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Tigertriever-Assisted Stent Retriever Angioplasty for Acute Basilar Artery Occlusion Due to Intracranial Atherosclerotic Stenosis: A Case Report

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Abstract

Intracranial atherosclerotic stenosis (ICAS) is an important cause of acute large vessel occlusion (LVO), but the optimal endovascular treatment strategy remains uncertain. Although stent retriever (SR) angioplasty using the Tigertriever (Rapid Medical, Yokneam, Israel) has been reported for anterior circulation ICAS-related LVO, its application in the posterior circulation remains insufficiently documented. We report the case of a 75-year-old Japanese man with known basilar artery (BA) stenosis who presented with fluctuating right-sided weakness and dysarthria and subsequently developed acute BA occlusion (BAO) accompanied by neurological deterioration. Initial mechanical thrombectomy (MT) failed to achieve recanalization. Stepwise SR angioplasty using the Tigertriever was therefore performed after administration of dual antiplatelet therapy (DAPT) consisting of aspirin (200 mg) and prasugrel (20 mg). Stable reperfusion was achieved 30 minutes after antiplatelet administration, with approximately 70% residual stenosis and no subsequent angiographic recoil or re-occlusion during the observation period. Follow-up magnetic resonance angiography (MRA) on postprocedural day one confirmed BA patency. The patient was discharged home on postprocedural day 11 with a modified Rankin Scale (mRS) score of 1. Follow-up MRA at 16 months after the procedure demonstrated sustained BA patency. This case suggests that Tigertriever-assisted SR angioplasty combined with prompt antiplatelet therapy may be a feasible non-stenting rescue strategy for selected patients with BAO resulting from underlying ICAS.

Categories: Neurosurgery
Keywords: basilar artery occlusion, intracranial atherosclerotic stenosis, mechanical thrombectomy, stent retriever angioplasty, tigertriever

Introduction

Mechanical thrombectomy (MT) has become the standard treatment for acute ischemic stroke due to large vessel occlusion (LVO). However, the optimal endovascular treatment strategy for LVO associated with intracranial atherosclerotic stenosis (ICAS) remains uncertain [1-3]. Although conventional plain old balloon angioplasty (POBA) and permanent stenting are used as rescue treatments in selected cases, robust evidence supporting their use in the acute phase remains limited [4,5]. These approaches carry procedural risks. Balloon angioplasty may displace atherosclerotic plaque into adjacent perforator origins, resulting in perforator infarction, whereas stent deployment may cause endothelial injury or distal embolization [6]. Furthermore, angioplasty in the posterior circulation, particularly in the basilar artery (BA), is associated with relatively high procedural risk because this vascular territory gives rise to numerous perforating arteries supplying critical brainstem structures [6,7].

To overcome these limitations, stent retriever (SR) angioplasty, which involves deploying a thrombectomy stent to dilate the underlying stenotic lesion, has been explored [7-9]. However, conventional SRs generally possess relatively low radial force, limiting their efficacy as true angioplasty devices. Moreover, technical concerns remain regarding potential endothelial injury during device retrieval [8,9]. With the introduction into clinical practice of the Tigertriever (Rapid Medical, Yokneam, Israel), a new approach to SR angioplasty has emerged. Akiyama et al. recently reported the utility of Tigertriever SR angioplasty for ICAS-related LVO in the anterior circulation [10]. The Tigertriever features a unique mechanism that allows for manual adjustment of mesh expansion and precise control of radial force [11]. This technical advantage suggests that the technique may also be applicable to the posterior circulation. Here, we report a case of acute BA occlusion (BAO) associated with underlying ICAS that was successfully managed with Tigertriever SR angioplasty.

Case Presentation

A 75-year-old Japanese man with a history of diabetes mellitus, hypertension, and dyslipidemia presented to our outpatient department at approximately 4:00 PM. Previous magnetic resonance angiography (MRA) had

demonstrated moderate ICAS of the BA, with approximately 62% diameter stenosis calculated using the Warfarin-Aspirin Symptomatic Intracranial Disease (WASID) [12] method. He had no previously diagnosed transient ischemic attacks (TIAs). However, he had experienced recurrent episodes of right-sided weakness and dysarthria over the preceding three days, with each episode resolving completely. The exact onset time of the first episode was unclear. He had been symptom-free on the morning of presentation; however, the symptoms recurred at approximately 3:00 PM and had persisted since. He was receiving teneligliptin, valsartan, and pravastatin for diabetes mellitus, hypertension, and dyslipidemia, respectively, but was not taking any antithrombotic medication.

On initial neurological examination, he was slightly somnolent and had mild right hemiparesis and dysarthria, corresponding to an initial National Institutes of Health Stroke Scale (NIHSS) score [13] of 4. Initial MRA demonstrated acute BAO, accompanied by small acute ischemic lesions in the left thalamus and left occipital lobe. Neither of the posterior communicating arteries was visualized on MRA. No significant stenosis was observed in either extracranial vertebral artery. The posterior circulation Alberta Stroke Program Early CT Score (pc-ASPECTS) on diffusion-weighted imaging [14] was 8 (Figures *1*, *2B*).

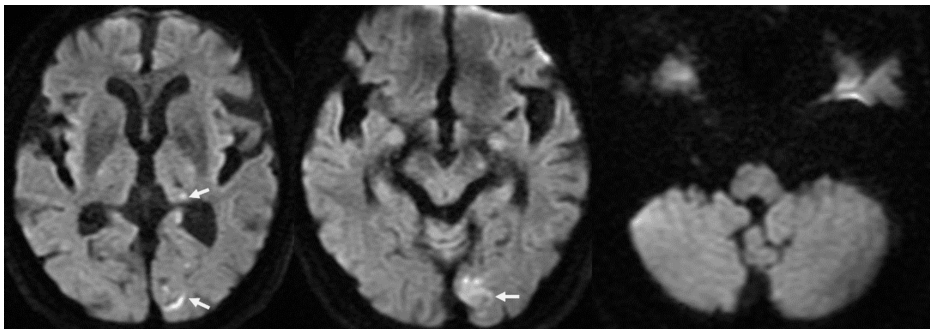


FIGURE 1: Baseline MRI findings

DWI on arrival demonstrating small positive lesions in the left thalamus and left occipital lobe (white arrows)

MRI: magnetic resonance imaging; DWI: diffusion-weighted imaging

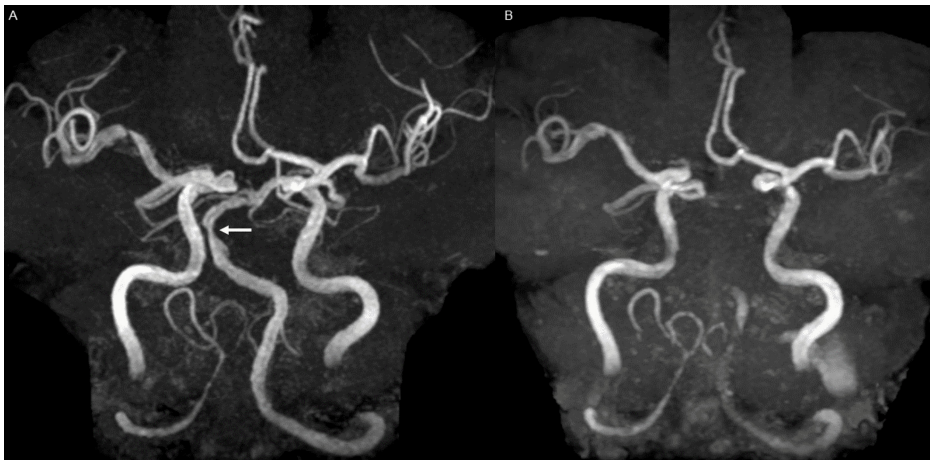


FIGURE 2: MRA before and at presentation

(A) Brain MRA performed before presentation, demonstrating pre-existing basilar artery stenosis, with approximately 62% diameter stenosis calculated using the WASID study method (white arrow). (B) Initial brain MRA obtained on arrival, showing complete signal loss/occlusion of the basilar artery

MRA: magnetic resonance angiography; WASID: Warfarin-Aspirin Symptomatic Intracranial Disease

Laboratory investigations on admission revealed no elevation of brain natriuretic peptide (BNP) or D-dimer levels. Approximately one hour after arrival, the patient experienced sudden neurological deterioration, with altered consciousness and severe right hemiparesis, and the NIHSS score increased from 4 to 11. Given the acute neurological deterioration in the setting of MRA-confirmed BAO, emergency endovascular treatment was deemed necessary. Because of the associated risk of aspiration, the patient was urgently

intubated and placed on mechanical ventilation for airway protection before the endovascular procedure. Emergency digital subtraction angiography (DSA) was performed via a right femoral arterial approach and revealed BAO (Figure *3A*).

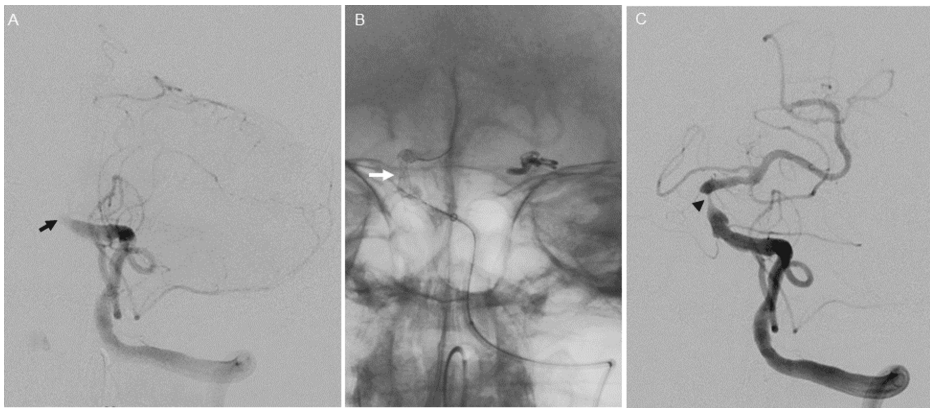


FIGURE 3: Intraprocedural images

(A) Initial left vertebral artery angiography demonstrating complete occlusion of the basilar artery (black arrow). (B) Unsubtracted fluoroscopic image showing deployment and expansion of the Tigertriever across the stenotic segment of the basilar artery (white arrow). (C) Final post-procedural angiography demonstrating successful recanalization with residual stenosis of approximately 70% (arrowhead)

A 6-Fr FUBUKI ST 90-cm guiding sheath (Asahi Intecc, Aichi, Japan) was positioned in the left vertebral artery. A 5-Fr Esperance aspiration catheter (Wallaby, Shanghai, China) was advanced to the BA. The lesion was crossed using a Phenom 21 microcatheter (160 cm; Medtronic, Irvine, CA) and a CHIKAI 0.014-inch guidewire (Asahi Intecc). Initial mechanical thrombectomy using a combined technique with the Esperance aspiration catheter and a Tigertriever 17 (Rapid Medical) failed to achieve recanalization. Based on the pre-existing BA ICAS demonstrated on previous MRA, the preceding fluctuating neurological symptoms, and the acute angiographic findings, an ICAS-related mechanism of BAO was suspected. Therefore, we decided to proceed with SR angioplasty. Dual antiplatelet therapy (DAPT) consisting of aspirin (200 mg) and prasugrel (20 mg) was immediately administered via a nasogastric tube. The Tigertriever was expanded by 11 clicks until the distal mesh angle reached approximately 90° (Figure *3B*). After deployment, angiography was performed to assess recanalization.

Once recanalization was achieved, the device was collapsed in situ and left in place. Angiographic assessment was repeated every five minutes. Re-occlusion was observed at five and 20 minutes after DAPT administration. On each occasion, the Tigertriever was redeployed by expanding the device to 11 clicks. Stable recanalization was ultimately achieved approximately 30 minutes after DAPT administration, and the procedure was terminated. Final angiography demonstrated complete reperfusion (modified Thrombolysis in Cerebral Infarction [mTICI] grade [15] 3) with approximately 70% residual stenosis as assessed using the WASID method (Figure *3C*). No angiographic evidence of vessel perforation, dissection, or contrast extravasation was observed during the procedure, and no angiographic recoil or re-occlusion occurred during an additional 20-minute observation period. The patient was transferred back to the ward under endotracheal intubation and was extubated the following day. Follow-up MRI on postoperative day one demonstrated a new small ischemic lesion in the left occipital lobe without hemorrhagic transformation. The BA remained patent, with no evidence of re-occlusion (Figure *4*).



FIGURE 4: Post-procedural images

(A) MRI obtained on post-procedural day one shows a small DWI-positive lesion in the left occipital lobe (white arrow). (B) MRA obtained on post-procedural day one shows sustained recanalization of the basilar artery with residual stenosis (white arrowhead)

MRI: magnetic resonance imaging; DWI: diffusion-weighted imaging; MRA: magnetic resonance angiography

DAPT with aspirin (100 mg) and prasugrel (3.75 mg) was continued, and the patient experienced no recurrent ischemic events during the hospital stay. Transthoracic echocardiography showed no left atrial enlargement or significant valvular disease. In addition, electrocardiographic monitoring revealed no evidence of atrial fibrillation. The patient demonstrated favorable neurological recovery, and he was discharged home on postoperative day 11 with an NIHSS score of 1 and a modified Rankin Scale (mRS) [16] score of 1. Follow-up MRA performed at 16 months post-procedure confirmed sustained long-term patency of the BA without any new ischemic lesions.

Discussion

We discuss a case of acute BAO associated with underlying ICAS that was successfully treated with SR angioplasty using the Tigertriever together with prompt DAPT administration. This approach may represent a rescue strategy for selected patients in whom conventional mechanical thrombectomy fails to achieve durable recanalization. Akiyama et al. described four potential advantages of Tigertriever-assisted SR angioplasty over conventional intracranial angioplasty or stenting techniques [10]. These include a relatively high radial force, adjustable device expansion, full-length radiopacity, and compatibility with a microcatheter having a 0.017-inch inner diameter. In vitro testing has demonstrated that the Tigertriever generates greater radial force than conventional self-expanding stent retrievers, although its radial force remains lower than that of angioplasty balloons [11].

Clinical studies have also reported an increase in vessel diameter at the occlusion site following Tigertriever thrombectomy in patients with ICAS-related LVO [17]. The rationale for SR angioplasty is to temporarily restore antegrade blood flow across the stenotic lesion, giving antiplatelet therapy time to take effect [7-9]. A device that provides an intermediate degree of radial force while allowing manual adjustment of its expansion may offer a balance between luminal dilation and controlled force application to the vessel wall [11,17]. Furthermore, the ability to fully collapse the Tigertriever in situ may reduce friction against the vessel wall during repositioning and retrieval, potentially minimizing endothelial injury [10,17]. Because mechanical endothelial injury can provoke acute local thrombus formation and compromise the primary goal of maintaining temporary antegrade blood flow until antiplatelet therapy takes full effect, performing an atraumatic procedure that preserves vascular endothelial integrity is paramount in SR angioplasty.

Rescue angioplasty and/or stenting has also been investigated as a treatment option for ICAS-related LVO. Observational studies and registry-based analyses have evaluated the feasibility and potential benefits of these rescue approaches in selected patients who do not respond adequately to conventional MT [3,4]. An important consideration when applying SR angioplasty to the posterior circulation is the anatomical and procedural differences between the anterior and posterior circulations. In particular, the BA gives rise to numerous perforating arteries that supply critical brainstem structures. Consequently, plaque displacement or compromise of perforator origins during angioplasty may result in devastating brainstem infarction. This risk highlights the importance of carefully controlling the degree of vessel expansion and minimizing mechanical injury to the vessel wall. Furthermore, differences in vessel diameter, vascular geometry, and perforator distribution may limit the direct extrapolation of experience with SR angioplasty in the anterior circulation to the posterior circulation.

Although Akiyama et al. demonstrated the potential utility of Tigertriever-assisted SR angioplasty in anterior circulation ICAS-related LVO [10], its application to BAO requires further investigation. The present case illustrates the potential feasibility of this approach in the posterior circulation. Another important consideration is the choice of antiplatelet therapy. Prasugrel has a faster onset of action and less interindividual variability in platelet response than clopidogrel [18]. However, evidence supporting its use in acute ICAS-related LVO remains limited. Clinical experience with prasugrel in emergent neuroendovascular procedures has been reported. Niimi et al. described the use of prasugrel as rescue therapy in neuroendovascular procedures, including a 20 mg loading dose, and reported no major hemorrhagic complications in their case series [19]. Asai et al. investigated prasugrel administration during emergent endovascular treatment for ICAS-related LVO and reported a significantly higher target-vessel patency rate in patients receiving prasugrel than in those who did not, with no symptomatic intracranial hemorrhage observed in either group [20].

In the present case, stable recanalization was achieved approximately 30 minutes after DAPT administration. Although the contribution of antiplatelet therapy to maintaining vessel patency cannot be established from this single case, the temporal association suggests that prompt platelet inhibition may have helped prevent recurrent thrombosis during temporary luminal dilation. Further studies are warranted to clarify the optimal antiplatelet regimen and the duration of temporary flow maintenance required to prevent re-occlusion. In the present case, the underlying mechanism of BAO was considered most likely to be ICAS rather than a purely embolic event. This interpretation was supported by the presence of pre-existing moderate BA stenosis (approximately 62% diameter stenosis according to the WASID method) on prior MRA, the absence of significant extracranial vertebral artery stenosis, the preceding fluctuating neurological symptoms, recurrent occlusion during the procedure, and substantial residual stenosis (approximately 70%) after recanalization.

Furthermore, cardiac evaluation revealed no apparent cardioembolic source. There was no elevation of BNP or D-dimer levels on admission, and subsequent echocardiography and electrocardiographic monitoring revealed no apparent cardiac source of embolism. Collectively, these findings supported the diagnosis of BAO associated with underlying ICAS, although a concomitant embolic mechanism could not be completely excluded. Another potential advantage of the Tigertriever is its full-length radiopacity, which allows continuous visualization of the device configuration during deployment [10,11]. This feature may be particularly useful in SR angioplasty because the underlying stenosis may not be clearly delineated before recanalization. Deformation of the expanded mesh may provide visual cues to the location of the stenotic segment and help the operator assess whether the device appropriately spans the target lesion [10,11].

In the present case, the procedure was terminated despite approximately 70% residual stenosis because stable antegrade flow was maintained without angiographic evidence of recoil or re-occlusion during the observation period. Follow-up MRA at 16 months confirmed sustained BA patency, and no recurrent ischemic events occurred during hospitalization. Previous studies of ICAS-related LVO have described strategies that avoid permanent stent implantation when recanalization is achieved and antegrade flow remains stable, with close angiographic monitoring for early re-occlusion [3,4]. However, the optimal management of severe residual stenosis remains uncertain. This report has several limitations, including its single-case design. Further case reports and larger clinical studies are needed to clarify the safety, efficacy, and optimal procedural strategy of SR angioplasty using the Tigertriever for acute ICAS-related BAO.

Conclusions

Angioplasty using the Tigertriever may offer a feasible non-stenting rescue strategy for selected patients with acute ICAS-related BAO in whom conventional mechanical thrombectomy fails to achieve durable recanalization. Its adjustable expansion mechanism and ability to collapse in situ may facilitate controlled luminal dilation and reduce unnecessary device manipulation. In the present case, stable basilar artery patency was maintained despite substantial residual stenosis, and the patient made a favorable clinical recovery, with sustained patency at 16 months. However, the safety and efficacy of this approach cannot be established from a single case, and further studies are required to determine the appropriate patient selection, antiplatelet regimens, and procedural strategies.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Kohei Funato, Kousei Yoshimura, Ryosuke Kaneko, Yusuke Hara, Mao Yamamoto

Acquisition, analysis, or interpretation of data: Kohei Funato

Drafting of the manuscript: Kohei Funato

Critical review of the manuscript for important intellectual content: Kohei Funato, Kousei Yoshimura, Ryosuke Kaneko, Yusuke Hara, Mao Yamamoto

Supervision: Kohei Funato

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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