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Distal transradial access in the anatomical snuffbox for balloon guide-assisted stentriever mechanical thrombectomy: Technical note and case report

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Abstract:

Recent trends in neuroendovascular surgery have seen a rise in alternative access utilization. Social media feeds such as #RadialFirst or #RadialForNeuro are the beacons of a growing movement among more and more endovascular neurosurgeons, as they venture away from the traditional femoral access gravitating toward radial access. We have previously shown our distal radial access technique utilizing the snuffbox to be a reliable means of endovascular access and in addition to traditional ventral radial access provides access to the entire cerebrum. Stroke thrombectomy often encounters reticence from those who prefer transfemoral access over the radial access. Thrombectomy has been performed radially in a few series and only once previously in a case report of distal radial access for thrombectomy. Hesitance to adopt radial access for mechanical thrombectomy is often related to perceived increased access times and a lack of suitable balloon guide catheters for radial techniques. Here, we present one of the first descriptions of a distal transradial access with balloon guide flow arrest for stentriever thrombectomy.

Keywords:

Distal transradial access, radial, stroke, thrombectomy

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Introduction

Mechanical thrombectomy is among the most beneficial medical procedures developed in the current era of modern medicine. Multiple large randomized controlled clinical trials, including DAWN,[1] DEFUSE 3,[2] and MR CLEAN,[3] have reinforced its role in improving outcomes after stroke and expanded time windows for the intervention from 6 to 24 h and beyond. Conventionally, transfemoral access is the mainstay approach for mechanical thrombectomy. Over the past decades, interventional cardiologists have adopted a transradial first approach codified in 2012 by the ESC guidelines for acute coronary intervention which recommends radial access over femoral access.[4] This recommendation is based on the improved safety profile of the transradial access over transfemoral approaches. Retroperitoneal hemorrhage (RH) is the most feared groin access site complication. In the cardiac literature, one study looked at 511,106 participants who underwent percutaneous coronary intervention via femoral artery access between 2007 and 2014 and noted a 0.6% overall rate of RH, a 12% in-hospital mortality rate, and an increased 30-day mortality for patients with RH.[5] Although rare, RH is a serious and potentially life-threatening complication of femoral artery

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access for endovascular procedures. Glycoprotein 2b/3a inhibitors (odds ratio [OR]: 2.6), femoral access (OR: 19.6), and warfarin (OR: 2.5), all resulted in increased odds of RH.[5]

Social media feeds such as #RadialFirst among other social media posts have encountered some caution among neurointerventionalists, and caution should be advised as one study noted assessing social media data and inherent bias.[6] Turning to the literature, McCarthy *et al*. noted no difference in reperfusion times, thrombolysis in cerebral infarction (TICI) score, or functional outcomes in patients undergoing transradial versus transfemoral mechanical thrombectomy.[7] The authors concluded that transradial mechanical thrombectomy may be better than transfemoral access in well-selected patients. The authors do report the use of 6 Fr or 7-Fr Cello Balloon Guide Catheters through an exchange technique and state their preferred technique to save time is utilization of large-bore 088 catheters with aspiration (Infinity Guide, Stryker). Only six patients in their series received a radial balloon guide catheter 33%.

Other benefits of radial access include ease of navigation for type 2/3 arches as well as tortuous common origin of the left carotid takeoffs. The access allows the patient to be freely mobile following the procedure immediately, and bleeding site complications are rare and easily controlled with pressure or a radial band.

Distal transradial access or snuffbox access has previously been described for thrombectomy in the literature.[7] Benefits of the snuff box include shorter compression times and theoretical lower risks of thrombosis. Disadvantages include smaller caliber vessels on the deep palmer arch. McCarthy *et al.* utilized a sheathless 088 Infinity guide catheter (Stryker) for the distal radial access.[7] To the best of our knowledge, the use of distal radial access for balloon catheter supported thrombectomy has yet to be reported. We describe our techniques below.

Case Report

A 73-year-old independent female with a medical history significant for congestive heart failure and hypertension presented with right facial droop, aphasia, gaze deviation, and hemiplegia. Her last known well was 2.5 h prior, and tissue plasminogen activator (tPA) was given in the emergency department. Imaging revealed a distal M1 occlusion with large >100 cc penumbra and small to moderate 15cc core [Figure 1]. The patient had a common origin tortuous arch. She was emergently taken for mechanical thrombectomy. Her National Institutes of Health Stroke Scale (NIHSS) was 19.

The procedure was performed awake with minimal sedation. The right arm was used for access according to our previous description of ultrasound-guided distal transradial artery access in the anatomical snuffbox.[8] The patient had a notably slender wrist and small, <2 mm, and distal radial artery. A 5–10 cc of 2% lidocaine without epinephrine was used for local anesthesia. A 5-Fr micropuncture kit was used to cannulate the

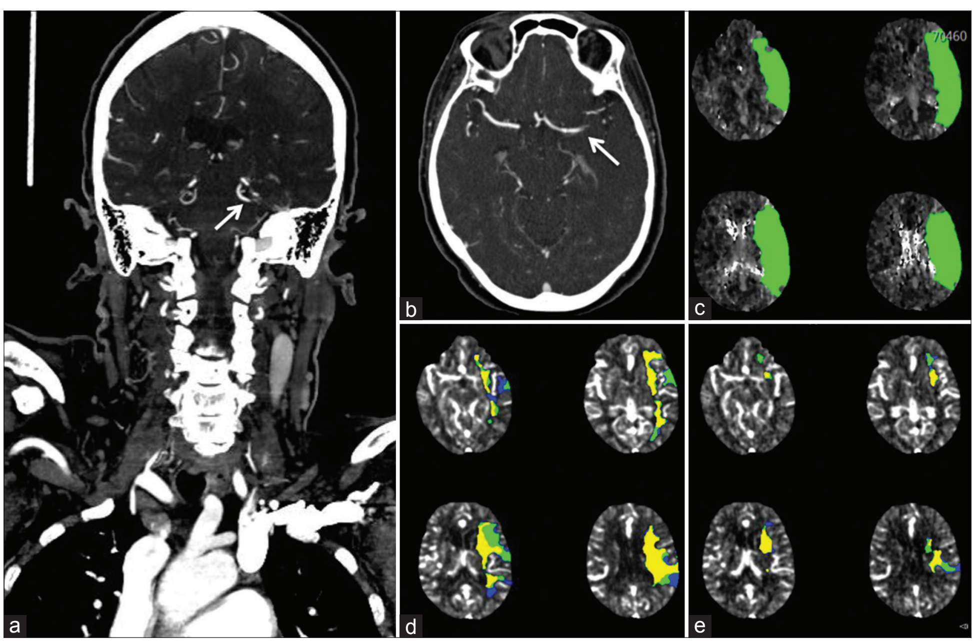

Figure 1: A 73-year-old female with National Institutes of Health Stroke Scale 18 L middle cerebral artery distal M1 clot, posttissue plasminogen activator. (a) Coronal computed tomographic angiography image depicting the common origin left carotid artery from a type 2 arch. (b) Axial computed tomographic angiography revealing distal M1 cutoff. (c) Axial computed tomography perfusion images revealing increased Tmax (green). (d) Axial computed tomography perfusion images revealing decreased cerebral blood volume. (e) Axial computed tomography perfusion images revealing decreased cerebral blood volume or core size

artery, and 100 mcg of nitroglycerin and 5 mg of verapamil were administered intra-arterially. A 7-Fr glide slender sheath was then placed in the snuffbox over an 018 wire [Figure 2]. Given the known common origin, we believed the left common carotid artery could be selected with a glide advantage wire (Terumo) alone through the 6 + Cello (95 cm) balloon guide catheter (Medtronic). The prepped cello was taken up directly over a wire and placed into the high cervical internal carotid artery [Figure 3]. Of note, if the white inserter on the cello is lost a 7F tear away dilator can be used to protect the balloon on insertion. The M1 clot seen on computed tomographic angiography was now in the superior division M2 likely related to tPA administration. A Marksman microcatheter (Medtronic) over a Fathom-16 wire (Boston Scientific) was then navigated into the superior division M3. A micro run was obtained to ensure the catheter was beyond the clot in the correct territory [Figure 4]. A Solitaire 4 mm × 40 mm device (Medtronic) was deployed from the M2/3 into the M1 segment. The device was left up 5 min for clot integration. Of note, the 6 + Cello has a small 054 lumen, as such with the Marksman within it was very difficult to obtain control runs. The device was pulled slowly under Penumbra pump aspiration with the Cello Balloon inflated for flow arrest and minimal flow reversal. A small red clot was noted on the device, and the Cello cleared through the Penumbra pump aspiration. Final runs demonstrated TICI 3 recanalization within 3 h of symptom onset in a single pass [Figure 5]. Access to the procedure completion was 40 min with 19 min of fluoroscopy time and 370 mGy reported.

A PreludeSync Distal Radial Band (Merit Medical) was applied over the snuff box after sheath removal [Figure 2]. The NIHSS was improved to 10 immediately after the procedure. 24 h later, the patient was talking and her NIHSS was 2.

Discussion

Here, we describe the use of a Cello Balloon Guide through a distal radial artery approach for successful left Solitaire M2 thrombectomy underflow arrest and aspiration. This case was performed in an expeditious manner comparable to traditional radial and femoral access techniques. We agree with McCarthy *et al*. in that the use of balloon guide catheters through a radial approach can be difficult given the small internal diameter (ID) of the 6 Fr- and 7 Fr-balloon guides, and the large outer diameter (OD) requiring larger access sheaths. This means that the small balloon guides cannot accept a guiding coaxial Simmons catheter of 4 Fr or 5 Fr size, and thus require the use of an exchange wire technique which can add time to the procedure or anatomy (common origin) favorable for cannulation with a curved glide wire. It is for this reason many radialist forgo the balloon guide despite the ample evidence of balloon guide-assisted technique's superior outcomes through transfemoral placement. Transfemoral balloon guides for mechanical thrombectomy have been noted to shorten procedure times and increased the first pass thrombectomy rates.[9] Furthermore, balloon guide catheters in the STRATIS registry were noted to be independent predictors of the highest first-pass effect and functional outcomes (61%) compared to guide catheters (47%) and distal access catheters (51%).[10] These results seemed to hold true for contact aspiration assisted by the balloon guide catheters as well.[11] A large meta-analysis of over 2000 patients confirmed that these findings suggesting balloon guide catheters are associated with superior outcomes to other conventional guide catheters.[12]

Disadvantages of balloon guide catheters include the time it takes to prep the balloon, the stiff nature of the catheter given the two lumens and the relatively large OD compared to the small ID. From a distal radial perspective, these disadvantages are compounded by a smaller vessel caliber and propensity of the radial artery to spasm. The balloon guide can also not be placed sheathless, as this could damage the balloon, and thus a peel away dilator or sheath is necessary. Even a 9 Fr Cello

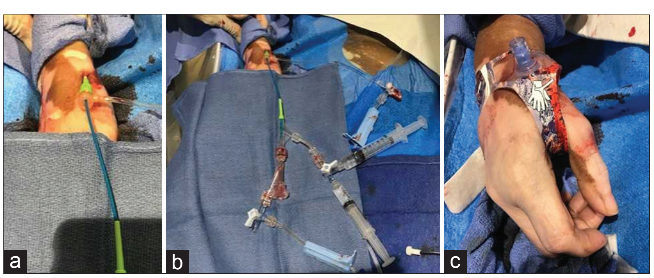

Figure 2: Distal radial (snuffbox) access. (a and b) 7-Fr glide slender sheath in the snuffbox with a 6+ Cello Balloon Guide placed coaxially through. (c) PrecludeSync Distal Radial Band designed for the distal radial or snuffbox compression

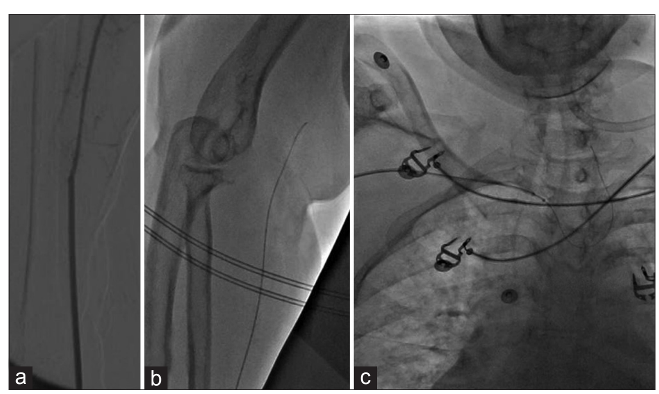

Figure 3: Distal radial access and guide placement. (a) 7-Fr glideslender snuff box sheath roadmap demonstrating minimal radial spasm. (b) Navigation under native images of the glide advantage wire. (c) Selecting the left common origin with the glide advantage wire and advancing the Cello into the left carotid artery

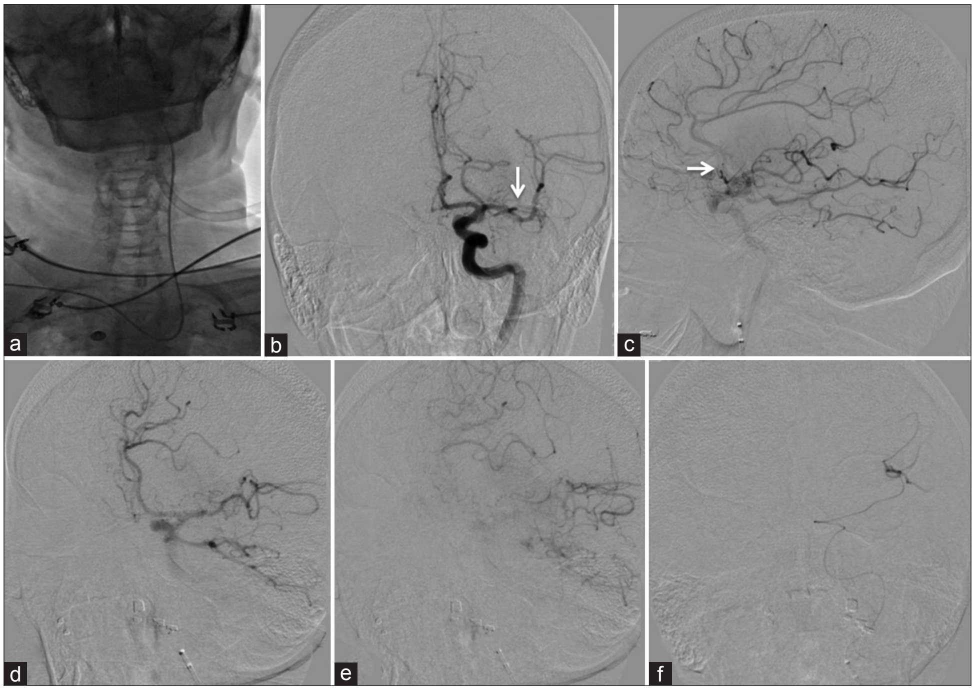

Figure 4: Distal radial artery balloon guide-assisted thrombectomy. (a) Native anteroposterior cervical/cranial images revealing the Cello in the high cervical internal carotid artery. (b and c) Anteroposterior and lateral left internal carotid artery injection revealing a M2 superior division occlusion and perfusion deficit with contrast stasis at origin (arrow). (d and e) Oblique left internal carotid artery injection better revealing the occluded M2 branch with perfusion deficit. (f) Anteroposterior M3 middle cerebral artery microrun demonstrating the catheter within the target territory and beyond the clot

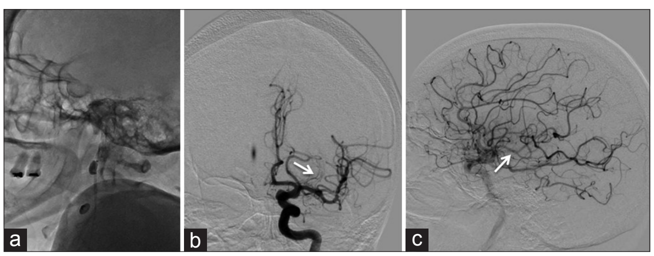

Figure 5: Distal radial artery balloon guide-assisted thrombectomy. (a) Cello Balloon guide inflated in the high cervical internal carotid artery providing flow arrest during device retrieval and aspiration postdevice and clot removal. (b and c) The anteroposterior and lateral final runs after the thrombectomy reveal two M2 from a superior division trunk now seen (arrow) in addition to the frontal parietal M2–M4 branches previously not seen

in the femoral artery cannot accept a 6 Fr Sophia Plus aspiration (Microvention) catheter given the relatively small ID. The other issue with balloon guide catheters and radial placement is the difficulty in selecting the target anterior circulation vessel, oftentimes, a Simmon catheter is necessary, and many operators have adopted a coaxial technique for speed which cannot be performed transradial given the small ID of 6 Fr and 7 Fr Cellos.

Limitations and effective strategies

The distal radial balloon guide technique is great for quick hemostasis and mobility of the patient, especially in those individuals that have received tPA. However, no intermediate aspiration catheter can be utilized, and the ID of 6+ Cello is so small that control runs are difficult with a 027 microcatheter. While flow arrest is achieved, the pump aspiration and flow reversal were likely not as effective until the microcatheter has been removed. As seen in this case, more effective flow reversal could have been achieved with a larger caliber balloon guide, such as a 7 Fr Cello. Another method of increasing aspiration force and flow reversal would be removal of the microcatheter completely after the stentriever is deployed; however, this approach raises other concerns such as device failure or fracture. There is a learning curve to distal radial access, and one should gain experience and familiarize themselves with the technique on nonemergent diagnostics prior to emergent strokes. Glideslender sheaths provide the highest ID for OD size and should be used for all radial cases requiring a sheath. The last drawback of the current generation balloon guides in 6–7 Fr size includes the inability for emergent carotid stent if needed in the event of tandem stenosis due to smaller ID. This pathology would require the larger 088 conventional guide catheters but can still be done through a distal radial approach as previously described by our group.

Conclusion

As illustrated in this case, balloon guide use for thrombectomy and flow arrest are possible through a distal radial artery approach with good results in select cases with favorable anatomy. The current generation balloon guide catheters are not tailored to radial access given large ODs and small IDs. New development of the balloon guides in a longer, flexible design, with larger IDs is necessary for speedy coaxial placement through a distal radial approach for thrombectomy.

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Conflicts of interest

There are no conflicts of interest.

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