Snuff box radial access: A technical note on distal radial access for neuroendovascular procedures

Introduction

Radial access has been used in the field of interventional cardiology for years and is associated with very low access site complication rates, decreased length of stays, and decreased hospital charges.[1] Transradial access was originally described in 1989 and has since been incorporated into a myriad of interventions.[2] Recently, radial access has become more prevalent in neuroendovascular procedures due to more pliable catheters and technological advances allowing for smaller diameter radial access to distal intracranial vasculature. Unlike interventional cardiology procedures, the arch and cervical vessels must be interrogated during neuroendovascular procedures which require longer, more trackable catheters.[3,4] Traditional radial artery access can typically accommodate up to 6-French sheaths, and the arm is placed on an arm board in a supinated position. Micropuncture is then completed on the ventral radial artery just proximal to the hand. Benefits of radial access include patient satisfaction, immediate ambulation, and lower access site complication rates. One cost–benefit analysis noted 275 dollars savings per patient accessed radially instead of femorally.[5] From a surgeon's perspective, traditional radial access with the patient's hand and arm supinated on a lateral arm board can ergonomically feel different than transfemoral access and can require an operator to stand closer to the radiation source. Conventionally, radial access in neuroendovascular procedures was used primarily for posterior circulation access, rescue, or bailout access when transfemoral access could not be obtained.[6]

Snuff Box (Aka Distal Lateral Radial) Access

The anatomic snuffbox is a triangular-shaped depression on the radial side of the wrist. The "snuff box" was named for its unique ability to cradle powdered tobacco for insufflation. Its boundaries include laterally the extensor pollicis brevis and abductor pollicis longus tendons. The medial border is the tendon of extensor pollicis longus. Proximally, the styloid process of the radius is the landmark, while the floor consists of the scaphoid bone. The distal radial artery lies at the depth of the snuff box passing along the scaphoid from its ventral location to its dorsal palmar arch. The distal radial artery is roughly 80% of the size of the vessel in the forearm and roughly 2.5 mm.[7] The deep palmar arch is the branch of the radial artery in the snuff box emanating from the superficial arch at the proximal wrist. With distal radial access, iatrogenic occlusion seems to be better tolerated and the vessel can be accessed more proximally at a later date given the preserved traditional access point at the ventral wrist. An occlusion at this distal location theoretically preserves the superficial palmar arch and its collaterals. The superficial branch of the radial nerve runs just proximal to the artery but more superficial. Distal transradial lateral access or snuff box access has been previously detailed in cardiology literature. The left radial snuff box access allows for comfortable positioning of the patient's hand by the right groin, which permits the operator to stand at a further distance from the radiation source, allowing for patient comfort and an ergonomically friendly workflow similar to femoral access [Figure 1]. One study of 70 cardiac patients noted a snuff box arteriotomy failure rate of eight patients.[8] Further benefits cited for snuff box access include shorter discharge times due to statistically significant decreases in the time needed for radial artery compression (69 min less than traditional radial puncture for punctures in the snuff box in patients undergoing cardiac interventions).[9] As of 2018, only 200 snuff box radial access cases had been described and predominately in the cardiac literature.[9]

Snuff Box Radial Access for Neuroendovascular Procedures

There are very few descriptions of this relatively new access point in the neuroendovascular literature aside from a case report published in 2019 which details the use of snuff box radial access for one diagnostic angiogram and one mechanical thrombectomy.[10]

We have recently switched to a predominately radial approach to neuroendovascular surgery. The snuff box radial approach has been used for all of our diagnostic cases and many of our interventions since the switch from femoral access. To date, we have completed 24 diagnostic and interventional cases through the anatomic snuff box. There have been no access site complications, and hemostasis is obtained with a TR Band radial compression device (Terumo) placed with the balloon on the snuff box. Gauze can be fashioned for extra compression should the balloon not sit on the snuff

box correctly (the TR band was designed for traditional radial access). Our typical diagnostic angiogram is completed with a 4- or 5-French short sheath with a radial cocktail consisting of heparin, nitroglycerine, and verapamil. This cocktail is given after the transitional dilator is placed. Next, a 4- or 5-French Simmons 2 Glide catheter (Terumo) is used for diagnostic angiography. We have aborted snuff box access and converted to femoral or traditional radial access in three cases, two of which were related to difficulty with placing intracranial guides due to patient anatomy and one failed access attempt. At this time, emergent thrombectomies are assessed for ease of access and the easiest and fastest access completed. However, we are performing carotid stents radially with the technique in selected patients.

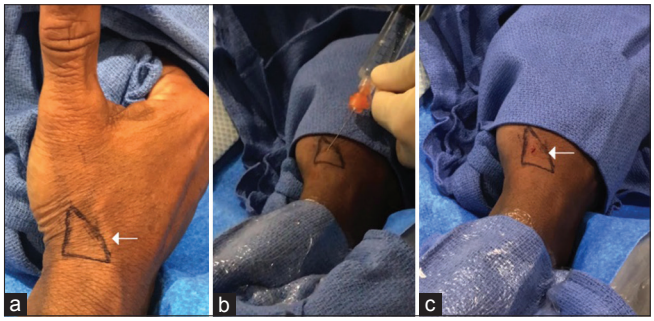

Figure 1: Distal radial "snuff box" access technique: (a) Identifying the snuff box (white arrow) is performed by having the patient abduct and extend their thumb thus activating the extensor pollicis longus and abductor pollicis longus tendons. (b) A small 2–3 cc aliquot of lidocaine is injected before incision. (c) Depending on sheath or guide size (if placing a sheathless long guide), the skin is nicked or incised along the distal radial artery (white arrow)

This approach offers the operator a very similar experience to transfemoral access as the hand is left in the anatomical position (thumbs up) at the side (next to the groin). The sheath exits the wrist at a 30° angle and is very supportive given the surrounding tendons and the scaphoid bone. No closure devices are needed, and when a 4-French sheath is used, coagulation studies need not be as stringent as with traditional transfemoral access. Nursing staff monitors our patient for 1 or 2 h depending on sheath size and coagulation profile. Further, the patient can ambulate and sit up immediately once the procedure is completed and patient satisfaction has been encouraging. Patients appreciate not having to expose or have their groin shaved for traditional femoral access. Companies such as Merit Medical is now making a new snuff box-specific compression band that is customizable (PreludeSYNC Band) catering to this distal approach.

Our Snuff Box Access Technique

The patient is placed onto the table in the supine position with their arm at their side and thumb pointing up. The anatomic snuff box is palpated and the radial pulse identified. Allen's test or similar test is utilized

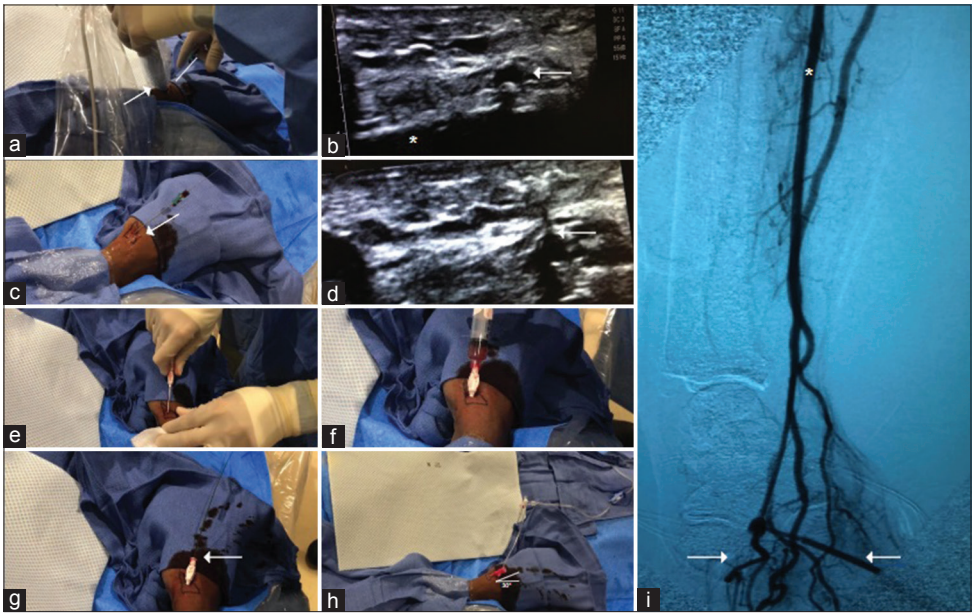

Figure 2: Distal radial "snuff box" access technique: (a) The ultrasound probe is positioned in a coronal section of the distal radial artery (white arrow), keep in mind that the vessel is on the top of the scaphoid and runs lateral and up at roughly 20° before reaching the back of the hand from the ventral wrist location. (b) The distal radial artery is seen within the snuff box (white arrow), the scaphoid bone is noted with a white star beneath. (c) Once the micropuncture needle returns brisk arterial blood (note the medial and inferior direction of the needle in the snuff box, white arrow), (d) we can verify intraluminal placement of the needle on ultrasound (white arrow). (e) A 4- or 5-French transitional dilator is placed allowing a 38 Bentson guide wire for sheath or guide placement. (f) A radial cocktail of heparin, 100-μg nitroglycerine, and 2.5–5 mg of verapamil is given slowly through the transitional dilator. (g) The 038 Bentson wire is placed through the dilator (white arrow) and the dilator removed. (h) Finally, the sheath or long guide is placed and attached to flush (note the arm is at the patient's side and the sheath facing the surgeon). (i) Good distal runoff (white arrow) and proximal arterial patency (white star) are noted on the distal radial artery run

to document palmar collaterals. After infiltration with lidocaine, a linear skin nick or incision (depending on the sheath or guide size) is utilized to open the skin. A micropuncture needle is directed under ultrasound into the distal radial artery keeping in mind that the vessel is traveling up and lateral toward the operator (for the right-sided access, the needle must angle inferior and medial). Once a flash of blood is obtained, a 0.018 inch Cope Mandril is used to cannulate the artery. A transitional dilator is utilized at this point and the radial artery cocktail given. Next, a 0.038 inch Bentson wire (Cook Medical) is utilized and the 4–6-French short sheath is placed [Figure 2]. For focal radial artery spasm at the apex of a short sheath, one bailout maneuver we have performed is the placement of a 25-cm sheath to bypass the spasm after verapamil injection if the wire is able to freely traverse the narrowing. Our preferred 6-French guides in 070 lumens include Benchmark (Penumbra) for posterior circulation procedures or Envoy (Depuy-Synthes) for anterior circulation when added firmness is needed. For procedures demanding large bore guide catheters 0.088–0.091 inch, we utilize the Infinity or Infinity Plus guide (Stryker) with a sheathless technique. Berenstein diagnostic catheters are utilized for coaxial placement of guide catheters into the ipsilateral vertebral artery to radial puncture. Simmons 2 Diagnostic (Glide catheters for diagnostic procedures) catheters are used for anterior circulation access into the carotid arteries or contralateral vertebral artery access. We have successfully reaccessed snuff box access points as soon as 5 days after the first puncture with ultrasound.

Snuff Box Radial Neuroendovascular Case Examples [Figures 3-6]

In the first case we performed a snuff box radial approach with a 5-French short sheath (Terumo) [Figure 3]. A 5-French Simmon 2 glide catheter and 0.035 glide wire (Terumo) were utilized to access and climb into the right external carotid artery. The patient had a life-threatening oral cavity hemorrhage from a recent

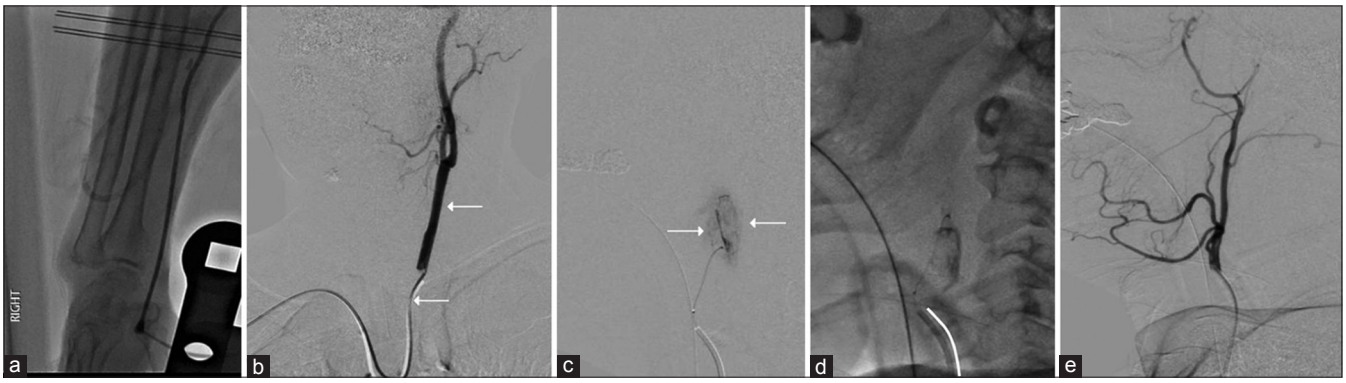

Figure 3: Distal radial "snuff box" approach for external carotid artery oral cavity hemorrhage post tumor biopsy. (a) Roadmap post 5-French sheath placement reveals no vasospasm and patent proximal radial artery. (b) Anteroposterior view Simmon 2 Glide catheter is placed over a 035 Glide wire into the right common carotid artery (white arrows) and navigated into the external carotid artery. (c) (Lateral view) Headway Duo microcatheter is placed coaxially through the Simmons 2 Glide catheter and a micro run demonstrates a small neoangiogenic vessel with tumor blush (white arrow), small active extravasation (mouth was packed with gauze) and dissection from the ascending pharyngeal artery. (d) (Lateral view) Onyx 34 (EV3) is injected with good tumor and dissected vessel penetration. (e) (Lateral view) No off-target embolization noted on the post embolization external carotid artery run. The patient had the packing removed the next day

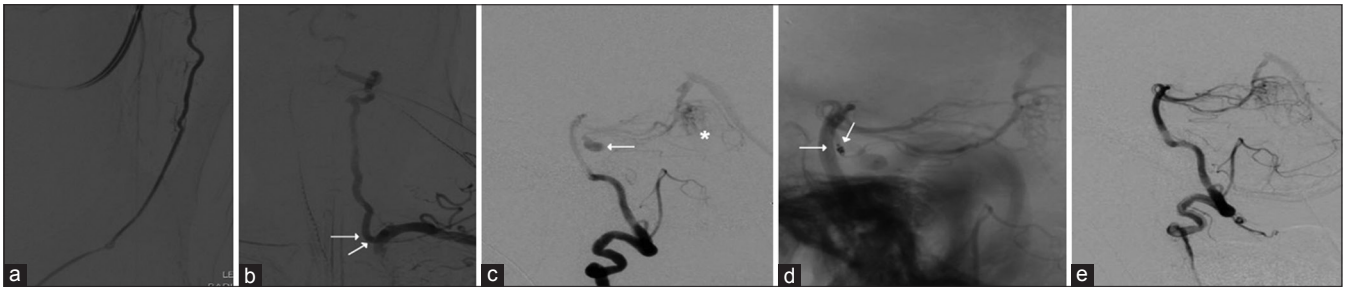

Figure 4: Distal radial "snuff box" approach for embolization and parent vessel takedown of left superior cerebellar artery contributing to a 9 mm rapidly enlarging flow-related aneurysm. (a) Roadmap post-6-French short sheath placement reveals no vasospasm and patent proximal radial artery. (b) (Anteroposterior view) left subclavian roadmap reveals a moderately tortuous left vertebral artery origin (white arrows). (c) (lateral view) Left vertebral injection reveals a large 9-mm flow-related superior cerebellar artery aneurysm (white arrow) contributing to a tentorial/precentral vein Borden 3 arteriovenous malformation/dural arteriovenous fistulae (white star). (d) The superior cerebellar artery was very stenotic before the aneurysm, and despite multiple attempts could not be navigated past, thus a parent vessel takedown with coils (white arrows) and Onyx 34 was performed just proximal to the aneurysm. (e) (Lateral view) Post left superior cerebellar artery takedown left vertebral run demonstrates no further aneurysm, but the contralateral superior cerebellar artery continues to fill the dural arteriovenous fistulae/arteriovenous malformation

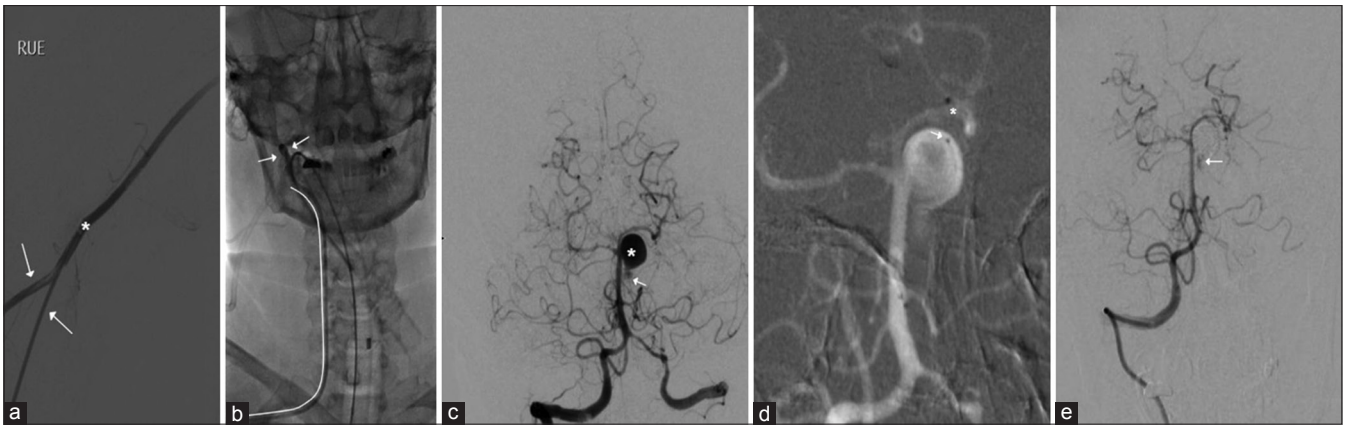

Figure 5: Distal radial "snuff box" approach for low-profile visualized intraluminal support stent assisted coiling of a 1.2 cm ruptured left superior cerebellar artery aneurysm. (a) A 25-cm 6F sheath was placed, and roadmap of the distal brachial (white star), proximal ulnar and radial arteries (white arrow) is seen. (b): (Anteroposterior view unsubtracted) the 6F Benchmark guide can be seen in the right V3 portion of the vertebral artery (white arrows). (c) (Anteroposterior view) Right vertebral run demonstrates a large 1.2-cm basilar/superior cerebellar artery aneurysm (white star) with fusiform superior cerebellar artery originating from the aneurysm inferiorly (white arrow). (Patient and family wishes were for endovascular treatment after discussion of open vascular treatment and endovascular treatment). (d) (Anteroposterior view) Right vertebral roadmap is revealing the Headway 17 (white star) in the left posterior cerebral artery and the Headway Duo in the superior cerebellar artery aneurysm (white arrow). (e) (Anteroposterior view) Post-low-profile visualized intraluminal support stent coiling right vertebral injection reveals the dome of the aneurysm has been excluded, a small amount of filling of the superior cerebellar artery is present inferiorly (white arrow), which will be observed for now

Figure 6: Distal radial "snuff box" approach for the right common and internal carotid artery stenting for 60% tandem stenosis in a symptomatic patient. (a) A roadmap after the transitional 5F dilator was placed and radial cocktail given (this is because we used a 80-cm 6F Infinity Plus 091 guide without a short sheath). (b) (Anteroposterior view) Roadmap of the common carotid artery details the sharp turn from the right brachiocephalic into the right common carotid artery (white arrow). (c) (Anteroposterior view) Right common carotid artery run, tandem common, and internal stenosis can be seen (white arrows), the contour of the Infinity guide from the right brachial to the right common carotid artery can be seen (white stars). (d) (Anteroposterior view) The Spider FX can be seen in the upper independent component analysis and again noted is the hairpin (white star) turn that the guide takes for stent delivery from the brachial artery to the right common carotid artery. (e) (Anteroposterior view) Balloon angioplasty with a 5-mm Euphora balloon post stenting can be seen (white arrow). (f) (Anteroposterior view) Poststenting and angioplasty right common carotid artery run reveal no residual stenosis and mild distal internal carotid artery spasm from the Spider FX distal embolic protection device (removed) (white arrow)

tumor biopsy. A small pseudoaneurysm within a tumor blush was seen and embolized with Onyx 34 through Headway Duo microcatheter (Microvention) was coaxially placed through the Simmons 2 Glide catheter for embolization. Tip: Radial-placed sheaths even the Glide Simmons 2 catheters are supportive enough to perform embolizations in extracranial vessels.

In the second case we performed a snuff box radial approach with a 6-French short sheath (Terumo) [Figure 4]. A Benchmark guide catheter (Penumbra) over a Berenstein catheter was used to access the V4 vertebral artery. A Headway Duo microcatheter (Microvention) was used for parent vessel superior cerebellar artery (SCA) takedown given a rapidly enlarging ruptured 9-mm flow-related SCA aneurysm due to a dural arteriovenous fistulae/arteriovenous malformation at the precentral vein. Coils and Onyx 34 were utilized. Tip: Radial access for posterior circulation procedures provides a simple route when ipsilateral to the vertebral artery; this access is preferred, especially in the elderly as mobility is not limited.

In the third case we utilized a snuff box radial approach with a 6-French 25-cm sheath given some mid radial artery spasm that only a Bentson wire (Cook Medical) would initially cross [Figure 5]. The 25-cm sheath was able to reach the brachial artery. On removal of the sheath, the radial artery was patent. A Benchmark guide

catheter (Penumbra) was again utilized and this large 12-mm SCA/basilar artery aneurysm was stent coiled with a low-profile visualized intraluminal support stent (Microvention) in the basilar/left posterior cerebral artery and numerous HydroCoils (Microvention). Tip: Sometimes, focal spasm at the end of a short sheath can impede access in the radial artery, after giving verapamil, if wire will freely pass, a 25-cm sheath can be placed radially to bypass this.

We utilized an Infinity Plus 091 80-cm guide (Stryker) without a short sheath through the snuff box [Figure 6]. A Simmons 2 130-cm (Cook Medical) diagnostic catheter was placed coaxially through the guide to access the right common carotid artery. A Spider FX (Medtronic) 4-mm distal protection device was utilized and a Xact stent (Abbott) placed across the tandem common and internal carotid stenosis in this symptomatic patient. Balloon angioplasty with a 5-mm Euphora balloon (Medtronic) was completed. The tight turn from the subclavian into the right common carotid artery was difficult to manage; however, with slow steady pressure on the stent, the Infinity Plus guide remained stable and allowed for the stents passage into the carotid artery. Tip: Large-bore catheters can be placed through the snuff box technique; we recommend no short sheath be utilized.

Conclusions

Snuff box, or distal transradial access, is a useful technique in a surgeon's armamentarium. While this technique's use is in its infancy within the neuroendovacular setting, at this time, it appears to be safe, well tolerated, and preferred by patients over transfemoral access.

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