

Bilateral Percutaneous Ulnar Artery Approach for Anterograde Chronic Total Occlusion Intervention

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Abstract

Trans-Radial Vascular Access (TRA) for coronary angiography and interventional procedures has grown in popularity, and it is shown to be a safe and effective technique with a success rate comparable to that of the transfemoral approach with less access site complications. Trans-Ulnar Access (TUA) can serve as an alternative approach whenever the risk of TRA failure or complications is expected to be high. There is limited data on the efficacy and safety of the trans-ulnar approach for Chronic Total Occlusion (CTO) Percutaneous Coronary Intervention (PCI). In this case report, a patient who underwent coronary intervention for CTO of the Right Coronary Artery (RCA) using the anterograde technique via the bilateral ulnar approach is presented.

Keywords: Bilateral percutaneous; Trans-ulnar access

Introduction

Trans-Radial Approach (TRA) for coronary angiography and intervention procedures nowadays is considered a default vascular access in many centers performing these types of procedures, especially across Europe. It has grown in popularity due to enhanced patient safety (i.e. reduced major vascular and bleeding complications), early patient ambulation and reduced hospital stay when compared with femoral artery access [1]. It is a safe, and effective technique that has shown a success rate comparable to that of the trans-femoral approach with less access site complications. Trans-Ulnar Access (TUA) can serve as an alternative approach whenever the risk of TRA failure or complications is expected to be high due to a small diameter, radial stenosis calcification, tortuosity, radial loops, radial artery access originating from high brachial or axillary arteries or other known anatomic issues [1-3]. Regarding mentioned pathology, and anatomical variations, it is known that 5% to 10% of patients are not suitable for TRA at all [4]. TUA was first reported in 2001 and since then, it was found to be a safe and feasible alternative for diagnostic and Percutaneous Coronary Intervention (PCI) [3]. Although there are less anatomical variations and vasospasm in the ulnar artery than in the radial artery, its deeper location and nearby ulnar nerve increases the difficulty of puncture and complication rate [5].

Prevalence of CTO in patients who underwent coronary angiography ranged between approximately 20% and 50% [6]. There is limited data on the efficacy and safety of the trans-ulnar approach for CTO (Chronic Total Occlusion) PCI because in most cases need for bilateral injection during CTO procedures, the standard method was a bilateral trans-femoral approach. Today, when the trans-radial approach has become most popular vascular access, CTO procedures are usually done through one arm (i.e. right trans-radial) and right trans-femoral access. Recently, bilateral trans-radial or combination of standard trans-radial and distal trans-radial (i.e. anatomical snuffbox) approach is frequently used, but there are limited cases of combining trans-radial and trans-ulnar approach [7]. There is a case report that showed “single arm-double access” for CTO intervention, where radial and ulnar arteries were used in one arm [8]. Regarding literature search, there is only one publication from 2010, where bilateral trans-ulnar approach was used for retrograde CTO intervention [9].

Case Report

A 52-year-old female Caucasian patient, who had smoking cigarettes as a lone cardiovascular risk factor, was transferred from another hospital to our center with the diagnosis of sub-acute infero-

posterior myocardial infarction. Initial echocardiography showed preserved ejection fraction of left ventricle, 55%, with basal inferior hypo-kinesia, mild mitral regurgitation, and mild left atrial dilatation. In ECG, inferior Q with negative T waves was verified. The invasive study was done on November 9, 2018. The right radial and right ulnar approach was tried, without the possibility of wire passage after vessel puncture. After that, the left radial puncture was made, and Glidesheath slender 6F sheath (Terumo Corp. Tokyo, Japan) was inserted. Further, in the procedure, diffuse spasm of the left radial artery was noticed. Angiography showed hypo-plastic radial artery with anomalous origin from high brachial artery (Figure 1). With coronary artery catheterization was done through cannulated left radial artery with 5F Judkins right 4.0 catheter over the hydrophilic wire, but due to more extensive spasm, catheterization was finished through right femoral approach. Coronary angiogram showed occlusion of the proximal Right Coronary Artery (RCA) with TIMI 0 flow (thrombolysis in myocardial infarction coronary flow grade), (Figure 2) without significant disease of the left coronary artery. Small collaterals to Posterior Descending (PD) and Postero-Lateral (PL) branches of RCA were visualized from the left system. A patient was dismissed without chest pain and heart failure.

On February 21, 2019 control echocardiography was made, and the ejection fraction of left ventricle showed 65%, with visualization of mild inferior wall hypo-kinesia. Low dose dobutamine stress echo was performed and very good viability of region was verified—diffuse strong contractility of left ventricular myocardial wall, with an increase of left ventricle ejection fraction to 80%. It is important that the patient was very symptomatic, stable angina pectoris-CCS III (Canadian Cardiovascular Society grading of angina pectoris). Because of the proven excellent viability of RCA region with high-grade angina, PCI of RCA CTO was planned.

The patient was admitted on March 6, 2019. Due to known hypo-

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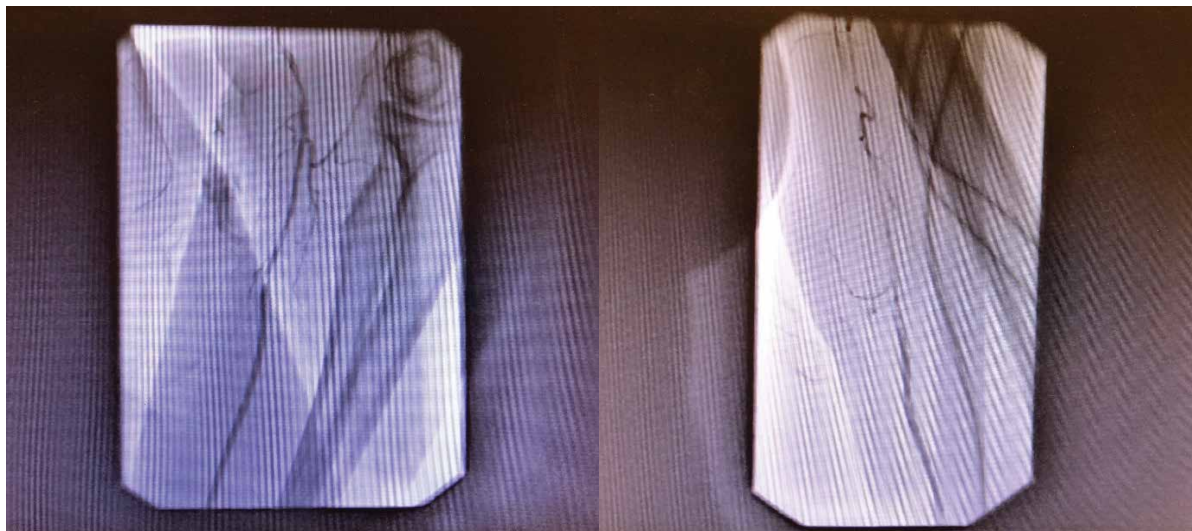


Figure 1: Angiography showed hypoplastic and prone to spasm radial artery with anomalous origin from high brachial artery.

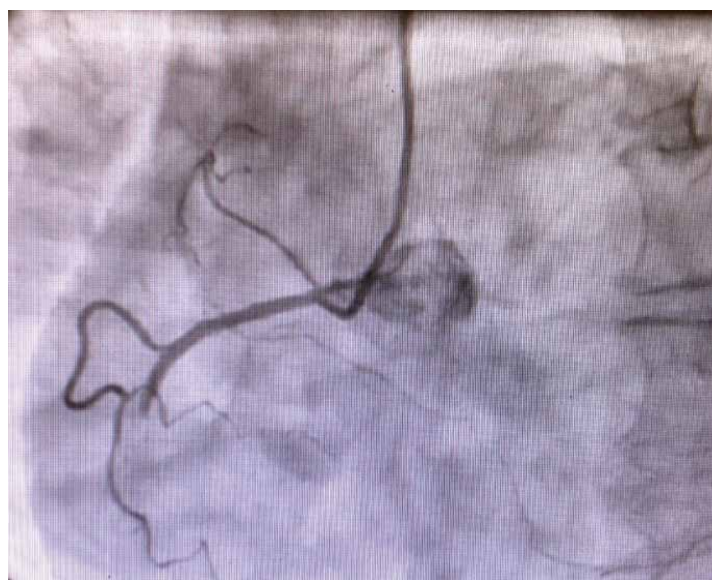


Figure 2: Coronary angiogram showed occlusion of the proximal right coronary artery (RCA) with TIMI 0 flow.

plastic both radial arteries, bilateral ulnar access was used. The ulnar arteries were punctured using a 21-gauge needle aiming 60°-70° angle, with the Seldinger technique and double wall puncture proximal to the pisiform bone. After canulation, a soft-tip, 0.021-inch straight guidewire is introduced, over which a sheath with dilatator. In left ulnar artery Glidesheath slender 7F was inserted, and 6F Glidesheath slender in right ulnar artery (Figure 3). Before introducing the catheters, bilateral intraarterial verapamil 2.5 mg was injected for vasospasm prophylaxis. Diagnostic Judkins left 3.5 6F catheter was placed in the left main coronary artery from right arm, and guiding catheter Judkins right 4.0 7F SH (Launcher, Medtronic, Minneapolis, USA), was introduced to RCA through the left arm. Bilateral angio was made, and fortunately, microchannel through CTO segment with distal TIMI 1 flow was visualized (Figure 4A). After heparin administration, a lesion

was passed easily with Sion wire (Asahi Intecc, Japan). Distal position of the wire was checked with contralateral injection, (Figure 4B), then lesion was predilated with 1.5 x 15 semi-compliant balloon (Ryujin Plus, Terumo Corp. Tokyo, Japan), and finally DES (drug-eluting stent) 2.5 x 24 (Ultimaster, Terumo Corp. Tokyo, Japan) was implanted. The final angiogram showed the excellent angiographic result with TIMI 3 flow in distal RCA (Figure 4C). A procedure was without complications. Immediately after the procedure, the introducer sheaths were removed, and hemostasis was performed with TR Band (Terumo Corp. Tokyo, Japan) in an inverted position due to better apposition on ulnar site. Total fluoro time, total contrast usage, and radiation were 7 minutes and 5 seconds, 120 mL and 391.8 mGy, respectively. The patient was dismissed 3 days after the procedure.



Figure 3: Bilateral trans-ulnar vascular access setting. glidesheath slender 7F on the left side, and 6F glidesheath slender in right ulnar artery with inserted catheters and PCI gear.

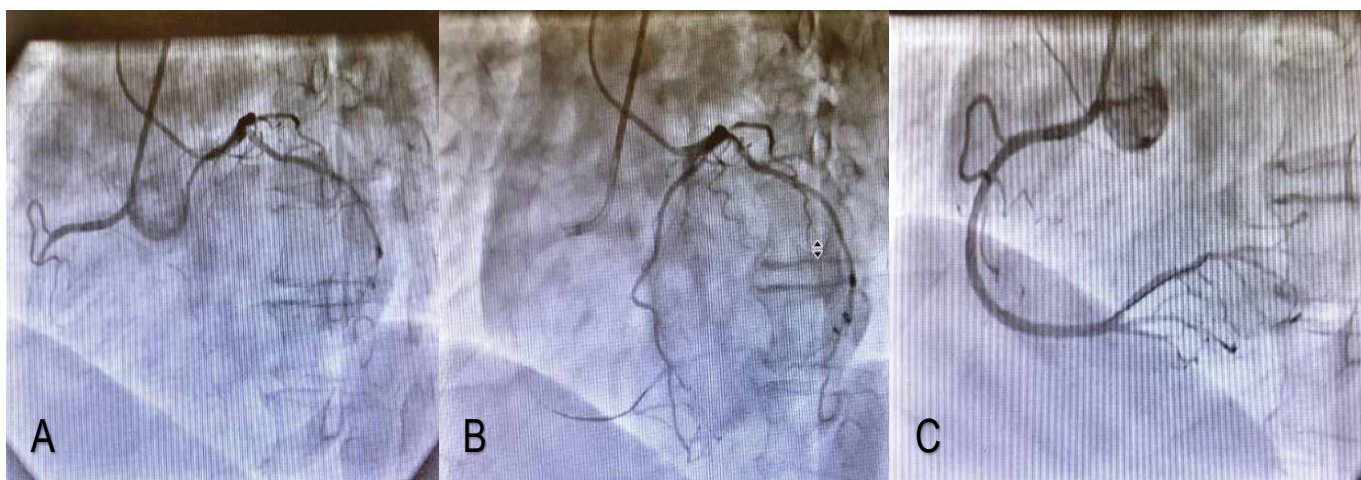


Figure 4: (A) Microchannel through CTO segment with distal TIMI 1 flow was visualized. (B) Distal position of the wire was checked with contralateral injection. (C) The final angiogram showed the excellent angiographic result with TIMI 3 flow in distal RCA.

Discussion

The possibility of using both ulnar arteries approach for PCI of a CTO with the anterograde technique in a patient with bilateral hypoplastic and anomalous high origin radial arteries is demonstrated. Due to my best knowledge, this is the second case of bilateral trans-ulnar approach for PCI of a CTO. The first case was published by Hussein et al., in 2010, presenting the case of a patient who underwent coronary intervention for CTO *via* the retrograde approach [6]. CTO PCI was safely performed with a relatively low radiation time and contrast usage, similar to other vascular access sites. In the presented case, both ulnar arteries were selectively cannulated, but due to a lower diameter, a lot of time for canulation was spent. In our center, TRA is a default vascular access for coronary angiography and interventional procedures, and also arm veins are preferred for a right heart catheterization. In my practice, TRA is performed in more than 95% of cases. The second choice of vascular cannulation is trans-ulnar, and the third option is trans-femoral approach. In the presented case, there were no post-procedural vascular complications during hospital stay. Our finding showed that TUA is the presence of hypo-plastic, anomalously originated and prone to spasm radial artery is safe and feasible.

For CTO interventions, femoral access is recommended for most operators. Recently, radial and combining femoral and bi-radial access is frequently used. The feasibility of the retrograde approach in CTO PCI of using bilateral radial access has been demonstrated in previous studies conducted by trans-radial PCI experts [9]. There is limited data with a trans-ulnar approach. The mean diameter of the ulnar artery was 2.76 +/- 0.42 mm that could be larger or smaller than radial artery branching from the same brachial artery [10,11]. With developed low profile, silicone sheaths (i.e. Glidesheathslender, Terumo corp., Tokyo, Japan), process of cannulation smaller arm vessels is eased, and It is possible to use frequently 6F or 7F catheters which allows complex procedures, micro-catheters and extension catheters usage, kissing balloon technique, intravascular ultrasound and other with high success and low complications rates.

The advantages of using ulnar access in this patient were many. Bilateral radial arteries were hypoplastic with anomalous high origin from brachial arteries and prone to strong spasm during the first procedure. Ulnar arteries were considered a reasonable alternative, because of adequate diameter showed on angiography during the first procedure. Further, the patient suffered prolonged pain in right trans-femoral puncture site, though without vascular complications, and she was not comfortable with another femoral puncture. Finally, the overall incidence of vascular access complications is higher with the trans-femoral than the TR approach [12].

In this case report, the primary endpoint was very rare vascular access in a CTO procedure. Whole setup was prepared and was ready for more complex procedure (i.e. using various micro-catheters, extension catheters, parallel wire technique, or if necessary switch to retrograde approach), but due to "*de novo*" verified micro-channel through occlusion, the case actually ended like functional CTO (TIMI I flow through micro-channel) not real CTO by definition, which demands TIMI 0 flow.

Limitations of bilateral ulnar approach: there is a learning curve that is even longer than for TRA, due to a deeper position of ulnar artery and close relation to the ulnar nerve, with a chance of traumatic needle injury of structures. Also, the patent hemostasis is harder to achieve, because of much deeper position of the artery with much soft tissue around, and no close position to the ulnar bone for compression. Another limitation is a hand position on the operating table, especially for the left hand, when in most of the time, strongly forced supination is needed, which produces patient fatigue and pain. One possible solution for this problem is a full pronation position of the left hand, with access to the sheath beneath the wrist. Peri-procedural assessment of hand circulation by pulse palpation or Doppler study is recommended, and consider every pro and cons, to avoid possible severe hand ischemia after TU intervention.

Conclusion

Regarding literature search, this is the second published case of bilateral ulnar approach for PCI of a CTO, in a patient with bilateral hypo-plastic and anomalously originated radial arteries, with the intention to prevent vascular complications of trans-femoral approach. It proved to be as effective as alternative access sites and safer than trans-femoral approach.

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