Cureus
Part of SPRINGER NATURE

Open Access Case Report

Ipsilateral Transulnar Rescue Access for Mechanical Thrombectomy After Failed Transradial Navigation Due to a Brachioradial Artery: A Case Report

Akihiro Shimoi [1], Ryuya Okawa [2], Shunsuke Tamaki [3], Kaito Hosouchi [1], Kazunori Akaji [1]

1. Department of Neurosurgery, Mihara Memorial Hospital, Isesaki, JPN 2. Department of Diagnostic Imaging, Mihara Memorial Hospital, Isesaki, JPN 3. Department of Neurology, Mihara Memorial Hospital, Isesaki, JPN

Corresponding author: Akihiro Shimoi, a.shimoi314@gmail.com

Review began 11/02/2026
Review ended 11/09/2026
Published 11/13/2026

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DOI: 10.7759/cureus.119594

Abstract

Transradial access is an increasingly used alternative to transfemoral access for mechanical thrombectomy, but anatomical variations of the radial artery can obstruct passage of large-bore guiding systems. We report a 94-year-old woman who presented with severe left hemispheric stroke symptoms (National Institutes of Health Stroke Scale score, 28) caused by occlusion of the superior division of the left middle cerebral artery M2 segment. Mechanical thrombectomy was initially attempted through the right radial artery. Marked resistance to guide-catheter advancement in the upper arm prompted angiography, which revealed a brachioradial artery (high-origin radial artery) and an unfavorable path for the guiding system. Rather than continue manipulating the catheter, the operator converted to ipsilateral right transulnar access. A 7 Fr slender sheath accommodated the guiding system, and combined stent-retriever and aspiration thrombectomy achieved complete reperfusion (Thrombolysis in Cerebral Infarction grade 3) on the first pass. Door-to-puncture time was 83 minutes, and puncture-to-reperfusion time was 40 minutes. No immediate access-site complication was documented. This case illustrates the importance of angiographically identifying the cause of resistance during transradial thrombectomy and shows that, in carefully selected patients, ipsilateral transulnar conversion may provide an effective wrist-based rescue route.

Categories: Neurosurgery
Keywords: ais (acute ischemic stroke), brachioradial artery, mechanical thrombectomy (mt), transradial access (tra), transulnar access

Introduction

Transfemoral access (TFA) remains a conventional route for mechanical thrombectomy, whereas transradial access (TRA) is feasible in selected patients [1-3]. Mechanical thrombectomy requires stable proximal guiding-catheter support and adequate internal diameter for delivery of aspiration catheters and microcatheter-based stent retrievers. Consequently, small caliber, sharp angulation, or tortuosity in an upper-extremity arterial route may prevent safe delivery of a large-bore guiding system, even after successful arterial puncture [4,5]. Evidence comparing primary radial and femoral approaches cannot establish the relative merits of crossover techniques after radial access failure.

The success of TRA depends on the anatomy of the upper-extremity arterial tree. Radial loops, spasm, small caliber, tortuosity, and high-origin radial arteries can make guide-catheter advancement difficult or unsafe [4,5]. The brachioradial artery is a high-origin radial artery arising proximal to the cubital fossa; the clinical implications depend on its configuration and its relationship to the intended device system [5]. Conversion to the femoral artery is a conventional bailout route. Transulnar access (TUA) is another possible wrist-based route, although literature supporting TUA for neurointervention in general is more extensive than evidence specifically addressing ipsilateral radial-to-ulnar rescue during acute stroke thrombectomy [6-9].

We describe a single case of emergent thrombectomy in which resistance during radial guiding-catheter navigation led to recognition of a brachioradial artery and conversion to the ipsilateral ulnar artery. The report addresses decision-making after an anatomical failure of radial navigation, particularly the trade-off between femoral crossover and same-wrist ulnar rescue. It does not establish a general indication for ipsilateral transulnar thrombectomy.

Case Presentation

A 94-year-old woman who had been living independently was last known to be well at 9:00 a.m. on day 1 (D1). She was found collapsed at home at 5:15 p.m. and arrived at our hospital at 6:02 p.m. Her medical history included prior cerebral infarction, hypertension, dyslipidemia, and hyperuricemia. According to the available record, no regular preadmission medication was documented at stroke onset, although remote

cilostazol use had been recorded in 2016.

On arrival, she was awake but aphasic and unable to follow commands. The Glasgow Coma Scale (GCS) score was E4V1M4 [10]. Neurological examination showed left conjugate gaze deviation, impaired response to visual stimulation from the right side, severe aphasia, and profound right hemiparesis. The right upper and lower extremities were nearly plegic, whereas spontaneous movement was preserved on the left side. Sensory responses were reduced, and the National Institutes of Health Stroke Scale (NIHSS) score was 28 [11]. The individual item scores were as follows: 1a, 0; 1b, 2; 1c, 2; best gaze, 2; visual fields, 2; facial palsy, 1; left arm, 1; right arm, 4; left leg, 2; right leg, 4; limb ataxia, 0; sensory, 2; best language, 3; dysarthria, 2; extinction/inattention, 1.

Diffusion-weighted magnetic resonance imaging showed acute ischemic lesions in the left middle cerebral artery territory, and the diffusion-weighted imaging Alberta Stroke Program Early CT Score (DWI-ASPECTS) was 8/11 [12]. Magnetic resonance angiography demonstrated occlusion of the superior division of the left M2 segment (Figure *1*).

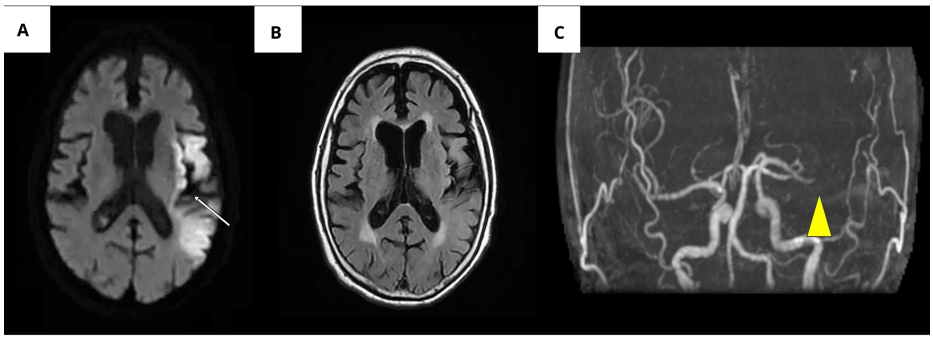


FIGURE 1: Preprocedural Magnetic Resonance Imaging and Angiography

(A) Diffusion-weighted imaging demonstrates acute ischemic lesions in the left middle cerebral artery territory (white arrow). (B) Fluid-attenuated inversion recovery image. (C) Magnetic resonance angiography demonstrates occlusion of the superior division of the left M2 segment (yellow arrowhead).

Emergency mechanical thrombectomy was performed under local anesthesia. Before puncture, ultrasonography showed right radial and ulnar arterial diameters of 2.4 and 1.6 mm, respectively, at the proposed puncture sites. The native brachial arterial diameter was measured as approximately 4.4 mm. The high-origin radial branch diameter and precise brachioradial takeoff angle could not be reliably quantified from the available images. The right radial artery was punctured, and a 4 Fr sheath was inserted, followed by exchange for a 7 Fr slender sheath after intra-arterial vasodilator administration. A 7 Fr RIST guiding catheter (Medtronic, Minneapolis, MN, USA), a 5.5 Fr Simmons 2 catheter, and a 0.035-inch Radifocus guidewire (Terumo, Tokyo, Japan) were advanced. Marked resistance was encountered in the upper arm. Rather than force the system, angiography through the radial route was obtained and demonstrated a high-origin brachioradial artery with an unfavorable course for the large-bore guiding catheter (Figure *2*). A diagnostic angiogram through the original 4 Fr sheath before upsizing was not documented, nor was an exact point of resistance or a brachioradial takeoff angle measured.

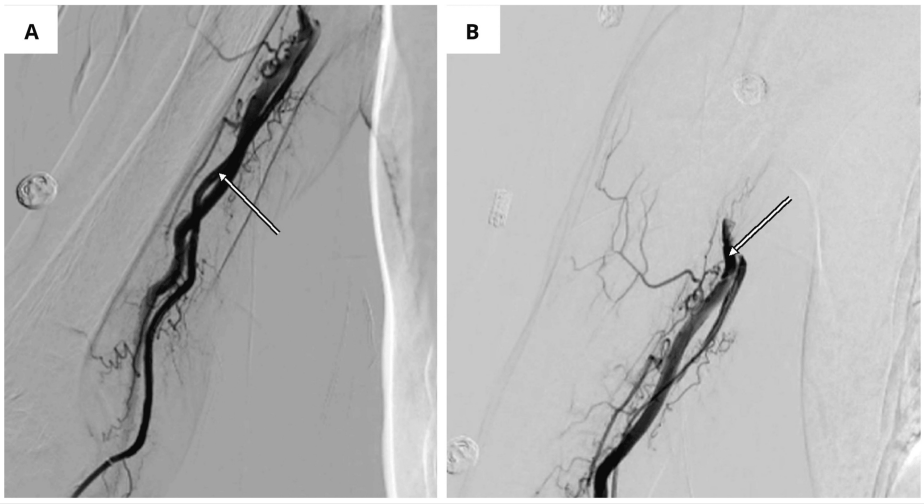


FIGURE 2: Right Upper-Extremity Angiography Showing a Brachioradial Artery

Right upper-extremity angiography after resistance during transradial guiding-catheter navigation. Frontal (A) and oblique (B) projections show an anomalous high-origin radial arterial course (brachioradial artery). White arrows highlight the unfavorable narrow and tortuous arterial segment. The exact point of mechanical resistance and the complete native brachial trunk cannot be determined from these projections alone.

After radial navigation failed, ipsilateral right transulnar conversion was selected on the basis of the apparent puncturability of the ulnar artery and the clinical circumstances. Preprocedural computed tomography angiography had shown tortuosity in the central arterial pathway, and the femoral access field had not yet been prepared in a sterile fashion. These factors contributed to a case-specific decision to remain with the wrist-based setup; they do not prove a time or safety advantage over femoral crossover. Formal Allen and Barbeau tests were not performed. Angiography of the puncture region showed a patent ulnar route, and portions of distal vessels toward the hand were visible, but this limited view did not establish a complete palmar arch or adequate collateral circulation. The ulnar puncture-site diameter was 1.6 mm on preprocedural ultrasound, which raises an important potential sheath-to-artery mismatch concern when using a 7 Fr slender sheath. A 4 Fr sheath was inserted into the right ulnar artery and, after intra-arterial vasodilator administration, exchanged for a 7 Fr slender sheath. The system advanced proximally from the ulnar artery into the brachial and axillary arterial pathway. The left common carotid artery was selected with the RIST and Simmons 2 configuration, and the guide catheter was placed in the distal cervical internal carotid artery. Angiography demonstrated the superior-division left M2 occlusion (Figures *3A*, *3B*).

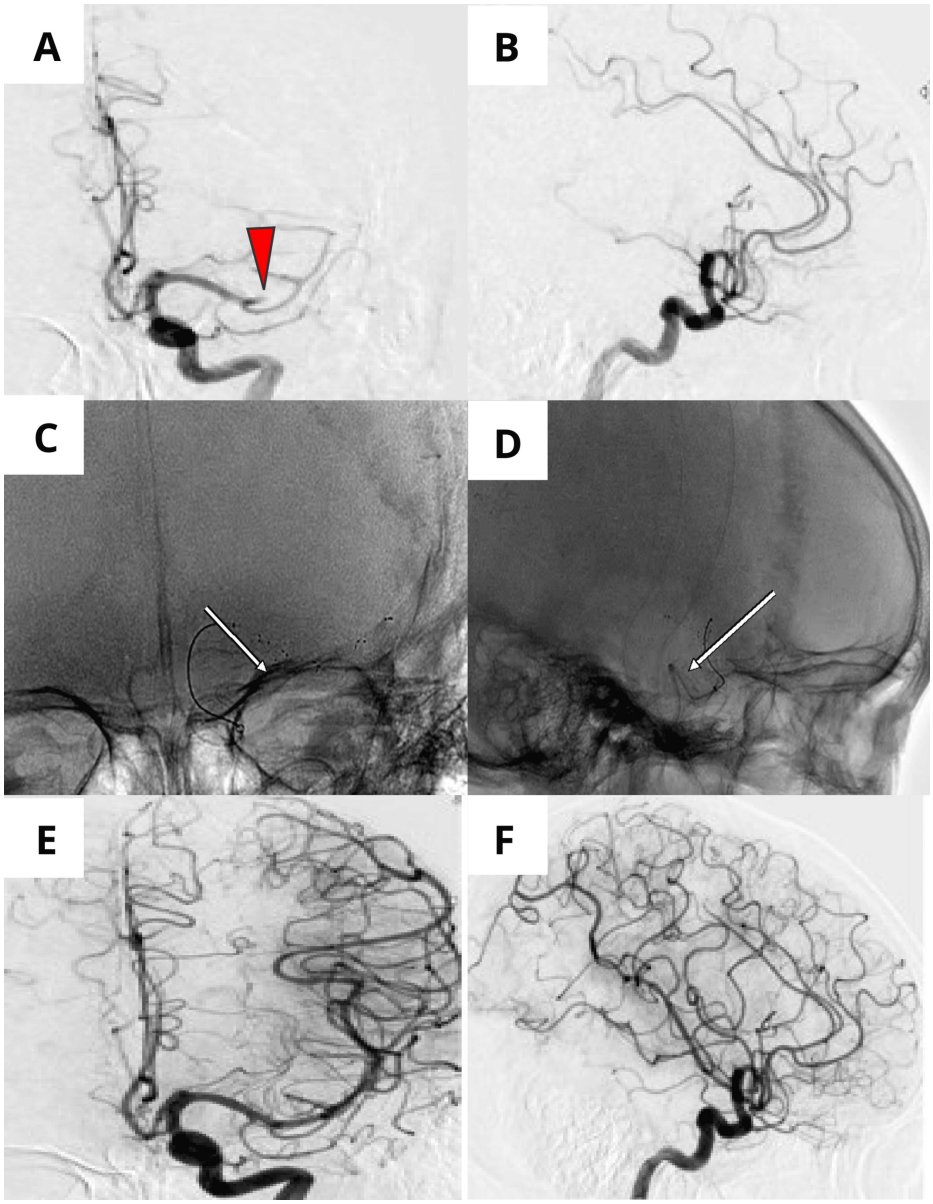


FIGURE 3: Mechanical Thrombectomy Following Conversion to Ipsilateral Transulnar Access

(A, B) Frontal and lateral left internal carotid angiograms show occlusion of the superior division of the left M2 segment (red arrowhead in A). (C, D) Fluoroscopic images demonstrate deployment of the Solitaire 4 × 40 mm stent retriever across the target lesion (white arrows). (E, F) Final angiograms show complete reperfusion (mTICI grade 3) after one pass. The upper-extremity catheter path is not shown in this intracranial image series.

A 5 Fr Esperance aspiration catheter (Wallaby Medical, Laguna Hills, CA, USA), a Trevo Trak 21 microcatheter (Stryker, Kalamazoo, MI, USA), and a Synchro Standard microwire (Stryker) were navigated across the lesion. A Solitaire 4 × 40 mm stent retriever (Medtronic) was deployed from M2 into M1 (Figures *3C*, *3D*). After partial resheathing, the aspiration catheter was advanced to the superior M2 division, and thrombectomy was performed using a combined stent-retriever and aspiration technique based on the stent-retrieving into an aspiration catheter with proximal balloon (ASAP) concept [13]. Complete reperfusion (mTICI 3) was achieved after a single pass (Figures *3E*, *3F*) [14]. Neither heparin nor dual antiplatelet therapy was administered during the procedure. The first arterial puncture occurred at 7:25 p.m., and reperfusion was achieved at 8:05 p.m.; door-to-puncture time was 83 minutes, and puncture-to-reperfusion time was 40 minutes.

Manual compression achieved hemostasis at both wrist puncture sites; arterial pulsation was confirmed following hemostasis. Postprocedural ultrasonography demonstrated preserved patency of both the radial and ulnar arteries, without documented occlusion. The precise timing of ultrasonography relative to hemostasis was not recorded in the material used for this report. No immediate clinically apparent access-

site complication was documented. However, formal palmar collateral circulation testing or standardized long-term forearm arterial surveillance was not performed. Selected admission (D1) and next-day (D2) laboratory results are summarized in Table *1*. Transthoracic echocardiography showed left atrial enlargement and aortic stenosis; the stroke mechanism was considered cardioembolic. Neither heparin nor dual antiplatelet therapy was used during the periprocedural period. Edoxaban 15 mg once daily was started on D4 for secondary prevention. Aphasia and right hemiparesis persisted but partially improved. At transfer to a rehabilitation hospital on D20, the NIHSS score was 20, and the modified Rankin Scale (mRS) score was 4. The 90-day mRS score and long-term vascular outcomes were not available (Table *2*).

Parameter	D1 admission	D2 next day	Unit	Local reference
Hemoglobin	11.3	10.4	g/dL	11.5-15.0
Platelets	18.8	17.6	×10⁴/μL	15.0-35.0
PT-INR	1.06	1.09	-	0.85-1.15
APTT	26.3	26.7	s	25.1-40.0
Fibrinogen	375	347	mg/dL	160-400
D-dimer	4.04	4.44	μg/mL	<1.00
Creatinine	0.71	0.73	mg/dL	0.5-1.3
eGFR	56.6	-	mL/min/1.73 m²	-
Glucose	103	109	mg/dL	70-110
HbA1c (NGSP)	5.8	-	%	4.6-6.2
Total cholesterol	278	263	mg/dL	128-219
LDL cholesterol	201.7	-	mg/dL	65-139
BNP	778.9	-	pg/mL	≤18.4
CRP	0.04	0.08	mg/dL	≤0.3

TABLE 1: Laboratory Findings on Admission and the Following Day

Laboratory values obtained on day 1 (D1) and day 2 (D2), with units and institutional reference ranges. A dash (-) indicates that the test was not repeated on D2.

PT-INR: prothrombin time-international normalized ratio; APTT: activated partial thromboplastin time; eGFR: estimated glomerular filtration rate; BNP: B-type natriuretic peptide; NGSP: National Glycohemoglobin Standardization Program; LDL: low-density lipoprotein

Day/time	Event
D1, 09:00	Last known well.
D1, 17:15	Found collapsed at home.
D1, 18:02	Arrival at hospital; severe left hemispheric stroke syndrome, NIHSS 28.
D1	MRI/MRA: left MCA territory ischemia, DWI-ASPECTS 8/11, left M2 superior-division occlusion.
D1, 18:12 (lab record)	Admission blood tests available; platelets 18.8 × 10^4/μL, PT-INR 1.06, APTT 26.3 s, glucose 103 mg/dL.
D1, 19:25	Initial arterial puncture (right radial access); neither heparin nor DAPT was administered during the intervention.
D1	Radial angiography reveals brachioradial artery; ipsilateral transulnar crossover (individual times not recorded).
D1, 20:05	Single-pass thrombectomy achieves complete reperfusion (mTICI 3).
Postprocedure (time not recorded)	Palpable pulsation after manual-compression hemostasis; ultrasound confirmed radial and ulnar patency.
D2, 07:14	Follow-up laboratory panel available.
D4	Edoxaban 15 mg once daily initiated for secondary prevention.
D20	Transferred to rehabilitation with residual aphasia and right hemiparesis; NIHSS 20, mRS 4.

TABLE 2: Clinical Timeline and Procedural Milestones

D1 indicates the day of admission and mechanical thrombectomy. The timestamps of radial-access failure, ulnar artery puncture, and completion of access conversion were not independently recorded. The 40-minute puncture-to-reperfusion interval includes the initial radial attempt and subsequent transulnar conversion.

NIHSS: National Institutes of Health Stroke Scale; DWI-ASPECTS: diffusion-weighted imaging Alberta Stroke Program Early CT Score; mTICI: modified Thrombolysis in Cerebral Infarction; mRS: modified Rankin Scale; DAPT: dual antiplatelet therapy; MRI: magnetic resonance imaging; MRA: magnetic resonance angiography; MCA: middle cerebral artery; PT-INR: prothrombin time-international normalized ratio; APTT: activated partial thromboplastin time

Discussion

This single case describes technical completion of thrombectomy through ipsilateral ulnar access following failure of transradial guiding-catheter navigation caused by a high-origin radial arterial variant. The requirement for stable large-bore guiding-catheter support means that advancement against resistance in a small or tortuous artery may result in spasm, dissection, perforation, or delay [4,5]. Angiography performed after resistance was encountered revealed the brachioradial route and prompted a change of access. Earlier diagnostic angiography through the 4 Fr sheath might have identified the unfavorable anatomy before upsizing, but such imaging before upsizing was not documented in this case. No immediate vascular injury was documented; an unrecognized subclinical injury cannot be excluded without systematic vascular assessment.

High origin of the radial artery does not, by itself, prohibit radial access; suitability depends on the caliber and configuration of the artery and on the equipment to be advanced [5]. Preprocedural ultrasound in this patient measured the radial and ulnar puncture-site diameters as 2.4 and 1.6 mm, respectively, while the native brachial artery was approximately 4.4 mm. The brachioradial segment diameter and takeoff angle were not reliably measurable from available angiographic views. Importantly, the ulnar diameter of 1.6 mm is small in relation to a 7 Fr slender sheath, creating a possible sheath-to-artery mismatch. The fact that the procedure was completed does not establish a safe caliber threshold for use of such a sheath.

After unsuccessful radial navigation, transfemoral crossover would have been a reasonable alternative, providing a familiar access route while avoiding sequential puncture of both arteries in the same forearm. The operators selected the ipsilateral ulnar route because the local ultrasound and angiographic findings suggested that puncture was technically possible, central arterial tortuosity had been noted on preprocedural computed tomography angiography, and the groin had not been prepared as a sterile access field. The system then followed the proximal ulnar-brachial-axillary arterial pathway. This was an individualized procedural judgment, not a claim that transfemoral rescue was contraindicated. Although initial radial puncture-to-reperfusion time was 40 minutes, there was no matched femoral comparator and the individual durations of radial failure and ulnar conversion were not recorded. Thus, a comparative time advantage cannot be inferred.

Prior publications describe TUA in cardiology and in diagnostic or therapeutic neuroendovascular procedures [6-8], and a technical report with systematic review included thrombectomy-related ulnar access experience [9]. However, those reports are not direct evidence that ipsilateral TUA after failed radial navigation is generally safe, effective, or faster than transfemoral crossover for acute stroke. The contribution of this case is limited to describing one specific access failure, the rationale for the subsequent route selection, and successful technical completion of mechanical thrombectomy.

Sequential instrumentation of the radial and ulnar arteries on the same side raises concern for arterial spasm, dissection, thrombosis, forearm artery occlusion, hematoma, nerve injury, and potentially severe hand ischemia if both forearm arteries become compromised. Formal Allen and Barbeau tests were not performed. Limited puncture-site angiography showed a patent ulnar route and partial visualization of distal hand vessels but was not a formal assessment of palmar arch completeness or collateral adequacy. Despite the small measured ulnar puncture-site diameter, a 7 Fr slender sheath was used. Hemostasis was achieved by manual compression, palpable pulsation was documented after hemostasis, and postoperative ultrasonography confirmed that both radial and ulnar arteries remained patent. These short-term findings are reassuring for this patient, but they do not prove intact palmar collateral function or exclude delayed occlusion. In this context, the potential benefit of preserving the wrist-based setup must be weighed against the additional risk of same-side dual arterial access; a femoral rescue route remains a reasonable alternative [15].

Important limitations include the single-patient design, the absence of a direct femoral comparator, nonrecorded segment-specific crossover times, and the lack of reliable measurements of the anomalous brachioradial diameter and takeoff angle. Formal preprocedural collateral tests were not performed, and limited angiographic visualization cannot establish palmar collateral sufficiency. Although both radial and ulnar arteries were patent on postoperative ultrasound, neither standardized long-term arterial imaging nor 90-day functional follow-up was available. The NIHSS score improved from 28 at presentation to 20 at D20 transfer, when mRS was 4; however, this does not establish that access-route selection improved functional outcome. The small measured ulnar diameter also limits the generalizability of sheath selection. First-pass mTICI 3 reflects technical reperfusion, not established clinical efficacy or access safety.

Conclusions

In this single case, ipsilateral transulnar conversion permitted mechanical thrombectomy and first-pass complete reperfusion after failed radial guiding-catheter navigation associated with a brachioradial artery. Postprocedural ultrasonography showed patency of both forearm arteries, but formal palmar collateral testing and long-term vascular and functional outcomes were unavailable. This experience demonstrates technical feasibility under these specific circumstances; it does not establish general safety, effectiveness, or a procedural advantage over transfemoral rescue. Access selection should therefore be individualized, and further experience is needed before broader conclusions can be drawn.

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: Akihiro Shimoi

Acquisition, analysis, or interpretation of data: Akihiro Shimoi, Ryuya Okawa, Shunsuke Tamaki, Kaito Hosouchi, Kazunori Akaji

Drafting of the manuscript: Akihiro Shimoi

Critical review of the manuscript for important intellectual content: Akihiro Shimoi, Ryuya Okawa, Shunsuke Tamaki, Kaito Hosouchi, Kazunori Akaji

Supervision: Kazunori Akaji

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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