



## Case Report

# Recanalization for straight sinus thrombosis through combined mechanical thrombectomy: A case report

Yuhei Michiwaki, Fumitaka Yamane, Tatsuya Tanaka, Ryohei Sashida, Ren Fujiwara, Tomihiro Wakamiya, Kazuaki Shimoji, Eiichi Suehiro, Keisuke Onoda, Masatou Kawashima, Akira Matsuno

Department of Neurosurgery, International University of Health and Welfare, School of Medicine, Narita Hospital, Narita City, Chiba, Japan.

E-mail: \*Yuhei Michiwaki - wayside.bamboo@gmail.com; Fumitaka Yamane - fyamane@iuhw.ac.jp; Tatsuya Tanaka - s96047@hotmail.com; Ryohei Sashida - sashidaryohei@gmail.com; Ren Fujiwara - renfujiwara9@gmail.com; Tomihiro Wakamiya - twakamiya@iuhw.ac.jp; Kazuaki Shimoji - shimoji@iuhw.ac.jp; Eiichi Suehiro - esuehiro@iuhw.ac.jp; Keisuke Onoda - onoda3883@gmail.com; Masatou Kawashima - mkawashima@iuhw.ac.jp; Akira Matsuno - akira.dr.ruby@gmail.com



### \*Corresponding author:

Yuhei Michiwaki,  
Department of Neurosurgery,  
International University of  
Health and Welfare, School  
of Medicine, Narita Hospital,  
Narita City, Chiba, Japan.

wayside.bamboo@gmail.com

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## ABSTRACT

**Background:** Systemic anticoagulation has been the standard treatment for cerebral venous sinus thrombosis (CVT). Although endovascular treatments, including mechanical thrombectomy (MT), have been reported to be effective for CVT, no clear evidence has been established.

**Case Description:** A 51-year-old woman who had been administered oral contraceptive pills was transferred to our hospital with altered consciousness and disorientation. Computed tomography (CT) revealed a hyperdense signal in the straight sinus (StS), and CT angiography revealed a defect in the basal vein and StS, leading to a diagnosis of StS thrombosis. Although systemic anticoagulation through unfractionated heparin was performed, her neurological condition deteriorated, and venous ischemia was observed on CT the next day. She then underwent MT. Partial recanalization was achieved with an aspiration catheter and a stent retriever. Her neurological condition improved tremendously, and venous ischemia was reversed following MT. She was discharged 3 weeks later without neurological deficits with oral anticoagulant.

**Conclusion:** This was a relatively rare case with CVT confined to StS. Immediate combined MT for StS thrombosis can improve venous circulation, make the venous ischemia reversible, and improve patient outcomes, even if it results in partial recanalization.

**Keywords:** Case report, Mechanical thrombectomy, Recanalization, Sinus thrombosis, Straight sinus

## INTRODUCTION

Cerebral venous sinus thrombosis (CVT), a rare cause of stroke, is mainly induced by oral contraceptive pills, pregnancy or puerperium, iron deficiency, infection, trauma, and potential hypercoagulable status, and has a risk of death or dependence.<sup>[5]</sup> CVT involving the deep venous system is reported to be negatively associated with patient outcome.<sup>[3,5,6]</sup> While the standard treatment for CVT is systemic anticoagulation,<sup>[4,13]</sup> several promising studies have reported that endovascular thrombolysis (ET) and mechanical thrombectomy (MT) could contribute to improving patient outcomes in cases of aggressive clinical deterioration or a poor response to systemic anticoagulation.<sup>[7,8,12,15-17]</sup> Conversely, the TO-ACT randomized and clinical study did

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not reveal a significant superiority of endovascular treatment for CVT.<sup>[2]</sup> Thus, no clear evidence of endovascular treatment for CVT has been established.

This report presents the case of a patient with straight sinus (StS) thrombosis treated with MT through the combined use of an aspiration catheter and a stent retriever. Following partial recanalization through MT, neurological conditions improved tremendously, and venous ischemia was reversed. This report suggests that immediate MT for StS thrombosis is effective even if it results in partial recanalization.

## CASE DESCRIPTION

A 51-year-old woman who had been administered oral contraceptive pills for menstrual pain was transferred to our hospital because of altered consciousness, disorientation, and urinary incontinence. Her initial Glasgow Coma Scale (GCS) score was 14 (E4V4M6) on admission. Plain computed tomography (CT) showed a hyperdense signal at StS [Figure 1a] without parenchymal hemorrhage, and CVT caused by oral pills was suspected. CT angiography revealed defects in the basal vein of Rosenthal (BVR) and StS [Figure 1b], and the bilateral transverse sinuses (TSs) were not occluded. Although systemic unfractionated heparin anticoagulation therapy for CVT had been administered immediately, her neurological condition deteriorated (GCS: 11; E3V3M5). Moreover, CT demonstrated venous ischemia at bilateral basal ganglia on the following day [Figure 1c], and it was decided that she would undergo MT to improve cerebral venous circulation.

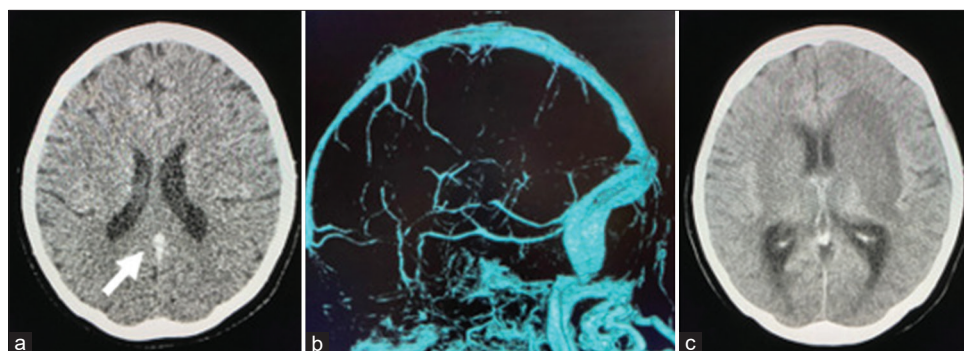
MT was performed under local anesthesia with sedation. A 6Fr guide sheath was inserted into the right femoral vein and positioned in the left jugular vein, and a 4Fr diagnostic catheter was inserted into the left femoral artery and positioned in the left internal carotid artery. Bilateral carotid and vertebral angiograms demonstrated venous

flow defects in the BVR and StS [Figure 2a] and deep venous congestion [Figure 2b]. A Trevo track 21 (Stryker, Kalamazoo, MI) microcatheter was navigated into the occluded StS through the left TS using a 0.014" microguidewire, and a REACT68 (Medtronic, Minneapolis, MN) aspiration catheter was located at the confluence of the sinuses. Venography at the StS revealed a filling defect near the confluence [Figure 2c]. Following deployment and anchoring of a Trevo NXT (6 × 37 mm, Stryker) stent retriever through the microcatheter at the StS, the REACT68 catheter was navigated into the StS near the proximal end of the deployed Trevo NXT [Figure 2d]. Using a combination technique with clot aspiration from the REACT68 catheter and Trevo NXT stent retrieval methods, a significant clot was captured. A total of four passes were performed through the combination technique, and a visible clot was captured in each session. Although not all thrombi could be removed completely and complete recanalization was not achieved, partial recanalization of the StS was obtained [Figure 2e], and the procedure was terminated at this point.

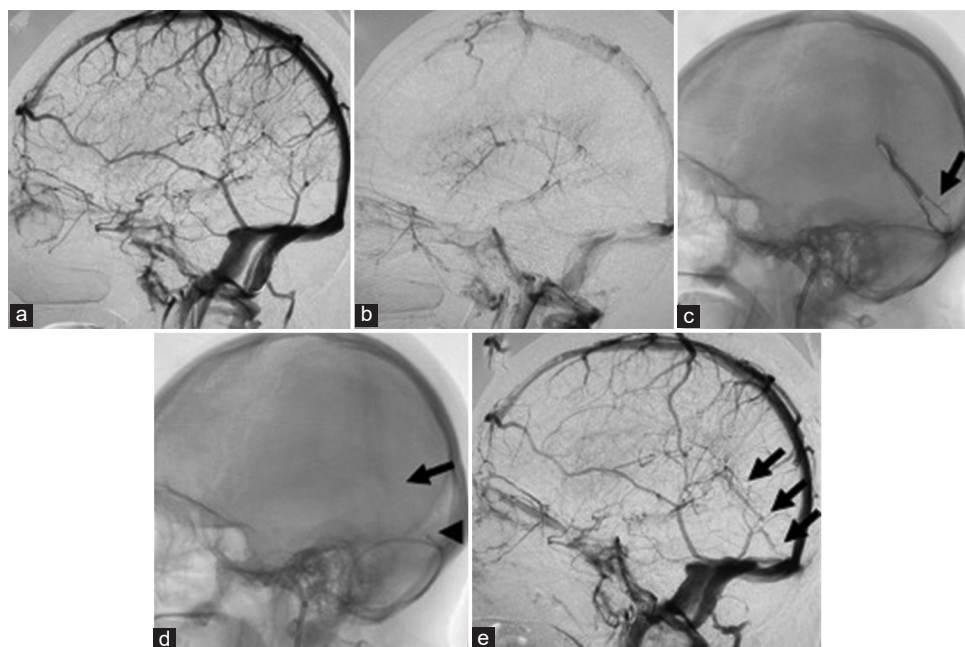
After MT, unfractionated heparin (dose: 10,000–20,000 units per day) therapy was continued for 1 week followed by oral anticoagulation medication. Her consciousness level improved tremendously (GCS: 15) the day after MT. Neuroimaging performed 2 weeks after MT demonstrated improvement of venous ischemia [Figure 3a] and complete recanalization of the BVR and StS without deep venous congestion [Figure 3b]. She was discharged 3 weeks later, following MT with no neurological deficits with oral anticoagulant therapy.

## DISCUSSION

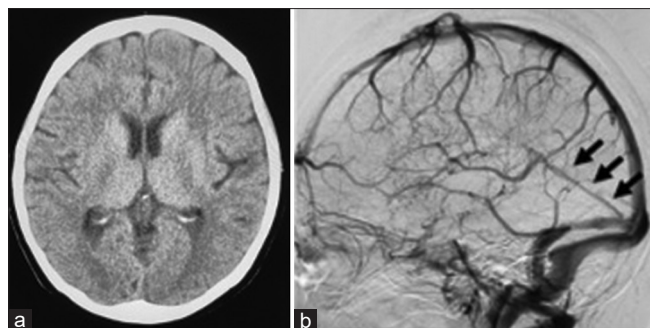
According to the International Study on Cerebral Venous and Dural Sinus Thrombosis (ISCVT), CVT has a 4.3% risk of death and an 18.9% risk of dependence.<sup>[5]</sup> Predictors of death



**Figure 1:** (a) Computed tomography (CT) showing a hyperdense signal (arrow) in the straight sinus. (b) CT angiography showing venous flow defect of basal vein and straight sinus. (c) CT performed next day demonstrating venous ischemia at bilateral basal ganglia.



**Figure 2:** (a) Carotid artery angiogram (CAG) revealing venous flow defect of the basal vein and straight sinus (StS). (b) Late venous phase of CAG demonstrating deep venous congestion. (c) Venography from StS revealing a filling defect of the StS near the confluence (arrow). (d) Mechanical thrombectomy through combined use of an aspiration catheter (arrowhead) and stent retriever (arrow). (e) Postthrombectomy CAG revealing partial recanalization of the StS (arrow).



**Figure 3:** (a) Computed tomography examination performed at 2 weeks after mechanical thrombectomy, showing improvement of venous ischemia at bilateral basal ganglia. (b) Angiography performed 2 weeks after mechanical thrombectomy, revealing complete recanalization (arrows).

or dependence were identified as follows: age >37 years, male sex, coma, mental status disorder, hemorrhage on admission CT, thrombosis of the deep cerebral venous system, central nervous system infection, and cancer.<sup>[5]</sup> In ISCVT, CVT occurs most often in the superior sagittal sinus and TS, and cases involving StS are relatively rare (18% of cases).<sup>[5]</sup> Moreover, as most CVT cases occur in more than 1 sinus, CVT confined to StS is rare as in this case. Other studies have reported CVT involving StS as a risk factor for poor prognosis.<sup>[3,6]</sup>

The standard treatment for CVT is systemic anticoagulation,<sup>[4,13]</sup> but endovascular treatment has also

been reported as an acceptable treatment for some cases of CVT, for which anticoagulation was ineffective.<sup>[7,8,12,15-17]</sup> The previous studies that reported the efficacy of endovascular treatment for CVT included multiple treatment options, including MT through aspiration catheter, stent retrieval, an AngioJet device (Boston Scientific, Marlborough, MA), ET with tissue plasminogen activator and urokinase, balloon angioplasty, intrasinus stenting, and a combination of each treatment.<sup>[7,8,12,15-17]</sup> Conversely, the TO-ACT study did not reveal significant efficacy of endovascular treatment for CVT.<sup>[2]</sup> Therefore, while the American Heart Association guidelines recommend considering endovascular treatment for patients with CVT who deteriorate despite anticoagulation,<sup>[13]</sup> no clear evidence of the effectiveness of endovascular treatments for CVT has been established.

This case report provides two important findings. First, MT through a combination technique using an aspiration catheter and stent retriever was effective for the recanalization of relatively rare StS thrombosis. Second, even partial recanalization of the occluded StS could improve cerebral venous circulation and patient outcomes if complete recanalization was not achieved.

Combined MT through an aspiration catheter and stent retriever, which was performed in the present case, has been reported as an effective strategy for CVT in some studies.<sup>[10,11,14,18]</sup> The endovascular approach and

catheterization for StS, particularly using a large-lumen aspiration catheter, might be difficult due to anatomical variations and venous angulation.<sup>[18]</sup> In the present case, the deployed Trevo NXT was anchored at the StS, allowing the REACT68 catheter to follow the StS.

Some systematic reviews reported high complete recanalization rates of 74% and 69%,<sup>[7,16]</sup> which were achieved with multiple endovascular treatment modalities in patients with CVT. Although there seems to be no doubt that complete recanalization could improve venous circulation, it is not easy to remove large amounts of CVT clots. The present case suggests that even partial recanalization improves venous circulation and patient condition, even if complete recanalization is not achieved by MT. Subsequent anticoagulant treatment, however, allowed complete recanalization of StS. It was hypothesized that local abnormal coagulation condition improved following partial recanalization of occluded sinuses, rendering anticoagulation treatment more effective.

The present patient did not undergo ET because significant recanalization was achieved with MT alone. However, there is a lack of consensus regarding the efficacy and safety of ET for CVT. The previous systematic reviews reported high complete recanalization rates, including cases of ET for CVT, at approximately 71% and 88%.<sup>[7,16]</sup> Moreover, the combination of ET with MT has been reported to improve condition and coagulation function in patients with CVT.<sup>[9]</sup> However, another study concluded that ET in conjunction with MT has no additional benefit.<sup>[7]</sup> Different opinions exist as to whether ET increases the risk of complications. While the hemorrhagic complication rate might be increased by ET,<sup>[11]</sup> more recent studies have shown otherwise in CVT.<sup>[7,16]</sup> Given these views, ET might be worth attempting when MT does not provide favorable recanalization for CVT.

The major reason for the favorable outcome in the present case was the immediate decision to perform MT and successful recanalization without complications reversing the venous ischemia.

## CONCLUSION

Immediate combined MT for patients with StS thrombosis who deteriorate despite anticoagulation is an effective treatment option that provides favorable outcomes, even if it results in partial recanalization.

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## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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