Case Report

Endovascular Treatment of Acute Limb Ischemia Due to Thrombosis of Abandoned Brachio-Cephalic AV Fistula

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Abstract

This report describes a unique case of a patient with end stage renal disease treated with hemodialysis via brachio-cephalic arterio-venous (AV) shunt in the right arm, while having the old brachio-cephalic arterial venous shunt in the left arm abandoned. The left shunt was complicated with acute upper limb ischemia and treated with endovascular means. A 77-year-old male was referred to our hospital due to severe pain of abrupt onset, accompanied with cyanosis and cold temperature in the left arm and wrist, distally to the dialysis shunt. Immediate vascular assessment revealed a big thrombus in the shunt, and total pulse absence distally to the dialysis shunt, which was confirmed on hand held Doppler scan. This article describes and illustrates an endovascular approach for diagnosis, curing and management of the acute upper limb ischemia to the abandoned brachio-cephalic AV shunt. With a salvage of the limb, with emphasis at the usage of retrograde distal sheath for evacuation of thrombi, and treatment of the outflow of the abandoned shunt with stent. Open the link for viewing video record of the entire procedure https://www.dropbox.com/s/e7n5glo4t5wjfth/AV%20SHUNT%20THROMBUS.mp4?dl=0

ABBREVIATIONS

atm: Atmosphere; AV Shunt: Arterio-Venous Shunt; Fr¹: French; IV: Intravenous; OTW: Over The Wire

INTRODUCTION

We present here the case of a patient with abandoned AV shunt who obtained a good prognosis following endovascular treatment. In this article, we will discuss the endovascular treatment of acute upper limb ischemia complicated from abandoned AV Fistula with a review of the literature.

CASE PRESENTATION

A 77-year old male reported with acute pain in his left arm, distally to abandoned arterio-venous shunt for hemodialysis. This patient has been suffering from diabetes mellitus type 2 for more than 30 years, with renal, cardiac and neurologic manifestations. Twelve years ago, an arterio-venous brachio-cephalic dialysis shunt was performed in the left arm, which served for routine hemodialysis for more than 9 years. Over time, the shunt patency deteriorated and a new arterio-venous brachio-cephalic dialysis shunt created, and routine hemodialysis was resumed 3 times a week. In the recent few months, the patients experienced few failures of the new (right) shunt due to stenosis distally to the shunt, which were treated percutaneously by balloon dilation in another hospital. It should be emphasized that the left shunt was abandoned and presenting no special problems.

The patient presented to our hospital due to severe pain of abrupt onset, accompanied with cyanosis and cold temperature in the left arm and wrist, distally to the abandoned dialysis shunt. Immediate vascular assessment revealed a big thrombus in the shunt, and total pulse absence distally to the dialysis shunt, which was confirmed on hand held Doppler scan. Vital sign were normal and analgesia was initiated immediately (beyond the scope of this paper). The patient was brought to endovascular laboratory for further assessment (further described).

Procedure description

After the appropriate scrubbing of the right femoral artery and the entire left arm, retrograde right femoral artery approach with 6 Fr¹ sheath was advanced with Seldinger technique, and...
fluoroscopy via selective cannulation with long sheath to the left brachial artery revealed extremely slow flow (with flow reverse phenomenon) in the left brachial artery, a big thrombus in the shunt budge and diffuse small thrombi in the radial and ulnar arteries, distally to the shunt (Figure 1).

Under local anesthesia, a blind retrograde needle puncture to the left radial artery (even with no pulse palpable) with radial needle and advancement of 0.014” hydrophilic long (150 cm) guide wire to the occluded artery proximally to the shunt (without the sheath being inserted yet) followed by insertion of 4 Fr’ hydrophilic radial artery sheath, carefully without retrieving the 0.014” guide wire, which was manipulated retrograde to the brachial artery (Figure 2A,2B).

Intravenous bolus Heparin of 4000 Units was given, and Over The Wire (OTW) balloon of 3*80 mm was retrogradly advanced over the 0.014” hydrophilic wire having the distal edge of the balloon in the brachial artery, and the proximal edge in the occluded radial artery, through the shunt area. The balloon was inflated with diluted contrast to a minute pressure of 2 atm revealing a critical stenosis on the outflow of the shunt to the radial artery, which was later inflated to 12 atm, and flow restoration to the radial artery was achieved (Figure 3).

The distal retrograde radial artery sheath was very useful in evacuating thrombi from the radial artery especially while applying gentle negative pressure with a syringe pump, and during the time of fluoroscopy to allow flow in the radial artery (Figure 4).

Repeated angiographies were performed through the femoral access. A negative recoiling was noticed in the stenotic spot and repeated trial of balloon angioplasty to eliminate the recoil was insufficient.

A detailed conversation with the patient about the implementations and limitations of deploying a stent in a flexion point were discussed (see discussion), and the patient consent was obtained. A balloon expandable stent of 4.5*40 mm was anchored with 22 atm making an excellent angiographic and clinical result (Figure 5A,5B)

Final result showing a good flow in the brachial artery, through the stent to the radial artery without thrombi (Figure 6A) and a good outflow through the radial sheath (Figure 6B). Gentle hemostasis with local pressure was applied on the left radial artery with an elastic bandage, delayed angiography showing retrograde flow in the ulnar artery via the palmar arch (Figure 7).

Femoral artery closure device was used for the right femoral artery.

One year of routine post procedural periodic follow up and during each dialysis session the stent and the artery distal to the stent was found to be patent as detected by left radial artery pulse.

The patient had received dual anti-platelet therapy with Aspirin and Clopidogrel for 1 month after the procedure, and then the Clopidogrel was ceased.

It is notable that 14 months of follow up, the left hand is viable,
and the patient resumed normal activity utilizing his left hand without any disability. The second finger which was ischemic immediately after the procedure is viable and well perfused.

**DISCUSSION**

Incidence of upper limb ischemia distal to AV shunt is low [1], and is usually related to steal syndrome [2], rather than thrombo-embolic events [3]. The literature counts only few cases [4] of digital ischemia due to thrombo-embolic events, and conservative treatment with continuous intravenous heparin remains the common practice[5]. Arterial embolization from AV shunt is rare, and the few reported cases describe an AV shunt that complicated distal thrombo-embolism while being in routine use [3]. Similarly, the literature lacks reports of acute ischemia due to abandoned AV shunt. This case describes a creative and novel endovascular solution, for treatment of acute upper limb ischemia, due to abandoned AV shunt.

The diagnosis was made straightforward by having a clinical history of acute, abrupt onset pain, accompanied with cyanosis, cold temperature and total pulse absence distally to abandoned left brachio-cephalic AV shunt, and was confirmed by hand held Doppler scan. The differential diagnosis of the thrombo-embolic event to the upper limb was systemic (e.g. cardio-embolic) versus local embolism that originated in the abandoned shunt budge. The normal sinus rhythm recorded by electrocardiogram, and the swelling in the shunt budge focused our attention to a local thrombosis in the shunt.

The option of conservative treatment, which is the common practice, seemed unsatisfactory owing the fact that the ischemia was vast and extensive, and failure of conservative treatment would eventually lead to necrosis, and amputation of hand. The pros and cons of angiography including pain hemorrhage rupture of the artery and procedural failure, versus the chance for re-vascularizing the hand was described to the patient, and an informed consent was signed.

In the hybrid cardio-vascular catheterization laboratory and with local anesthesia a 6 Fr’ retrograde femoral artery puncture was made allowing the diagnosis of total occlusion in the left brachial artery, and noticing the reverse phenomenon (Figure 1),
it was evident that an action should be made. The lack of long endovascular equipment to perform angioplasty from femoral artery required a closer arterial access. Antegrade brachial artery puncture was rationale, but the close distance from the puncture to the stenosis was not favorable due to practical measures, adding to the excellent experience of the invasive cardiologist with radial artery tipped the scales for the radial artery, which was of great importance for evacuation thrombi (discussed later).

Radial artery puncture with the use of long 0.014” hydrophilic wire from the invasive cardiology armamentarium allowed blind radial artery puncture, and advancement of the hydrophilic wire proximally to the shunt area (Figure 2A), and only then the hydrophilic 4 Fr’ sheath was inserted with the dilator over the 0.014” hydrophilic wire. This step was crucial, and the pre-planning of using the long (150 cm) wire rather than the standard (~30 cm) wire for achieving stability, and confirming the place of the wire with fluoroscopy (Figure 2B) made this case successful. Intravenous 4000 unit of heparin was administered to an activated coagulation time (ACT) target of 200-250 seconds.

The double access via femoral artery with long sheath arriving to the brachial artery for contrast media injection, and retrograde radial artery approach of performing angioplasty was very useful.

The treatment with continuous local percutaneous injection of thrombolytic agent (e.g. streptokinase or tissue plasminogen activator) was considered too [6], but the absence of flow, especially the reverse flow discouraged us, thus we preferred angioplasty.

After advancing the wire retrograde through the shunt to the brachial artery, an over-the-wire (OTW) balloon was advanced having the balloon tip in the brachial artery. The 0.014” was retrieved and back-flow came out assuring the balloon is in the brachial artery and not in any false lumen. This is a considerable step for patient safety and it should never be missed, since unwise balloon inflation could bring unflavored consequences, such as bleeding, compartment syndrome and eventually hand amputation.

The wire was advanced again through the OTW balloon and low pressure inflation (up to 2 atm) showed critical stenosis in the out-flow of the budge. High pressure inflation was then performed (12 atm) with success treating the stenosis, but negative recoiling followed, as demonstrated in Figure (3). Noting that angiography of the radial artery was not possible without holding the radial sheath connector open (or applying gentle suction with syringe pump) to facilitate flow in the radial artery, that would illusively seem occluded.

The extraction of the balloon was accompanied with multiple thrombi of medium size, which encouraged us to perform repeated suctioning from the radial artery until receiving blood free of thrombi. This procedure was repeated later, and we are confident that the thrombi that were extracted would alternatively wander distally to the ischemic hand and worsen the outcome.

The negative recoil of the stenotic area after multiple balloon inflations was critical, and it was obvious that if left untreated, re-occlusion was imminent. The deployment of stents in flexion-extension joints is controversial, as many stents are reported to break down, or become distorted and occluded, with repeated flexion and extension of the joint. This issue was discussed with the patient and he insisted in fixing his artery, fearing of losing his hand, and the job was resumed.

Deployment of balloon expandable stent from the radial artery, considering the small radial sheath diameter (4Fr’) and the wire caliber (0.014”), and placing the stent in the brachial artery through the stenosis in the shunt to the radial artery, with 22 atm (Figure 4) revealed a good angiographic result (Figure 5), and clinical result with remarkable immediate improvement in the pain, temperature and color of the hand, except distal second finger which remained ischemic, most probably due to distal emboli.

Removing the radial sheath was possible with gentle pressure over the radial artery with elastic bandage, allowing hemostasis and maintaining blood flow through the artery, enabling collateral flow from the radial artery, via the palmar arc to the ulnar artery retrograde up to the site of the AV shunt.

REFERENCES

Cite this article