

# Rapid Recanalization Using TrevoProVue through a 4.2 Fr Catheter without a Guiding Catheter via Transbrachial Approach: A Case Report

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Mechanical thrombectomy with a stent retriever has been reported to achieve high rates of successful recanalization, and reduce disability and mortality in patients with acute ischemic stroke (AIS) due to proximal vessel occlusion. However, in a few cases, the treatment is difficult due to artery tortuosity or other factors. The authors present a case of a 94-year-old man presenting with acute right middle cerebral artery occlusion. We attempted to treat using a stent retriever via transfemoral approach, but failed to advance the guiding catheter into the right internal carotid artery due to femoral artery tortuosity and a type III arch. By changing approaches from transfemoral to transbrachial and by using TrevoProVue through a 4.2 Fr Simmons-type catheter without a guiding catheter, we were able to achieve rapid recanalization in only 26 minutes from brachial artery puncture to reperfusion. In conclusion, rapid reperfusion in an AIS patient was successfully achieved by combining a stent retriever with a 4.2 Fr catheter (without a guiding catheter) and a transbrachial approach (as opposed to a transfemoral approach). When the transfemoral approach is not feasible, we recommend consideration of this strategy as an alternative.

**Keywords:** acute ischemic stroke, mechanical thrombectomy, TrevoProVue, transbrachial approach, 4.2 Fr catheter

## Introduction

Recent progress in endovascular treatment has been remarkable, especially in acute ischemic stroke (AIS). For AIS patients with a proximal vessel occlusion, many clinical trials have demonstrated that mechanical thrombectomy with a stent retriever combined with intravenous tissue plasminogen activator (t-PA) administration achieves higher rates of successful recanalization and of reduction in morbidity and mortality than t-PA alone.<sup>1–5</sup> In treatment with a stent retriever, use of a balloon guiding catheter via transfemoral approach may be recommended to prevent distal embolization.

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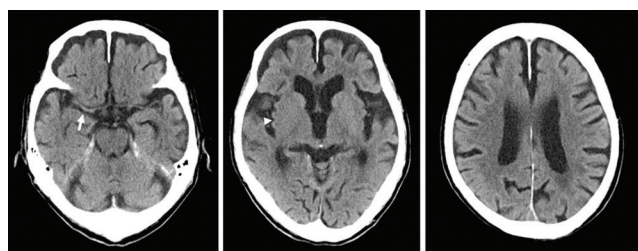
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However, in about 5% of one study's cases, a guiding catheter was difficult to advance into the target vessel because of vessel tortuosity, an elongated aorta or other factors.<sup>6</sup> We herein present a case of successfully achieving recanalization in substantially reduced time via transbrachial approach and TrevoProVue through a 4.2 Fr catheter without a guiding catheter, as a guiding catheter could not be advanced into the right internal carotid artery (ICA) due to severe femoral artery tortuosity and an elongated aortic arch (type III arch).

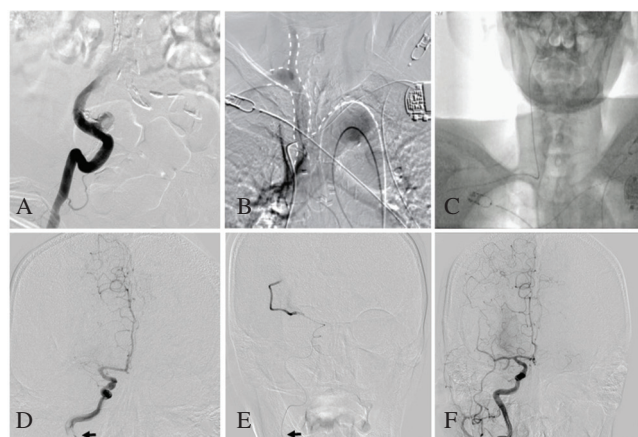
## Case Report

A 94-year-old male who had a history of chronic atrial fibrillation was transported to our hospital by ambulance at approximately 1.5 hours from symptom onset. Neurological examination showed dysarthria, left hemiparesis, right conjugate deviation, and hemispatial neglect. The patient scored 13 points on the Glasgow Coma Scale (GCS, E3V4M5) and 21 points on the National Institute of Health Stroke Scale (NIHSS). Computed Tomography (CT) showed a right hyperdense middle cerebral artery (MCA) sign and an early CT sign in the insula, with an Alberta Stroke Programme Early CT Score (ASPECTS) of 9 points (Fig. 1). Although time from onset of symptoms was within 4.5 hours, IV tPA treatment was contraindicated due to thrombocytopenia. The patient's family requested that we conduct endovascular treatment. A 6 Fr long catheter was inserted into the patient's right femoral artery, then 3000 units of Heparin were administered. Although we attempted to advance the 6 Fr guiding catheter into the right ICA via transfemoral approach, we could not advance the catheter because of a tortuous femoral artery and a type 3 aortic arch (Figs. 2A and 2B). Therefore, a 4 Fr sheath was inserted into the right brachial artery, and a 4.2 Fr "Hanako Excellent EN" Simmons-type catheter (Hanako-Medical Co., Urawa, Japan) was advanced into the right ICA cervical portion (Fig. 2C). Digital subtraction angiography (DSA) showed a right MCA occlusion (Fig. 2D). The occluded lesion was crossed with a 0.016 inch GT wire (Terumo, Tokyo, Japan), and a TrevoPro 18 microcatheter (Stryker Neurovascular, Mountain View, CA, USA) was advanced to the distal M1 portion through the 4.2 Fr catheter. The intravascular position distal to this thrombus was confirmed with a contrast medium gently infused through the micro-catheter. The resulting angiogram showed the inferior branch to be patent but the superior branch to also be occluded by a thrombus (Fig. 2E). With standard techniques, a TrevoProVue 4 mm × 20 mm thrombectomy device (Stryker Neurovascular, Mountain View, CA, USA)

was deployed across the occluding lesion from the M1 portion (distal) to the ICA. 10 minutes later, the stent and micro-catheter together with the 4.2 Fr catheter were gently withdrawn. Once withdrawn into the innominate artery, the stent and micro-catheter were resheathed into the 4.2 Fr catheter, and then, the catheter was pulled out through the 4 Fr sheath. After thrombectomy, ICA angiography showed recanalization of the M1 but continued occlusion of the superior branch. The Thrombolysis In Cerebral Infarction (TICI) score was 2A flow (Fig. 2F). Time from onset to reperfusion was 4 hours and 5 minutes, time from a femoral artery puncture to reperfusion was 1 hour and 39 minutes, and time from a brachial artery puncture to reperfusion was 26 minutes. Because collateral flow from the right anterior cerebral artery into the right frontal lobe was good, we did not conduct further intervention. The next day, CT revealed hemorrhagic infarction of basal ganglia but also that the majority of the cortex in the left hemisphere escaped infarction (Fig. 3). On the second day after treatment, left hemiparesis had improved from a manual muscle testing grade of 0 to a grade of 3. The postoperative course was uneventful, and the patient was transferred after a 34-day admission to a rehabilitation hospital.



**Fig. 1** Computed tomography (CT) showing hyperdense right middle cerebral artery sign (arrow) and early CT sign in the right insula (arrow head).

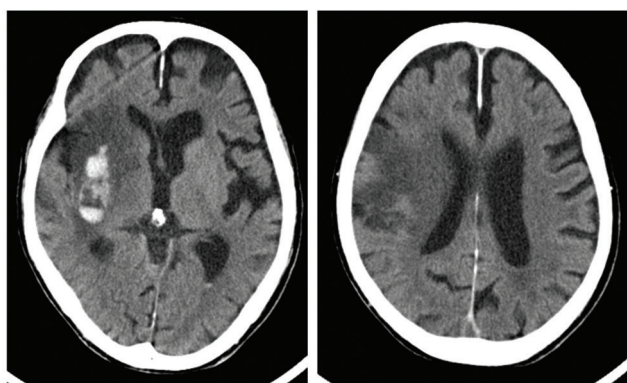


**Fig. 2** A: Digital subtraction angiography (DSA) showing right femoral artery tortuosity. B: DSA of right innominate artery showing type III arch. C, D: Right internal carotid artery angiography (anterior-posterior view) from a 4.2 Fr catheter (arrow) via transbrachial approach showing right M1 occlusion. E: Angiography from TrevoPro 18 through the 4.2 Fr catheter (arrow) showing patency of the inferior branch but occlusion of the superior branch. F: Final right common carotid artery angiography showing partial recanalization (TICI 2A).

## Discussion

TrevoProVue is one type of stent retriever used for AIS. Although several stent sizes are supplied by Solitaire FR (Covidien, Irvine, CA, USA), only one stent size, 4 mm × 20 mm, is supplied by TrevoProVue. That is why TrevoPro 18, which is a delivery catheter for TrevoProVue, has a narrower outer diameter than that of Marksman for Solitaire FR. The TrevoPro 18 has a lumen size of 0.021 inches and an external diameter of 2.7 Fr. This catheter can be inserted into a 4.2 Fr Hanako excellent EN catheter, which has an inner diameter of 1.05 millimeters and is normally used in angiography for diagnosis.

In our strategy, two demerits were considered. One was risk of iatrogenic Embolization into New Territory (ENT). A study of patients treated by stent retriever without mandatory proximal protection reported that 8.6% experienced iatrogenic ENT, and 5.6% experienced clinical signs of new ischemic stroke.<sup>5</sup> In contrast, use of proximal protection by means of a balloon guiding catheter (BGC) was reported to reduce distal embolization,<sup>7</sup> and only 1 to 3% of patients treated by stent retriever with mandatory use of a protection device experienced embolic events.<sup>8,9</sup> In a substudy of the North American Solitaire Acute Stroke (NASA) registry, although the rate of ENT did not differ between patients with or without use of a BGC, BGC use resulted in superior revascularization results, faster procedure times, and improved clinical outcome.<sup>10</sup> In order to avoid distal migration of the thrombus, in our case, the unresheathed stent was withdrawn into the innominate artery, after which the stent could be resheathed into the 4.2 Fr catheter. Although we did not have the distal iatrogenic embolization protections of a BGC with aspiration, angiography after recanalization fortunately did not show any ENT. In noting the merits of BGC use, if a BGC had been applicable in our case, we would have selected a 5 Fr Cello (Covidien, Irvine, CA, USA) because a 6 Fr sheath can be placed safely in a percutaneous transbrachial approach.<sup>11</sup> Another demerit was the difficulty of any subsequent procedures, if such had been needed. Because our strategy did not involve advancing a guiding catheter into the ICA, any subsequent thrombectomy would have required advancing either a 4.2 Fr catheter or a guiding catheter into the ICA once again.



**Fig. 3** On the day following endovascular treatment, computed tomography (CT) showing infarction in I and M4, and hemorrhagic infarction in L, as per Alberta Stroke Programme Early CT Score.

Yet even with the considerations above, our strategy offered a strong merit: the possibility of fast recanalization through a simple technique. Surprisingly, it took only 26 minutes from brachial artery puncture to reperfusion. In contrast, Haussen et al. reported that the mean time from radial puncture to reperfusion was  $2.2 \pm 1.0$  h (median 2.2 h).<sup>12)</sup> Regarding femoral puncture, ESCAPE trial and REVASCAT trial studies respectively reported groin-puncture-to-first-reperfusion median times of 30 and 59 min.<sup>1,3)</sup> We attribute this difference in time required to advance a guiding catheter into the ICA or vertebral artery to the general increased difficulty of the transbrachial approach over the transfemoral approach in advancing a guiding catheter into the target vessels. Yet the efficacy of the transbrachial approach for AIS patients, especially in certain patient-specific cases, should also be noted as reported by Okawa et al.<sup>13)</sup> In their report, a Simmons-type catheter was later exchanged for a distal access catheter (DAC), which is larger and longer than a Simmons-type catheter. In our case it was the transfemoral approach which would have been more time-consuming; we needed the transbrachial approach to save time. As we cannot obtain a 5 Fr Cello in our institution and we considered the advancing of a DAC by transbrachial approach to also be too time-consuming, we initially tried to advance a 4.2 Fr Simmons-type catheter: this strategy proved sufficient for advancing to the distal portion of the ICA, thus enabling the required distal accessibility of the microcatheter and stent retriever. Therefore, we did not need to exchange the Simmons-type catheter for a DAC, which led to critical time savings.

When considering alternative rapid perfusion strategies, some might view direct carotid artery puncture with local anesthesia as potentially applicable in this case. Yet such an alternative in our view is relatively invasive, presenting additional risks of large hematoma in the neck followed by upper airway obstruction.<sup>13,14)</sup> Thus, we consider a transbrachial or transradial approach to be preferable over the direct carotid artery puncture for all cases where possible, such that our choices both of catheter and of approach might have best supported the critical need for rapid and safe recanalization.

## Conclusions

Rapid reperfusion in an AIS patient was successfully achieved by combining a stent retriever with a 4.2 Fr catheter

(without a guiding catheter) and a transbrachial approach (as opposed to a transfemoral approach).

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## Conflicts of Interest Disclosure

The authors declare no conflict of interest.

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