Unusual Ultrasound Findings in a Difficult to Cannulate Arteriovenous Graft

Christy L. Gossett, Andrea G. Kattah, and Fawad Qureshi
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Case Description
A 42-year-old woman with ESKD due to type 1 diabetes mellitus, hemodialysis dependent for 5 years, presented to the local emergency department feeling unwell. She was found to have a serum potassium of 6.8 mmol/L. No recent dialysis treatments were missed. She had a history of multiple failed arteriovenous (AV) fistulas, with current dialysis access being a right forearm brachial artery to brachial vein loop graft created approximately 4 months ago. The graft had been difficult to cannulate, particularly for the venous access. Often, elevated venous pressures and pain of the graft site required a decrease in blood flow rate or early termination of the dialysis treatment.

At the time of admission, despite expert dialysis access cannulators, the above-mentioned challenges were encountered. Nursing noted “clots” with cannulation attempts. Assessment revealed adequate bruit and thrill and significant subcutaneous edema of the right arm overlying the graft. Vascular ultrasound identified a patent graft with 1798 ml/min mean average flow volume and unexpected finding of three adjacent fistulous communications between the distal forearm loop graft and a superficially overlying subcutaneous branch of the right forearm cephalic vein (Figure 1A). Surgical report at the time of graft creation was reviewed, and the overlying cephalic vein was not documented.

The vascular surgery service was consulted but did not recommend surgical intervention. A repeat ultrasound was performed to mark the patient’s arm with recommended cannulation sites (Figure 1B). Markings resulted in successful cannulation by the inpatient dialysis staff and subsequent patient discharge. One month later, the patient was readmitted with a similar presentation. Markings had not been preserved; thus, cannulation challenges recurred. Before readmission, fistulography was pursued and reported a patent fistula. More extensive markings were created (Figure 1C), identifying the overlying vein and recommended cannulation points. Due to pain and ongoing frustration, the patient refused further use of the graft and required central venous catheter placement.

We describe an unusual case of difficult arteriovenous graft cannulation due to an overlying, previously unmapped cephalic vein. Cannulation was improved with skin marking to guide the dialysis staff, although due to the impermanence of the markings, rehospitalization occurred and ultimately central catheter placement was required due to patient refusal to allow further graft cannulation. Review of the literature reveals that dialysis grafts with fistulous connections with an overlying vein are a rare and infrequently reported event.

Early assessment of cannulation challenges with diagnostic ultrasound of a patient’s dialysis vascular access may identify unexpected causes of cannulation challenges. Ultrasound and skin marking is a potential noninvasive means of improving cannulation in unusual cases. Delays in this assessment may lead to unintended adverse events. In this patient, repeated cannulation into and through the overlying cephalic vein may have resulted in enlargement of the cephalic vein, further limiting the usability of the dialysis graft. Of note, the overlying cephalic vein was not large enough to use as a dialysis access. Additionally, the placement of unnecessary central catheters may be avoided with early noninvasive assessment and interventions, such as those described in this patient.

Teaching Points
- Ultrasound can be an incredibly useful tool for identifying unusual causes of dialysis vascular access cannulation challenges and avoiding unnecessary interventions, such as fistulograms.
- Ultrasound-guided skin markings are a useful, noninvasive tool to improve cannulation of difficult dialysis vascular access.
- Early identification of the underlying cause of cannulation challenges may avoid placement of unnecessary central venous catheters.

Disclosures
A. Kattah reports consultancy agreements with ICU Medical. F. Qureshi reports chair membership of the ASDIN committee. The remaining author has nothing to disclose.
Figure 1. Imaging via ultrasound demonstrates fistulous communication between dialysis AV graft and overlying cephalic vein in addition to providing guidance for skin markings to improve future cannulation. (A) Ultrasound images identified the overlying cephalic vein. Additionally, three areas of fistulous communications between the distal loop graft and a superficially overlying subcutaneous branch of the right cephalic vein were identified and were likely due to cannulation attempts through his overlying vessel. (B) Initial skin markings done via ultrasound guidance to identify areas where the cephalic vein does not overlie the arteriovenous graft in order to assist with cannulation. (C) More extensive skin markings created 1 month after initial skin markings. Red marking indicates area where the overlying cephalic vein exists, whereas black marking indicates areas without the overlying cephalic vein that may be used for cannulation.

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Informed consent was obtained by the patient described in this case. Consent was signed to allow use of images for educational purposes, as long as the patient’s identity was not revealed.

Author Contributions
C. Gossett wrote the original draft of the manuscript. A. Kattah and F. Qureshi reviewed and edited the manuscript.

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