A Patient with Severe Cerebral Sinus Thrombosis in Whom Mechanical Thrombolysis with a Balloon and Thrombectomy with a Stent Retriever Were Effective


Objective: We report a patient with severe cerebral sinus thrombosis (CST) in whom mechanical thrombolysis with a balloon and thrombectomy with a stent retriever were effective.

Case Presentation: The patient was a 32-year-old male. Headache occurred, and magnetic resonance venography (MRV) showed occlusion of the superior sagittal sinus. Transvenous anticoagulant therapy was performed, but consciousness disorder and paralysis progressed in a few days. Head CT revealed marked edema of the bilateral frontal lobes and cerebral hemorrhage. Cerebral angiography showed occlusion of the superior sagittal sinus, and endovascular treatment with a balloon and stent retriever was performed, leading to recanalization. Finally, the course was favorable.

Conclusion: Endovascular treatment with a stent retriever may be safe and effective for severe CST.

Keywords: cerebral venous sinus thrombosis, mechanical thrombectomy, stent retriever

Introduction

Cerebral sinus thrombosis (CST) is rare among patients with stroke. Routinely, conservative treatment with anticoagulants is performed, but recanalization of the sinus is not achieved when thrombus-related occlusion involves an extensive area, leading to a severe condition in some cases. In this study, we report a patient with rapidly deteriorating CST for whom mechanical thrombolysis with a balloon and thrombectomy with a stent retriever were performed.

Case Presentation

Case: A 32-year-old male.
Complaints: Headache and left incomplete paralysis.
Family history: Not contributory.
Medical history: He had taken Warfarin to treat lower limb venous thrombosis.
Present illness: Mild headache had persisted for 1 week, but he did not consult a hospital. Severe headache suddenly occurred while working at his desk. Subsequently, mild left hemiparesis was noted, and he consulted a local clinic of neurosurgery. MRI revealed CST, and he was referred to our hospital.

Neurologic findings on admission: Concerning the consciousness level, the Japan Coma Scale (JCS) score was 1-0, and the Glasgow Coma Scale (GCS) score was 15 points (E4V5M6). Left incomplete paralysis (MMT: 4/5) was observed.

Hematological data on admission: AST 54 IU/L, ALT 106 IU/L, LD 196 IU/L, γ-GT 117 IU/L, UN 7.2 mg/dL, CRE 0.60 mg/dL, RBC 5.88 106/μL, Hb 16.5 g/dL, Hct 47.9%, Plt 239 103/μL, PT 12.3 sec, PT(%) 89.5%, PT-INR
1.07 INR, APTT 31.3 sec, Fibrinogen 364 mg/dL, AT-III 114%, FDP 4.3 μg/mL, D-dimer 2.5 μg/mL. Concerning the blood coagulation system, there was a slight increase in the D-dimer level. In addition, mild liver dysfunction was noted. Radiological findings on admission: CT showed high-density areas in the superior sagittal sinus and bridging vein (Fig. 1). Magnetic resonance venography (MRV) revealed the disappearance of the superior sagittal sinus (Fig. 2).

Course after admission: After admission, conservative treatment by anticoagulant therapy with heparin was started. However, systemic tonic-clonic convulsion occurred 3 days after admission. Head CT showed low-density areas in the bilateral frontal lobes. Paralysis of the bilateral upper/lower limbs progressed 6 days after admission, and the consciousness level reduced (JCS: 100). Head CT revealed increases in the low-density areas in the bilateral frontal lobes and partial hemorrhage-related high-density areas (Fig. 3). Assuming that no improvement may be achieved by further conservative treatment, emergency endovascular treatment was performed.

Endovascular treatment: As severe consciousness disorder was present, general anesthesia was performed after intubation. A 4 Fr sheath was inserted into the left femoral artery through the left inguinal region. Internal carotid angiography was conducted. In the arterial phase, there were no abnormalities. In the venous phase, the superior sagittal sinus was not visualized, and the bilateral transverse sinuses were slightly visualized. The occipital sinus was advanced; this was considered to be a primary etiological factor for venous return. Under systemic heparin administration, the activated coagulation time (ACT) was maintained at ≥300. To secure the back-up system of a guiding catheter, a 6 Fr shuttle sheath (Cook Medical, Bloomington, IN, USA) was inserted into the left internal jugular vein through the right femoral vein. In addition, a 6 Fr FUBUKI (Asahi Intecc Co., Ltd, Aichi, Japan) was coaxially inserted to an area adjacent to the confluence of the sinus. Subsequently, an SL10 (Stryker, Kalamazoo, MI, USA) was carefully guided to the forehead region of the superior sagittal sinus using a Cruise 14 (Asahi Intecc Co., Ltd). Angiography through a microcatheter was performed. After confirming the contrast enhancement of a portion of the sinus, urokinase at 60000 units was administered as several divided doses. However, recanalization was not achieved, and the SL10 was exchanged for an Amphirion PTA balloon catheter (Medtronic, Minneapolis, MN, USA).
Discussion

In the present case, conservative treatment with an anticoagulant was started to treat CST. However, consciousness disorder rapidly progressed, and brain edema with hemorrhage deteriorated. Endovascular treatment with a stent retriever was performed, leading to a favorable treatment course.

CST accounts for 0.5%–1.0% of all stroke patients.\(^1\) Previously, treatment had not been established, and the mortality rate was high.\(^2\) However, recently, the International Study on Cerebral Vein and Dural Sinus Thrombosis (ISCVT) reported that the early administration of adequate anticoagulants, such as undifferentiated or low-molecular-weight heparin, improved the prognosis, and that patients with unfavorable outcomes, including death, accounted for approximately 13%.\(^3\) However, endovascular treatment is considered for patients with hemorrhage in whom the systemic administration of anticoagulants is difficult, those in whom the site of occlusion of the venous sinus is extensive, and those in whom there is no improvement despite the systemic administration of anticoagulants.\(^4\) In the present case, the systemic administration of an anticoagulant was performed, but, subsequently, paralysis of the limbs and consciousness disorder rapidly progressed, inducing systemic convulsion. Head CT showed the progression of brain edema with cerebral hemorrhage related to intracranial perfusion disorder, and early revascularization by endovascular treatment was considered to be necessary.
Currently, it is recommended that endovascular treatment should be considered for patients with CST who do not respond to local fibrinolysis therapy in several guidelines. However, its usefulness has not been established. Therefore, endovascular treatment is considered for many severe-status patients in whom standard treatment is not effective for clinical deterioration during anticoagulant therapy, venous infarction-/cerebral hemorrhage-related compression effects, or an increase in the intracranial pressure. As endovascular treatment, selective fibrinolysis therapy and mechanical thrombolysis have been reported. The favorable results of selective fibrinolysis therapy with urokinase or tissue plasminogen activator (tPA) were published, but neither the dose nor continuation method has been established. On the other hand, a study indicated the exacerbation of hemorrhage in patients with cerebral hemorrhage before treatment. Mechanical thrombolysis procedures include thrombolysis with a balloon that using an AngioJet (Boston Scientific, Minneapolis, MN, USA), and thrombus aspiration with a Penumbra system (Penumbra, Inc., Alameda, CA, USA). In addition, a recent study reported the favorable results of mechanical thrombolysis with a stent retriever.

In the present case, initially, urokinase was administered through the tip of the superior sagittal sinus, but the site of occlusion involved the entire superior sagittal sinus; thrombolysis was considered to be difficult. Furthermore, cerebral hemorrhage occurred, and urokinase administration was switched to thrombectomy by mechanical thrombolysis, which may less frequently induce hemorrhagic complications, considering that further urokinase administration may promote hemorrhage.

Although several studies reported thrombus aspiration with a Penumbra system, thrombosis involved ≥2/3 of the superior sagittal sinus in the present case, and it was considered difficult to guide a large-profile catheter to the tip; a balloon and stent retriever were used. Several sessions of mechanical thrombolysis with a balloon and thrombectomy using a stent retriever may have contributed to early recanalization.

According to systematic reviews of endovascular treatment for venous sinus thrombosis, favorable prognosis patients with a modified Rankin Scale score of 0-2
accounted for 76.0%–84.0%, and the complete recanalization rate ranged from 69.0% to 74.0%. In addition, the incidence of hemorrhage was 8.7%–10%; the results were not better than those of standard treatment. However, endovascular treatment is frequently performed for severe-status patients who do not respond to standard treatment or those with hemorrhage according to guidelines. Under such conditions, the results were acceptable. Concerning the selection of devices, an AngioJet had been the most frequently used according to a review published by Siddiqui et al. However, the profile of this device is large and hard; therefore, it is difficult to guide it to the lesion site. They reported the usefulness of a Penumbra system with a more favorable guiding property and a profile that facilitates thrombus aspiration. With respect to a stent retriever, the number of patients in whom it was used is still limited, and favorable results may be achieved using this device in the future. Its merits include a profile smaller than that of the above aspiration-type catheter and a favorable guiding property. On the other hand, mechanical thrombectomy may induce hemorrhage related to vascular injury, but a soft device with a smaller profile may reduce the risk; a stent retriever may be advantageous. Ilyas et al. suggested that the venous sinus may not be damaged due to its large diameter and wall thicker than the vein wall. Furthermore, a study examined selective fibrinolysis therapy combined with mechanical thrombectomy, and reported that the incidence of hemorrhage was slightly higher in the selective-fibrinolysis-therapy-combined group although there was no significant difference; combination therapy should be carefully performed. On the other hand, the perioperative systemic administration of anticoagulants is recommended even for patients with intracranial hemorrhage. If there is no further increase in bleeding at the site of hemorrhage after surgery, anticoagulant therapy should be continued. To date, no study has prospectively investigated

Fig. 5  (A) On left common carotid angiography, the visualization of the former half (2/3) of the superior sagittal sinus was unfavorable in the venous phase.  (B) A microcatheter was inserted to the forehead region of the superior sagittal sinus, and angiography was performed. A thrombus-related shadow defect was observed.  (C) After treatment, the entire superior sagittal sinus was visualized.  (C) On postoperative MRV, the superior sagittal sinus was favorably visualized. MRV: magnetic resonance venography
endovascular treatment for CST or demonstrated its usefulness. In the future, further reports should be published.

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Mechanical thrombolysis with a balloon and endovascular treatment using a stent retriever may be safe and effective for severe CST.

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