made earlier diagnosis possible, which is a necessity for successful intervention. Treatment of dural sinus thrombosis with selective catheterization and urokinase infusion is controversial but has been described and is gaining acceptance. Because of its relatively infrequent occurrence, the most effective treatment of deep cerebral venous thrombosis is even less clear, although some authors have reported successful management of this life-threatening condition with systemic (heparin) anticoagulation therapy, even in the presence of hemorrhagic infarction.2,4 A previously reported attempt at the selective catheterization of the straight sinus for direct thrombolysis was unsuccessful.2 In the present case, we believed that our patient’s rapidly deteriorating condition warranted aggressive intervention. For this reason, we chose local thrombolysis rather than systemic heparinization alone; the treatment proved to be successful. Although it is possible that the patient might have recovered without local thrombolysis, her rapid decline in GCS score suggests otherwise.

This report demonstrates that selective catheterization of the straight sinus is feasible; it allowed successful direct endovascular thrombolysis in this patient with isolated straight sinus thrombosis and deep cerebral venous thrombosis.

References


Manuscript received August 2, 1996. Accepted in final form October 18, 1996.

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