

CASE REPORT

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Misplaced femoral vein central venous catheter placed into renal graft vein – a case report

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Abstract

Background Central venous catheterization is a common procedure that enables the application of drugs and fluids, can assist in hemodynamic monitoring or serve as vascular access for extracorporeal therapies. Central venous catheter insertion is generally safe, but complications do occur.

Case presentation We present a patient with a kidney transplant in the right iliac fossa and septic shock who was in need of urgent catheter insertion. The right femoral vein was chosen as the site of insertion. There were no major complications during the insertion and no problems with the use of catheter afterwards. Two weeks after the insertion we incidentally discovered that the tip and a large portion of the catheter had been inserted into the renal vein of the transplanted kidney. The position of the catheter was changed by the radiologist with no clear harm to the transplanted kidney.

Conclusions Femoral central vein catheter malposition into the renal vein of a transplanted kidney is to our knowledge very rare and has been reported only once. This case report highlights the importance of considering altered anatomy in kidney transplant recipients and emphasizes the importance of imaging and caution in such cases to prevent potentially serious complications.

Keywords Central venous catheter, Kidney transplantation, Renal graft vein, Imaging, Case report

Background

Central venous catheterization is a common procedure in hospitalized patients [1]. It enables the application of fluids and drugs when peripheral venous access is inadequate. Additionally, when inserted into the jugular or subclavian vein the central venous catheter (CVC) can be used to monitor certain hemodynamic parameters of the patient. Hemodialysis central venous catheters are used to carry out extracorporeal therapies such as hemodialysis and plasmapheresis [2].

Kidney transplantation is the most common solid organ transplantation [3]. Transplanted kidneys are usually placed into the iliac fossa with the renal vein anastomosed to either the left or the right iliac vein and the

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renal artery to either the left or the right external iliac artery.

We present a case report of a patient with a kidney transplant in the right iliac fossa who had a CVC inserted into the right femoral vein to ensure vascular access during an episode of septic shock. We incidentally discovered later on that it was positioned in the vein of the transplanted kidney.

Case presentation

The 72-year-old female patient was admitted to the Department of Nephrology, University Medical Centre Ljubljana on June 12, 2019, because of acute respiratory insufficiency caused by hypervolemia. Estimated glomerular filtration rate (eGFR) was 40 ml/min/1.73 m² at admission. She started treatment with hemodialysis in 2000 and received a deceased-donor kidney transplant in 2007. Her history was significant for poorly managed diabetes mellitus with several complications, including congestive heart failure, arterial hypertension and ischemic heart disease.

On June 24, the patient became febrile, with elevated C-reactive protein (CRP) and procalcitonin levels. Urine and blood cultures were obtained and after consultation with an infectious disease specialist (IDS), empiric antibiotic therapy with piperacillin/tazobactam was initiated. The most likely source of infection was a skin infection that developed following thrombophlebitis at the location of a peripheral venous access which was subsequently removed. Urine was positive for *Escherichia coli* and *Enterococcus faecalis*, while blood cultures were positive for *Escherichia coli*, *Pseudomonas aeruginosa* and *Stenotrophomonas maltophilia*, with all three bacteria being susceptible to all tested antibiotics. Based on the susceptibility the antibiotic therapy was changed in consultation with IDS to levofloxacin, which she received for seven days (until July 3).

Two days later, on July 5, she developed acute septic shock, initially considered of unknown origin, with no clear signs of skin infection or local infection elsewhere, but was later confirmed to have been a consequence of pneumonia. Blood cultures were taken immediately, a drop of eGFR from 36 to 20 ml/min/1.73 m² was noted. She deteriorated rapidly with progression to unresponsiveness and a blood pressure of 66/49 mmHg. Her existing peripheral venous catheter was found to be non-functional. The attending nurse was not able to insert a new one in two attempts and given the patient's rapid deterioration and the need for immediate fluid and vasopressor therapy, further attempts were deferred and the attending consultant nephrologist decided to perform an urgent insertion of a CVC. As ultrasound (US) was not available on the ward at the time, the attending physician decided to insert the CVC into the femoral vein using

landmark guidance. The right femoral vein was chosen without consideration of the side on which the kidney was transplanted. The catheter was inserted according to the standard Seldinger technique, and the guidewire was inserted without resistance for about 15–20 cm (past the third marking on the guidewire) after which a resistance was encountered. Despite that, the dilator and the CVC (Arrow™, Arrowgard Blue Plus Two-Lumen CVC, 7 Fr, 20 cm, Teleflex, Morrisville, NC, USA) were introduced smoothly over the wire without any resistance or other issues, after which fluids and norepinephrine were started without any problems. The catheter used was an infusion catheter and not a dialysis catheter, as the patient had a functioning arteriovenous (AV) fistula.

Empiric antibiotic therapy with ciprofloxacin and flucloxacillin was initiated after consultation with IDS. Blood cultures were positive again for *Pseudomonas aeruginosa* and the antibiotic therapy was changed to ceftazidime and gentamicin. The susceptibility testing revealed resistance to all tested antibiotics aside for gentamicin and colistin and the presence of carbapenem resistance was confirmed. Ceftazidime was stopped and gentamicin continued – over 6 days she received three doses (cumulative dose 480 mg). The highest measured gentamicin trough level was 3.1 mg/L (6.5 μmol/L), while the remaining 4 levels were all between 0.8 and 2.7 mg/L (1.6–5.6 μmol/L). In this time her septic symptoms subsided, kidney function improved to 65 ml/min/1.73 m², the catheter was functioning well, fluids and medications were given without any issues, and the staff did not note any catheter-related complications.

On July 11 a control blood culture was taken from peripheral blood and the result next day was positive again for *Pseudomonas aeruginosa*. Blood cultures from the catheter were not obtained. This time the strain was resistant to gentamicin and the therapy was changed after consultation with IDS to colistin (9 million units initial dose, after that 4.5 million units every 24 h). Follow-up blood cultures, taken on July 16 were negative. Shortly after changing the antibiotic the kidney function started to decline quickly and hemodialysis (HD) was necessary. It was suspected that this might be due to colistin treatment, but an alternative antibiotic therapy was not available. Due to kidney failure, the dose of colistin was lowered to 4.5 million units every 48 h. The first HD procedure was performed on July 18, using a functional AV fistula. On July 19, exactly two weeks after CVC insertion we performed an abdominal X-ray due to suspected ileus. The abdominal X-ray showed no signs of ileus but the radiologist suspected catheter misplacement with the catheter tip lying in the vein of the transplanted kidney. Fluoroscopy and venography performed on the same day confirmed the radiologist's suspicion (Fig. 1). The radiologist then removed the catheter and inserted a new CVC

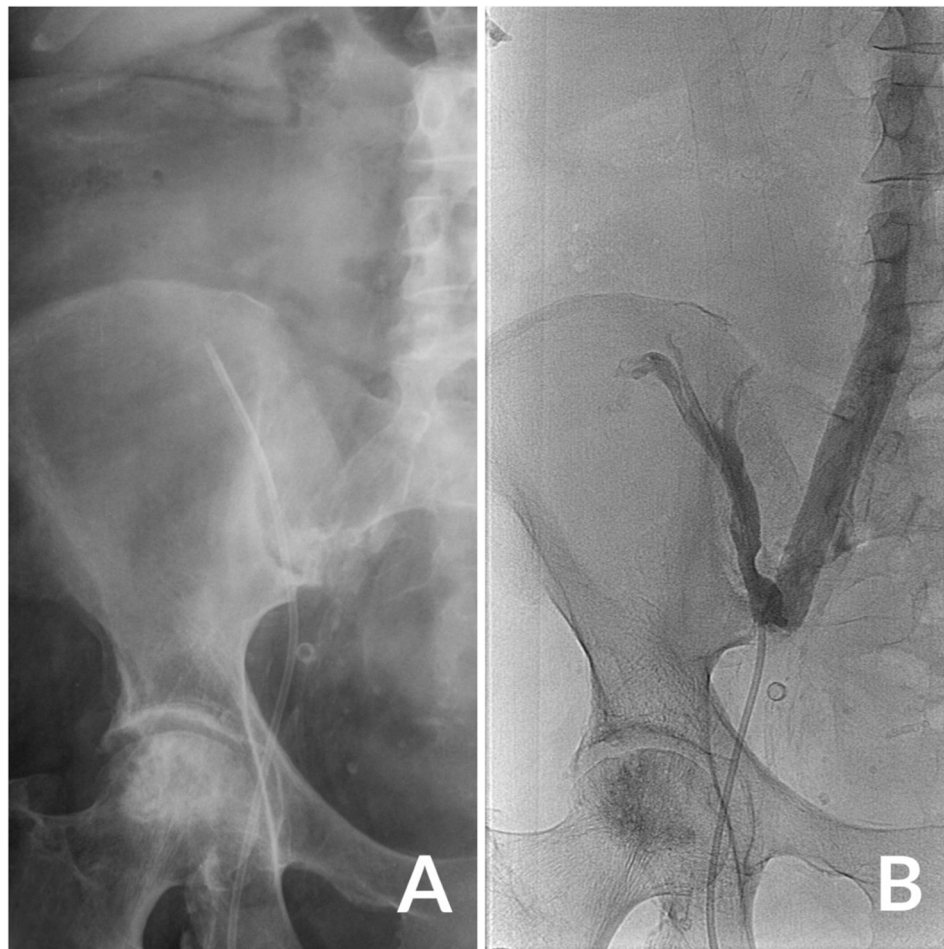


Fig. 1 (A) Abdominal radiograph demonstrating catheter course toward the renal graft vein. (B) Venography confirmed that the final part of the catheter was positioned in the renal graft vein

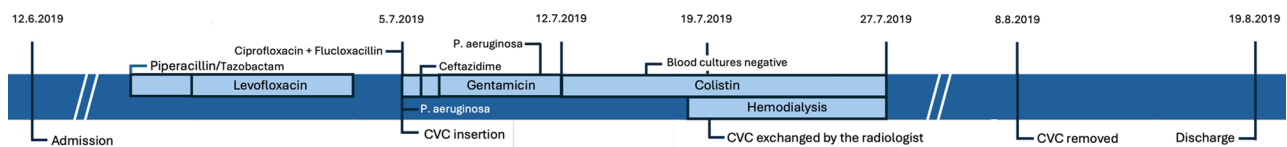


Fig. 2 The timeline of events

of the same type under fluoroscopy with the tip lying at the beginning of the inferior vena cava.

After the exchange of the CVC the kidney function continued to worsen. Another four HD procedures were performed. The colistin treatment was stopped on July 27 due to a favorable outcome of infection after 14 days of therapy, which was also the date of her last HD procedure. After discontinuing colistin the kidney function started to immediately improve, and no further HD procedures were needed. The CVC was removed on August 8. She was discharged on August 19 with an eGFR of 57 ml/min/1.73 m². The timeline of the events is presented in Fig. 2.

Discussion and conclusions

Several interventions have been put into practice to reduce the incidence of complications during CVC insertion, such as strict aseptic preparation, using catheters containing antimicrobial agents, and confirmation of venous placement of inserted wire or catheter with US, fluoroscopy, continuous EKG monitoring, or radiography [4]. Complications, associated with central venous catheterization can be divided into mechanical, infectious, and thrombotic. The most common mechanical complication is failure to place a catheter [5]. Other mechanical complications include but are not limited to malposition, pneumothorax, arterial puncture, hemothorax, and hematoma [5].

Some very interesting cases of CVC misplacement are described in the literature. In one patient venous catheter was positioned in the urinary bladder [6]. We found two cases describing abdominal compartment syndrome due to intraperitoneal placement of a femoral catheter [7, 8]. A case report of a patient with the transplanted kidney in the right iliac fossa described the catheter tip position in the urinary tract of the transplanted kidney [9]. A similar femoral catheter malposition in a renal transplant recipient has been described recently in a short conference abstract [10].

In controlled, elective situations, an upper-body site, such as internal jugular or subclavian vein, is generally preferred for central venous access [4]. Subclavian cannulation is associated with higher risk of central venous stenosis [11] and is therefore avoided in patients with current or potential need for hemodialysis vascular access. In emergency settings, femoral venous access is often selected because it can be obtained rapidly and avoids pleuropulmonary complications associated with subclavian or internal jugular cannulation [12].

In our patient the CVC was inserted in an emergent situation by an experienced consultant nephrologist with over 10 years of experience in CVC placement. As US was not available on the ward at the time and the attending physician performed most of his previous jugular CVC insertions using a US, the femoral approach was selected because it was the operator's preferred access site using a landmark technique. While inserting the guidewire, there was a resistance at a depth of approximately 15–20 cm. The operator considered aborting the attempt and trying out on the left femoral site but given the dire clinical situation of the patient and the complete inability to administer fluids and vasopressors, a decision was made to try and introduce the catheter which was possible without any issues. Ideally, a CVC inserted at the femoral site should be at least 24 cm long in order to reliably reach the inferior vena cava [13]. In our case only a 20 cm CVC was available on the ward at the time of insertion and a decision was made not to wait in order to acquire a longer one.

At the time of insertion, the operator did not suspect that the resistance to guidewire advancement could be related to altered vascular anatomy due to the ipsilateral kidney graft. In hindsight it is clear that such resistance should be regarded as a warning sign of misplacement into the graft vein and should prompt reassessment and consideration of imaging to confirm guidewire or catheter position.

The CVC insertion was smooth and there were no issues with the functionality of the catheter at any time during its use and the malposition was discovered only incidentally. Although we believe femoral access was appropriate in the given situation, conversion to an

internal jugular vein would have been preferable and should have been considered at least at two time points – the first when the control culture was positive for *Pseudomonas* and the second when the catheter was exchanged. At the first time point the removal of the CVC was deemed risky, given the problems with getting a peripheral venous access in this patient. In addition, the patient was clinically stable with a low CRP, and the testing revealed resistance to gentamicin as a possible cause of treatment failure. At the second time point the control blood cultures were negative and we were aware of the need to perform HD. While the AV fistula was functioning it had not been used in 12 years and we were not sure whether it would perform well enough which led us to decide to leave the jugular site free if HD catheters would be needed.

The patient experienced acute renal failure with a need for HD treatment. Based on timing of events, sepsis-associated kidney injury and colistin nephrotoxicity were considered the most likely causes. Gentamicin exposure with some trough levels above those recommended could have contributed to kidney injury. One hypothetical possibility would be that drug administration through a catheter positioned within the graft venous system might have increased local graft exposure, although this seems less likely given that generally the blood flow in the vein is directed outside of the graft. In addition, we cannot completely rule out that the catheter's position within the graft's renal vein could have caused partial venous outflow obstruction with renal venous congestion, potentially contributing to graft dysfunction even in the absence of overt thrombosis. The diameter of the graft vein was shown during venography to be 5.5 mm, while the diameter of the catheter was approximately 2.3 mm, seemingly leaving ample room for venous blood flow.

We have described a rare complication of CVC insertion into the renal vein of the transplanted kidney. We suggest to our colleagues that extra caution should be taken when placing a femoral catheter on the side ipsilateral to the transplanted kidney, particularly when there are problems with inserting the guidewire. While we found no permanent harm to the transplanted kidney in our case, there are certainly possible complications with a CVC inserted into the transplanted renal vein, like damage to the vein or venous thrombosis, which could cause irreversible damage to the graft. In light of this we believe that if the femoral site is chosen for CVC insertion, one should prioritize the contralateral femoral vein in transplanted patients. If the ipsilateral site is chosen, we suggest that it would be wise to perform an abdominal X-ray after insertion to confirm the correct position of the tip of the catheter even in cases where the insertion was uneventful.

Key lessons learned

- In patients with a transplanted kidney in whom an insertion of a central venous catheter is planned, the jugular veins should be the preferred insertion site as recommended by the guidelines.
- If the femoral vein is chosen as the insertion site, it is preferable to insert the catheter into the femoral vein that is contralateral to the position of the transplanted graft in order to avoid causing damage to the graft during insertion.
- If the femoral vein that is ipsilateral to the graft is chosen, the operator should be aware of the possibility of causing damage to the graft either with the guidewire or with the catheter itself. If any resistance is encountered, it is highly advisable that the attempt be aborted and alternative possibilities considered.
- In cases where the ipsilateral femoral vein is chosen and given the high risk of a misplaced catheter causing irreversible damage to the graft, we suggest that the position of the catheter should always be confirmed by an abdominal X-ray, even when the insertion was uneventful.

Abbreviations

CRP	C-reactive protein
CVC	Central venous catheter
eGFR	Estimated glomerular filtration rate
HD	Hemodialysis
IDS	Infectious diseases specialist
US	Ultrasound

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Author contributions

J. P. and A. Š. wrote the main text. A. Š. revised the text and provided corrections. P. K. provided the images and image interpretation. All authors read and approved the final manuscript.

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Data availability

The supporting data and findings of this study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

At the time of writing of this case report the patient was deceased. We acquired written approval for presentation from the next of kin.

Competing interests

The authors declare no competing interests.

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