Kobayashi *et al.*
Egypt J Neurol Psychiatry Neurosurg (2024) 60:124
https://doi.org/10.1186/s41983-024-00902-z

The Egyptian Journal of Neurology, Psychiatry and Neurosurgery

CASE REPORT Open Access

Mechanical thrombectomy for internal carotid artery occlusion beyond a large paraclinoid aneurysm

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Abstract

Background With the launch of mechanical thrombectomy (MT), the prognosis of patients with cerebral infarction associated with large-vessel occlusion has improved. However, good outcomes are still not achieved in a few patients because of technical difficulties.

Case presentation A 79-year-old Japanese woman was admitted with sudden-onset left hemiplegia. Tissue plasminogen activator was administered and MT was performed for internal carotid artery occlusion distal to a large paraclinoid aneurysm. Some technical difficulties were unique, including contrast agent retention, difficulty in guiding the system, and avoidance of rupture of the aneurysm. Here, we discuss the technical issues and solutions of the MT procedure employed in this case.

Conclusions The procedure used in flow-diverter devices should be referenced and a stent-retrieving into an aspiration catheter with proximal balloon technique may be the most appropriate method.

Keywords Mechanical thrombectomy, Aneurysm, Cerebral infarction, Stroke

Background

The development of mechanical thrombectomy (MT) has dramatically improved the prognosis of patients with cerebral infarction involving a large vessel and become a standard treatment. However, a favorable outcome is still not achieved in a few cases because of technical difficulties. We experienced MT for the management of an internal carotid artery (ICA) occlusion distal to a large paraclinoid aneurysm (AN). Here, we discuss the optimal procedure within a limited time considering the risk of AN rupture.

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Case presentation

The patient was a 79-year-old Japanese woman who had been commuted to the neurological department of our hospital because of hallucinations and delusions related to dementia with Lewy bodies. Magnetic resonance imaging was performed for the examination of dementia and incidentally revealed the presence of a large bilateral AN. We recommended surgery to the patient and her family; however, consent for surgery was not obtained because of her psychiatric symptoms. She was admitted to the hospital with sudden-onset left hemiplegia. Her NIHSS score was 24 and her ASPECTS score was 10. CT scans revealed a thrombus in the right-side large paraclinoid AN (Fig. 1A); therefore, tissue plasminogen

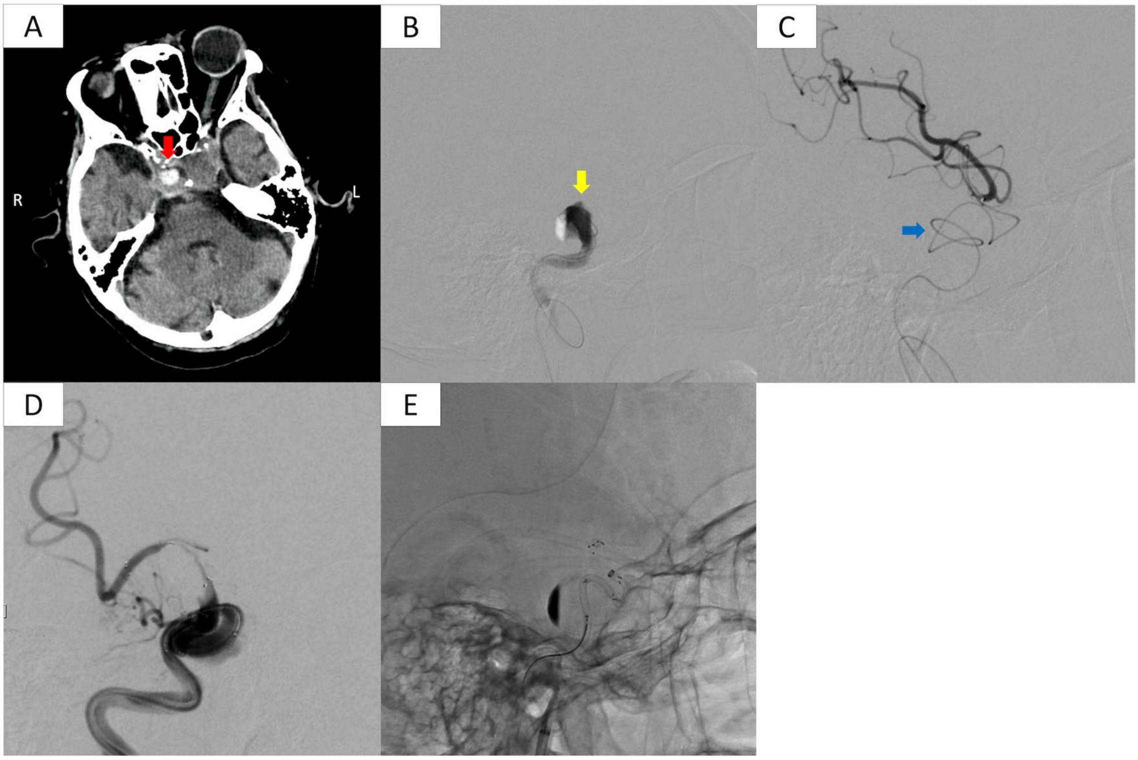

Fig. 1 **A** Head CT image on admission. A thrombus was detected in the right-side large paraclinoid aneurysm (AN) on CT (solid red arrow). **B** Digital subtraction angiography at mechanical thrombectomy. Contrast stagnation was significant, which interfered with the creation of a roadmap and the visibility of the microwire and catheter. When multiple images were captured at different angles, the exit of the AN was detected as a notch (solid yellow arrow). **C** Microcatheter formed a loop within the AN and was guided distally (solid blue arrow). **D** Imaging during stent retriever deployment from the M1 to the ICA. **E** Catalyst 7 catheter was pulled up using the stent retriever as the anchor. It can be observed that the Catalyst 7 catheter in the AN was straightened

activator was administered and the patient was subjected to MT. As thrombus formation is often detected in large ANs, we first considered the migration of thrombus from the AN. However, the patient was diagnosed with cardiogenic cerebral embolism because atrial fibrillation was detected and an occluded ECA was observed on MT. On the initial contrast of digital subtraction angiography, the thrombus moved and was placed in the distal vessel of the AN. However, the contrast media did not drain away, which hampered the detection of the exit point of the AN using contrast from the guiding catheter. We guided the Catalyst 7 catheter (Stryker, Fremont, CA, USA) as far as possible, and finally found the notch suspected as being the exit after the administration of several contrast agents. The stagnation of the contrast media precluded the preparation of a roadmap and impeded the visibility of the catheter; thus, occasional flushing with saline solution was necessary (Fig. 1B). We attempted to select the distal part of the AN directly using a microwire, but this procedure was difficult; thus, a microwire was needed to form a loop inside the AN to guide it to the M1 (Fig. 1C). A Solitaire device (Medtronic, Minneapolis, Minnesota, USA) was expanded from the M1 to the ICA of distal to the AN (Fig. 1D). After pulling and straightening the catheters, the Catalyst 7 catheter could be delivered beyond the AN (Fig. 1E). Because guiding the Catalyst 7 catheter to the distal part of the AN required a considerable amount of effort and time and posed a high risk of AN rupture, we considered that it would be advantageous to retain this catheter at the distal part of the AN. We pulled only the Solitaire device into the Catalyst 7 catheter. However, because no blood was aspirated from this catheter, it was assumed that the thrombus was trapped; therefore, the entire system, including the Catalyst 7 catheter, had to be retrieved. The same procedure was repeated up to three times and the result was TICI 1. The patient was discharged with mRS 5. Informed consent according to ethical regulation was obtained from her relatives.

We report here a suggestive case of MT beyond a large paraclinoid AN. The problems that were unique to this case were as follows: (1) the strategy and system to be used had to be considered carefully, to avoid AN rupture and (2) guiding the microcatheter was difficult and different from the general procedure used in flow-diverter devices (FDDs).

MT for LVO involving a cerebral AN in the target vessel is associated with an increased risk of AN rupture [1, 2]. It was reported that 3.7% of MT cases had an AN, and a 9% incidence of AN rupture was recorded during MT [2]. Awareness of AN rupture during MT is crucial.

To deploy an FDD, a stable distal access route across the AN neck must be achieved. However, reaching the distal artery from a large AN can be technically difficult because of the distorted anatomy of the AN [3].

Our case represented a different situation from the general FDD procedure, wherein the distal part of the AN was not clear and the contrast stagnated in ICA, including the AN. Contrast applied using the Catalyst 7 catheter was guided as distally as possible, and the flow rate of the perfusion from the guiding and aspiration catheters should be set high, to avoid contrast stagnation.

The microcatheter often forms a loop in the AN because of the difficulty in direct selection and guiding. It is risky to rotate an aspiration catheter along the microcatheter through the AN, which is stiffer than the microcatheter. Moreover, unlike the FDD procedure, it may be necessary to select a more distal vessel and use large forces that can act on the loops in the AN to guide the system beyond the vessels. In addition, stress to the AN neck caused by the ledge may pose a risk of rupture. For these reasons, it may be preferable to straighten the loop within the AN, as in the FDD procedure. Although resolving the loop of the microcatheter is not always easy, some techniques for encountering this issue have been described previously, such as the "balloon," "stent," "Solitaire," and "sea anchor" techniques in the FDD procedure [4–7]. We deployed the Solitaire device from the M1, straightened the deflection in the AN, and then pulled up the Catalyst 7 catheter. Stent retrievers (SRs) can be deployed and anchored, to shift vascular travel and reduce the stress caused by the ledge to the AN neck when guiding the aspiration catheter. Moreover, we used a Catalyst catheter, which has chambered edges and may have prevented trapping on the ledge of the AN neck. Although the performing MT using an aspiration catheter alone has been established [8], guiding the aspiration catheter beyond the AN is difficult because of the tortuous nature of the vessels around the large AN. Regarding the thrombus-retrieval method, we initially intended to pull the stent into the aspiration catheter, similar to the A Stent-retrieving into an Aspiration catheter with Proximal balloon (ASAP) technique [9], to leave the Catalyst 7 catheter at the distal part of the AN, for additional MT. Moreover, we considered the risk of expansion of the SR in the AN, which increases the risk of contact between expanding SR and the AN and the release of thrombus. We suspected the presence of a thrombus between the aspiration catheter and the SR because of the absence of bleeding from the aspiration catheter. Therefore, we switched to the continuous aspiration prior to intracranial vascular embolectomy (CAPTIVE) technique [10]. Although the CAPTIVE traction force is lower than that of a simple SR [10], shear stress acts on the vessel wall because of the traction force when SR withdrawal cannot be avoided. Furthermore, this force may be sufficient to tear the fragile wall that surrounds the AN neck. Fortunately, the AN did not rupture, but ASAP may be the most appropriate method in this setting.

For tandem lesions associated with neck ICA stenosis, MT after ICA-neck stenting is a well-experienced procedure. However, to the best of our knowledge, no reports of MT with emergency FDD placement are available. There is a risk of SR snagging on the stent, which hampers the collection procedure. In addition, unlike the neck, the FDD floats within the AN; therefore, the risk of the dropping of the freshly placed FDD into the AN when pushed up the system must be considered. Emergency FDD is not allowed by the Japanese insurance system.

MT requires immediate decision-making, because early recanalization is related to patient outcomes. We did not identify the best method for this case; however, we must share the characteristics and precautions of MT for the management of large paraclinoid ANs. Although this patient did not have recanalization and a good outcome, hopefully the report of this experience can be useful for future cases.

Conclusion

The procedure used in flow-diverter devices should be referenced and a stent-retrieving into an aspiration catheter with proximal balloon technique may be the most appropriate method.

Abbreviations

MT	Mechanical thrombectomy
ICA	Internal carotid artery
AN	Aneurysm
FDDs	Flow-diverter devices
SRs	Stent retrievers
ASAP	A stent-retrieving into an aspiration catheter with proximal balloon
LVO	Large vessel occlusion

Acknowledgements
Not applicable.

Author contributions
Y. Kobayashi: data acquisition, data analysis, and writing of the manuscript. G.W, K. Yamazaki, S. H, Y. Kondo, K. Yamamoto and Y. S: data acquisition and revision of the manuscript. Y. Kusano: surgeons of the patient. All authors have read and approved the manuscript.

Funding
This study was not supported by any fund or grant.

Availability of data and materials
Additional data that support the findings of this study are available on request from the corresponding author.

Declarations

Ethics approval and consent to participate
The Nagano Municipal Hospital ethics committee approved this case report (June 2023).

Consent for publication
The patient was dementia due to cerebral infarctions and consent from the patient was not obtained. The next of kin signed an informed consent to allow his data to be published. We obtained approval from the research ethics committee.

Competing interests
The authors declare that this research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 30 November 2023 Accepted: 6 October 2024
Published online: 14 October 2024

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