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Case Report *Vascular Interventions*

Renal artery embolization before cryoablation using radial artery through an abandoned hemodialysis fistula

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ABSTRACT

In patients with end-stage renal and current or planned arteriovenous fistula, trans-radial access is listed as a relative contraindication to preserve future hemodialysis (HD) fistula sites. Herein, we report a case of trans-radial trans-fistula arterial access in the setting of an abandoned HD fistula with preserved flow.

Keywords: arteriovenous fistula, cryoablation, embolization, trans-radial

INTRODUCTION

The use of trans-radial artery access (TRA) was first described in 1989, has increased over the past few years, and is now the standard to care arterial access for coronary angiography and percutaneous coronary interventions.[1-3] The adoption of TRA within interventional radiology (IR) has been slow; however, TRA has a number of advantages compared to femoral access, including a lower rate of bleeding complications, which is particularly important for patients undergoing IR procedures who have higher incidences of acute bleeding or coagulopathy from hepatic disease or disseminated intravascular coagulation, early post-procedure ambulation for patients, and rapid recovery hastening same-day discharge.

Radial artery occlusion is a common complication, occurring in around 8% of patients; thus, the society for cardiovascular angiography and interventions and the National Kidney Foundation have designated TRA a relative contraindication for patients with end-stage renal disease and planned hemodialysis (HD) fistula creation, as this could impede the creation of a fistula.[4] In addition, the presence of an existing upper extremity dialysis access elicits hesitancy to use TRA due to concern for jeopardizing the graft or fistula. Here, we describe a case implementing trans-radial trans-fistula arterial access in a patient with abandoned arteriovenous (AV) fistula with preserved flow for the purpose of embolizing the left renal artery before renal cryoablation therapy.

CASE REPORT

A 85-year-old male presented with a medical history of end-stage renal disease previously requiring HD, through a surgically created left upper extremity brachial to cephalic fistula.

Three years prior, patient received a cadaveric renal allograft transplant and now is in chronic kidney disease stage 3b, and does not require HD. The patient with gross hematuria underwent a multiphase magnetic resonance imaging and was found to have two distinct arterial enhancing renal masses in the left kidney (2.6 cm), consistent with bilateral T1a renal masses. The patient was referred to IR for minimally invasive local therapy with percutaneous ablation.

The patient underwent general anesthesia with endotracheal intubation. The patient was subsequently placed in the prone position on our nexaris angio-computed tomography (CT) combination angiography and CT unit (Siemens Healthineers, Erlangen, Germany) for the duration of the procedure. Before the procedure, a Barbeau test was performed to evaluate the patency of the radiopalmar arch revealing a type B wave form damping with complete recovery of flow at the left thumb. Left radial artery access was obtained through Seldinger technique using a 5 Fr Slender micropuncture Glidesheath (Terumo Interventional Systems, Somerset, NJ, USA). Next, a 5 Fr 130 cm Bernstein base catheter (Angiodynamics, Latham, NY, USA) was advanced just distal to the HD access site. Left upper extremity angiogram demonstrated the abandoned arteriovenous (AV) fistula with preserved flow into the venous limb with no opacification of the proximal brachial artery [Figure 1]. Subsequent angiogram with gentle manual compression of the outflow vein successfully opacified the proximal brachial artery. The AV fistula was traversed using the base catheter and a 0.35" Glidewire [Figure 1].

The base catheter was advanced into the abdominal aorta to the levels of the renal arteries. The main left renal artery was selected and a 2.4 F microcatheter was coaxially introduced. Angiogram followed by CT angiogram of the left renal artery with 4 mL of dilute with Omnipaque™ (iohexol) (GE Healthcare, Chicago, IL, USA) (50/50 contrast to normal saline) revealed the vascular supply and blush of the large left renal lesions [Figure 2]. The larger lesion was central in loculation and subsequently embolized with 40-micron particles (embozene [Varian Medical Systems, Palto Alto, CA]) mixed with Lipiodol (Ethiodized Oil [Gubert, Princeton, NJ, USA]) to decrease heat sink.

Due to the anterior location of the renal mass, before placement of left-sided probes, hydro-dissection with dilute sterile water was performed through a percutaneously placed 15 cm Yueh needle with the goal of displacing the adjacent large bowel from the region of interest using CT fluoroscopy [Figure 2]. Two 14 G IceForce (Boston Scientific, Marlborough, MA, USA) cryoablation probe was positioned within the left-sided renal lesion. Probes then underwent three freeze-thaw cycles with 10 min of freezing and 8 min of passive thawing. The progression of the ablation treatment

Figure 1: Left trans-radial access and evaluation of left upper arm fistula. (a) After radial access, 5 French catheter was advanced to the radial artery immediately distal to the anastomosis (black double arrow). Angiogram identified fistula and outflow vein (white arrow). Incidental note of stenosis in the outflow vein (black triangle). Additional flow was seen in the ulnar artery (curved white arrow). (b) Angiogram after manual compression of the fistula identified the brachial artery (black arrow) with patency of the outflow vein (white arrow). Prior stenting of the outflow vein (white triangle). (c) 5 French catheter was advanced into brachial artery (black arrow), angiogram with flow through the artery and fistula. (d) Post-procedure angiogram through the brachial artery (black arrow), again angiogram with flow through the artery and fistula is seen with patent flow in the proximal venous limb (white arrow).

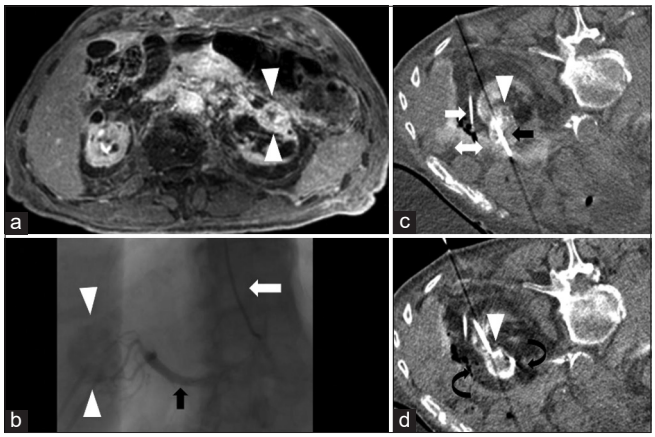

Figure 2: Radial access performed for angiogram and embolization before renal mass ablation. (a) Contrast-enhanced T1-weighted magnetic resonance imaging identifies a 2.6 cm centrally located mass in the native left kidney (white arrowheads). (b) Radial approach angiogram of the left kidney (white arrow 5 French base catheter; 2.4 French microcatheter is the distal renal artery (black arrow). Arterial enhancement of round renal mass (white arrowheads). (c) Intra-procedure computed tomography (CT) before ablation. Renal mass with lipiodol staining after embolization (white arrowhead). Hydro-dissection (white arrow) to separate kidney from adjacent bowel loops performed through a Yueh needle (white arrow). Cryoablation probe through the renal mass (black arrow). (d) Post-ablation CT, renal mass with lipiodol staining (white arrowheads), cryoablation iceball surrounding the renal mass (curved black arrows).

was tracked in real time through selective CT angiography to ensure contained growth of the iceball and an appropriate margin. Post-treatment cross-sectional imaging with 4 mL of dilute contrast demonstrates adequate treatment of all the left renal lesions. Radial hemostasis was subsequently achieved with Terumo TR band (Terumo Interventional Systems, Somerset, NJ, USA).

At the conclusion of the procedure, physical examination of the left upper extremity fistula was performed and an appropriate thrill was noted, similar to before the examination. The patient was admitted for observation and physical examination the next day identified a strong pulse in the left radial artery and again an appropriate thrill in the fistula. Approximately 1 month after the procedure, a Doppler ultrasound of the upper extremity fistula was performed. Good flow volumes (542 mL/min) were documented through the fistula with patency of the radial artery.

DISCUSSION

TRA access for percutaneous coronary intervention endovascular procedures is common; however, the use of TRA access is less common in IR for abdominal interventions. Advantages for using TRA compared to trans-femoral artery access (TFA) include an overall lower bleeding risk, shortened recovery time, and patient preference.[5] Often in TFA, closure devices or sustained pressure over the femoral artery are used to provide hemostasis whereas TRA can achieve hemostasis with radial compression bands, which may reduce the cost of the procedure and save time at the conclusion of the procedure and during recovery. However, renal disease and the need for future HD fistula creation is a relative contraindication to performing TRA. Typically, a distal to proximal approach to fistula creation is preferred with the radial artery initially assessed; thus, radial artery preservation is preferred.

Very little information is available in IR for the use of TRA after HD fistula creation. A previous case reported in the cardiology literature discussed the success of TRA for a coronary intervention in an abandoned HD fistula.[6] In the setting of an abandoned fistula with preserved flow, traversing the AV fistula to access the brachial artery proved to be challenging. In our procedure, after multiple attempts to access the brachial artery from the radial artery, occlusion of the venous outflow of the fistula using manual compression for a "blow back angiogram" was essential to evaluate the anatomy and after the occlusion, we were able to traverse the brachial artery beyond the anastomosis. Although manual compression is the classic method to opacify the proximal arterial limb, other techniques can be employed to restrict the venous outflow of the AV fistula site. For example, balloon occlusion with the use of a Fogarty balloon can be employed to achieve retrograde occlusive opacification, which is a safe and cost-effective method to evaluate an AV fistula. It is imperative to keep in mind that even with continued flow in the AV fistula, thrombus may be present in the outflow vein which can be dislodged and flow to the pulmonary artery; thus, we advocate avoiding wire or catheter access into the venous outflow. In our case, we did observe venous stenosis before a previously placed stent in the vein; thus, some degree of diminished turbulent flow was suspected in the AV fistula.

Once we traversed beyond the anastomosis, the base catheter was continued into the descending and abdominal aorta. Given the size, central location, and presence of a renal transplant, an angiogram was performed before percutaneous ablation of a renal mass for multiple reasons; (1) direct intra-arterial angiogram with CT better delineates the renal mass with less contrast. Pre- and post-CT scans were performed with a total of 6 mL of contrast compared to 70–150 mL of contrast required for a systemic CT. (2) Given the central location of the mass, and relatively large size (2.6 cm) embolization was performed to overcome heat sink effect. (3) Lipiodol was added to the particle embolization material to attain additional staining of the tumor to improve the accuracy of the probe placement and to better assess coverage of the iceball and margin on the post-procedure scan.

CONCLUSION

Trans-radial arterial access in the setting of abandoned HD fistula can be performed safely, while retaining the integrity and flow through the fistula. However, patients that have AV fistulas with preserved flow can present a challenge to obtaining trans-fistula access. Utilization of manual compression or other occlusive techniques can be safely employed to opacify proximal arterial limbs and subsequently obtain trans-fistula access. Further investigation in trans-radial, trans-fistula access is required to evaluate safety of TRA with current AV fistula use for HD.

Ethical approval

The Institutional Review Board approval is not required.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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