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Microcatheter Crossing of Radial Artery Loops and Tortuosities: New Ideas in Reducing Trans Radial Approach Crossover

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Abstract

BACKGROUND: Transradial access is currently the default access site for percutaneous cardiovascular interventions. Radial artery (RA) anomalies present a significant challenge in radial access success. RA 360-degree loops are an uncommon, but quite challenging vascular anomaly even for the most experienced radial operators.

CASE REPORT: We report on two cases of patients with complex RA loops referred for PCI through radial approach in a high-volume radial center. Pre-procedural RA angiography was performed in both cases identifying a 360-degree RA loop in the proximal part of the RA below the entrance into the brachial artery. In both cases, we present a novel "Microcatheter crossing" technique of the complex RA loop as a new strategy in overcoming even the most difficult radial adversary. After identifying the loop a hydrophilic wire 0.014 inch was used to cross the loop and extend it in the upper arm. Then a microcatheter ASAHI corsair (Asahi Intecc USA, Inc.) was advanced through the loop without difficulty. The microcatheter is advanced through the wire until middle of the upper arm. Hydrophilic wire is then exchanged with High Torque Iron man guide wire (Abbott Vascular). Again, the wire is advanced in the upper arm. Microcatheter is then removed and 5F catheter JR 4.0 or similar is advanced gently through the iron man wire with a clockwise rotation through the loop. Then, wire and catheter are pulled back to straighten the loop. The percutaneous angiography procedure was performed successfully in both cases.

CONCLUSION: Both patients were discharged without registered bleeding complications from place of puncture. They both reported slight pain during the beginning of the procedure in the arm of puncture, but without additional problems after the procedure.

Introduction

Transradial access (TRA) is now the default access site for percutaneous cardiovascular interventions [1-3]. All current guidelines for practice support conversion to radial access for all angiographic diagnostic and interventional procedures with an emphasis on decreasing access site bleeding and vascular complications without sacrificing procedural success [4-9]. TRA is of particular benefit in patients with increased risk of bleeding and vascular complications: Female gender, elderly, obesity, low weight, hypertension, renal failure, low platelet count, and anemia [4-8].

Still TRA is a complex approach with its own learning curve for operators, due to not so infrequent anatomic variations of the radial artery (RA) that can influence radial access success during angiographic procedures [9-14] and cause switching to another approach to finish the intervention. 360 degree RA loop is the most complex RA anomaly with the highest crossover rate in published studies [9-14]. It is important that physicians learning the radial technique become familiar with common anatomic variations and learn techniques how to navigate through them [9]. Several techniques have been developed over the years by dedicated radialists to help in overcoming these complex variations during procedures [15-19]. One of the most frequently used by operators is the balloon assisted tracking (BAT) technique BAT [16,18]. Pre-procedural RA angiography has shown to be of great value in timely identification of these anomalies and proper planning for the following procedure [20].

In these case series, we present a new technique that can help in overcoming most cases with RA anomalies, especially complex RA loops, found during transradial coronary procedures.

Case 1

A 50-year-old male patient with chest pain during physical strain and hypertension was admitted to our hospital. His chest pain started several months ago. A 12-lead electrocardiogram showed T-wave

inversion in the DIII and aVF leads. Transthoracic echocardiography was done at a regional center that showed hypokinesia of the inferior wall. After informed consent, coronary angiography was started. RA puncture and cannulation were performed using counter puncture technique with a 20 G plastic intravenous cannula and 0.025-inch mini guide wire of 45 cm and followed by 6 Fr hydrophilic introducer sheath (Terumo, Japan) placement. Spasmolytic cocktail (verapamil 5 mg) was given intra-arterially through the radial sheath. After the insertion of 6 Fr radial sheath, pre-procedural angiography was performed as a routine procedure before every percutaneous intervention at our hospital. A solution of 3 ml of contrast diluted with 7 ml of blood was injected through the cannula or through the side arm of the sheath under fluoroscopy in the posterior-anterior projection.

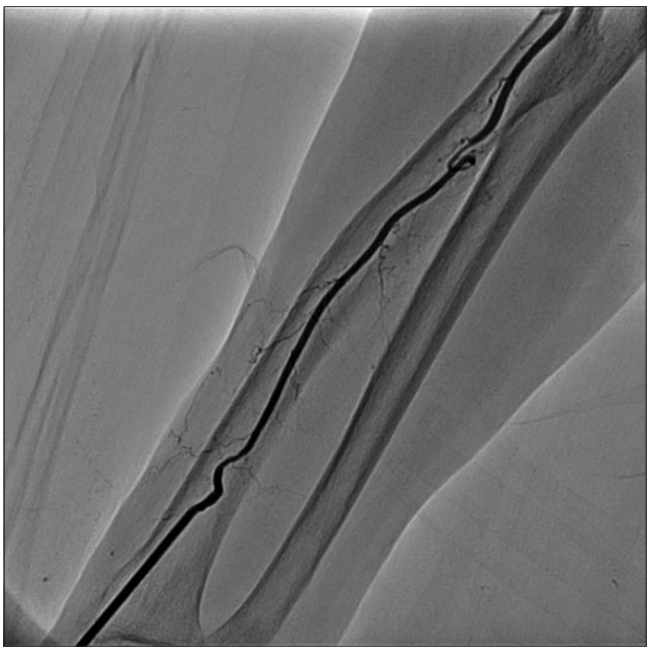

Figure 1: RA loop

Contrast injection through the radial sheath revealed a smaller-caliber RA than the ulnar artery with 360˚ loop in its proximal segment located in the region of the cubital fossa. The loop was crossed with a hydrophilic wire and an 5F catheter was advanced through the loop. This initial try was unsuccessful. Then the operator used a microcatheter ASAHI corsair (Asahi Intecc USA, Inc.) that was advanced through the loop and it passed without difficulty. Then, the microcatheter was advanced through the wire until middle of upper arm. The hydrophilic wire was retracted and exchanged with a High Torque Iron man guide wire (Abbott Vascular). The wire was once again advanced again until the upper arm. The microcatheter was removed and through the iron man wire a 5F catheter JR 4.0 (Launcher, Medtronic) was advanced gently with clockwise rotations through the loop without problems. Then, wire and catheter were pulled back to straighten the loop. Coronary angiography was performed in the usual manner, with no significant lesions.

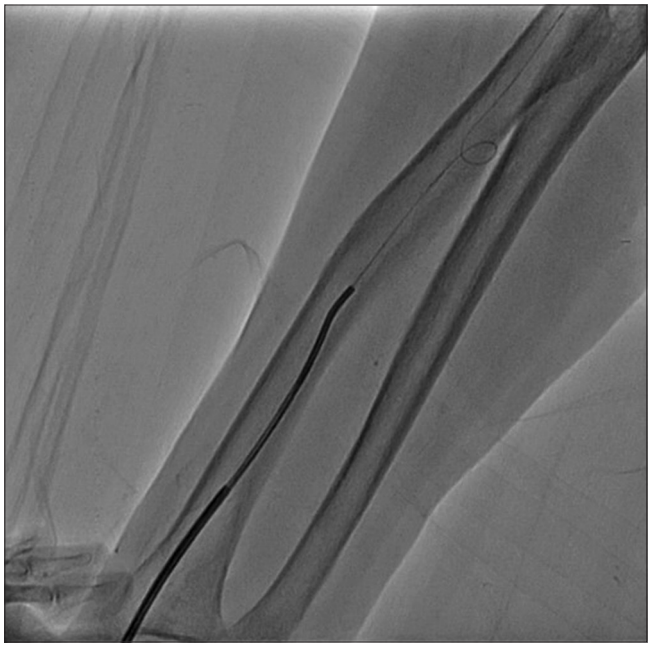

Figure 2: Hydrophilic wire 0.014 inch advanced through the anomaly

The sheath was removed immediately after procedure, and a TR band (Terumo, Japan) was applied to the wrist. To decrease the rate of RA occlusion, we applied patent hemostasis using pulse oximetry to confirm oxygen saturation on the punctured RA (>90%) after hemostasis was obtained (during measurement UA was compressed manually) [21]. Compression was applied for approximately 3-h period with gradual deflation of the TR band after the 1st h.

Patient was discharged the same day in the afternoon without registered local bleeding complications (Figures 1-5).

Case 2

A 76-year-old female was referred to our institution complaining of angina during minimal physical strain. From risk factors, she had hypertension and previous PCI of the left coronary artery in 2012. A 12-lead electrocardiogram revealed T-wave inversion in inferior limb leads. During her previous PCI, she had a bleeding complication with extravasation of the right RA in the mid segment. We could not visualize any problem on RA angiography from the previous film due to significant extravasation of contrast. During the first intervention and the access complication, the patient was transferred to the left RA access side approach. The operator in the first interventions had significant difficulties in engaging the right coronary ostium due to tortuous subclavian anatomy from the left radial approach (LRA). Pulsations of right RA were strong, so we decided to go this time again from the right RA but with the previous RA angiography which was not performed during the first intervention.

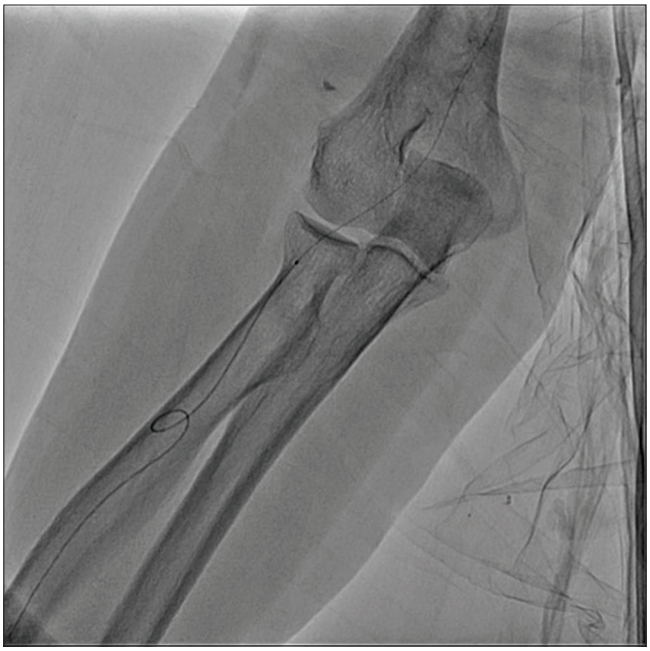

Figure 3: Microcatheter crossing the loop

After RA angiography performed through the cannula, a small but significant tortuous RA was visualized. The small loop was located in the proximal part of the RA, in the place of the previous intervention's extravasation. The sheath, 6 Fr hydrophilic introducer sheath (Terumo, Japan) was advanced only by half to avoid the present loop. A hydrophilic wire 0,014 inch was used to cross the tortuosity and a microcatheter ASAHI corsair (Asahi Intecc USA, Inc.) was advanced until mid-upper arm. The wire was pulled and exchanged with extra support guide wire (High Torque Iron man guide wire from Abbott Vascular). After which the microcatheter was removed. 5F catheter JR 4.0 (Launcher, Medtronic) was advanced through the tortuosity and coronary angiography was performed. It showed a lesion of the right coronary artery in the proximal segment and stent in proximal segment of LAD with 30% residual restenosis. Due to necessity for intervention and difficult subclavian tortuosity a 6F guiding catheter Amplatz Right 2 (Launcher, Medtronic) was advanced through the tortuosity without difficulties to cannulate the right coronary artery. PCI with stent implantation was done on the proximal segment of the right coronary artery without complications. There was no catheter friction or spasm after the straightening of the tortuosity.

Figure 4: Exchanging hydrophilic GW with a supportive Iron man GW

The sheath was removed immediately after procedure, and a TR band (Terumo, Japan) was applied to the wrist. Patent hemostasis was performed to confirm artery patency and oxygenation. Compression was applied for approximately 3-h period with gradual deflation of the TR band after the 1st h.

Patient was discharged the next day without registered local bleeding complications (Figures 1-5).

Discussion

The reported overall failure in transradial procedures ranges between 1% and 10% [9-14]. Prior studies have reported that RA anomalies found from wrist to aorta influence the success of transradial access (TRA) and are cause for access crossover from TRA to other access sites [9-14].

This technique has proved successful in traversing even the most challenging anomalies as complex RA loops. Using a microcatheter in crossing of complex RA loops and RA tortuosities is a novel technique which we hope will help in reducing TRA crossover. This technique can be used in cases with difficult RA anatomy without influence on procedural time or success of coronary interventions. The previous studies from our center have reported a significant percentage of RA anomalies that influence success of TRA procedures [20,22,23]. Small number of techniques for crossing difficult radial anatomy has been published until now [15-17]. The BAT technique has been known to help in these cases and lessen the damage to the RA while crossing the loop [16,17].

Establishing new techniques that can help in achieving a successful radial approach even in complex cases is necessary in the transradial world. The microcatheter technique is a new idea, which reduces the number of TR interventions crossed over to other access sites, especially femoral access, to finish the coronary procedures due to the presence of RA anomalies as 360 degree loop, significant RA tortuosities, and high take off radial arteries with significant spasm. This technique will also decrease the crossover to the less popular LRA that has lost popularity due to significant operator radiation and problems with

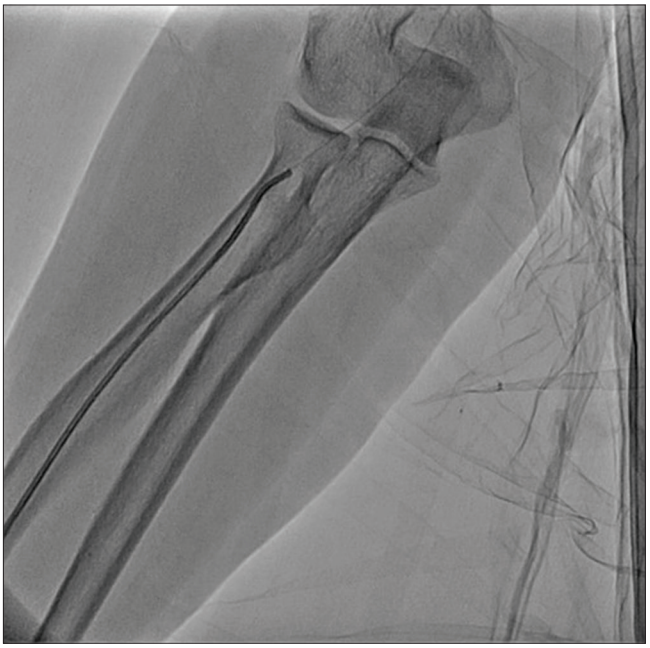

Figure 5: Advancing catheter through supportive GW and successful straightening of the loop

subclavian tortuosities. Even though recent published studies about ulnar approach showed no danger in switching to ipsilateral ulnar access in these cases, without safety concerns and great success [24], most operators feel more secure when using right radial access.

Moreover, RA tortuosities are more commonly seen in elderly and female patients who as a separate risk group have a great benefit in securing a successful TRA compared to switching to transfemoral approach (TFA) [4-8].

The easy advancement of the microcatheter helps us in easily crossing the loop even in the cases of most complex RA loops, which a regular catheter is not able to do. Exchanging the wire with a strong supportive guide wire makes the loop crossable to regular catheters unlike the wires that we use to initially cross the loop itself. The supportive wire also lessens the potential rip effect during the crossing of the loop with a catheter through a hydrophilic wire. This technique may be useful in both diagnostic and selective coronary interventions with 5 Fr and 6Fr catheters as we have seen in both cases.

Conclusion

Microcatheter crossing technique is a novel technique that can help in successfully overcoming the difficulties of RA anomalies found during transradial coronary procedures and decreases the rate of radial access site transfer.

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