Radiology Case Reports 19 (2024) 5287–5293

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Case Report

Intravenous misplacement of the nephrostomy catheter following percutaneous nephrolithotomy: A case report and review of 26 cases in the literature ☆

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ARTICLE INFO

Article history:
Received 21 June 2024
Revised 24 July 2024
Accepted 25 July 2024

Keywords:
Nephrostomy catheter
Misplacement
Percutaneous nephrolithotomy
Catheter withdrawal

ABSTRACT

Intravenous misplacement of the nephrostomy catheter following percutaneous nephrolithotomy (PCNL) is severe and extremely rare, and little information is available about this complication. Because the patient's prognosis may be poor, sufficient attention should be paid to early identification and treatment of this complication. We report a case with intravenous misplacement of nephrostomy catheter and severe bleeding from the catheter after PCNL was transferred to our hospital. The patient was successfully managed using a two-step intervention. First, the patient underwent embolization of the pseudoaneurysms in renal parenchyma, then underwent catheter withdrawal under digital subtraction angiography (DSA) and control bleeding by pushing the absorbable hemostatic material (Surgicel) into the tunneled renal drainage. There were no severe complications. Withdrawal could be performed by open surgery or under the supervision of imaging modalities. Some reports showed that minimally invasive management was safer and less invasive than open surgery.

☆ Competing Interests: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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https://doi.org/10.1016/j.radcr.2024.07.147

Introduction

Percutaneous nephrolithotomy is a minimally invasive procedure to remove kidney stones. Although PCNL is a safe and effective procedure with a low rate of complications, some severe complications such as adjacent organ (such as the liver, spleen, and bowel) injury, sepsis, hemorrhage, excretory system perforation may occur [1]. Nephrostomy tube misplacement into the venous system is extremely rare with an incidence rate of approximately 0.023%-0.050% [1,2]. There are few publications about intravenous misplacement of a nephrostomy tube have been reported. The main treatment approach is catheter withdrawal under fluoroscopy and open pyelotomy [3]. We present a case of drainage tube misplacement into the inferior vena cava after percutaneous nephrolithotomy.

Case report

A 40-year-old female patient was admitted to the hospital because of hematuria and unusual blood drainage through nephrostomy catheter after 4 days of right PCNL. She had right staghorn calculi and a previous right percutaneous nephrolithotomy. When percutaneous nephrolithotomy, the surgeon performed multiple punctures times to some calyces. On examination, the patient was conscious and pallor, the pulse rate was 100/min and the blood pressure was 110/70 mmHg, the abdomen was soft and not tender, there was blood drainage through nephrostomy catheter. Laboratory examination showed: red blood cells 2.72 T/l (normalL 4.2-5.9 T/l), hemoglobin 81 g/l (normal: 120-150 g/l), hematocrit 23% (normal: 36%-44%), platelets 211 G/l (normal: 150-450 G/l), blood creatinine 36 μmol/l (normal: 44-97 μmol/l). A contrast computed tomography (CT) of the urinary system showed the nephrostomy catheter was through the middle calyx, and passed through the renal parenchyma into the right renal vein and entered the inferior vena cava (Fig. 1). There was multiple pseudoaneurysms in right renal artery. The patient was continuously monitored in the intensive care emergency department, receiving antibiotics, drainage clamping, and blood transfusion (5 units of packed red blood cells). A multi-specialty consultation including urological surgeons, cardiovascular surgeons, internal cardiovascular surgeons, anesthesiologists, resuscitations, and interventional radiologists was conducted. The first intervention the patient underwent renal angiography and embolization of pseudoaneurysm (Fig. 2). On angiography, there were 3 pseudoaneurysms that were embolized selectively by coils. The second intervention was done after 1 day to remove the misplaced nephrostomy catheter. The patient was in conscious supine on angio-suite table. The right femoral vein was punctured and catheterized by a diagnostic catheter (Multipurpose catheter 5 French, Merit medical, US). The drain was exchanged by a 0.035-inche wire (Fig. 3). On vena cavagraphyr, there was no extravasation of contrast through the diagnostic catheter. Through the guidewire, a 4-French-sheath was advanced into the renal vein then the guidewire was removed. The nephrostomy catheter was then slowly withdrawn while injecting the contrast until it was out of the vein. Through the sheath, the resorbable hemostatic material (Surgicele) was slowly pushed into the tunneled nephrostomy catheter to control bleeding under fluoroscopic guidance. The tube withdrawal process went smoothly, and no bleeding occurred. Two days after interventions, the patient was awake and hemodynamically stable. There was no bleeding or hematoma formation after the removal of the percutaneous nephrostomy. A computed tomography scan revealed no active bleeding foci or pseudoaneurysms, and there was no hematoma around the right kidney. However, a small amount of thrombus was observed adhering to the wall of the vena cava. Although we consulted with cardiologists, due to the minimal extent of thrombosis and the patient's ongoing risk of bleeding, anticoagulation therapy was not initiated. Following 4 days of intensive monitoring in the Emergency Department, the patient's condition remained stable, with clear urine and drainage fluid. Consequently, the patient was discharged.

Discussion

Intravenous misplacement of nephrostomy catheters is an extremely rare complication. Some publications presented complications with PCNL misplacement into the vessel. Nephrostomy tube may be misplaced into the renal vein or inferior vena, contralateral renal vein, or right atrium [4–6]. The data from these publications with 26 patients are summarized in Table 1. It is seen that intravenous misplacement of nephrostomy catheters is usually seen on the left side.

A search of relevant databases showed that 26 patients developed this rare complication. In 6 patients, nephrostomy tube was misplaced into the venous system in solitary kidney, 1 case had horseshoe kidney was subjected to left heminephrectomy [2,7–9]. There were 2 cases in which the nephrostomy catheter migrated to contralateral renal vein [4,5]. One case had migration of the double-J tube into IVC [5]. The time management may be intermediate to 2 weeks. Clamping the catheter was performed immediately after detecting bleeding [2,3,5,6,8,10]. There were 6 and 5 cases in the literature in which the tracts the catheter was withdrawn in 1 and 2 steps under fluoroscopic guidance, respectively (Table 1). There were 2 cases managed with ultrasound guidance and 1 case with CT guidance [2,6]. The percutaneous nephrostomy catheter could withdraw in stages (1, 2, or more) under fluoroscopy, ultrasound or CT scan guidance [2,5,8]. The withdrawal distance is not constant depending on the patient, the catheter position and the radiologist's experience. The tube could be withdrawn to the collecting system or removed. Al Zahrani et al. [11] presented a case with the nephrostomy catheters into the IVC, they used 1-step withdrawal under fluoroscopy associated with balloon tamponade and alternated the patient's position between prone and supine during the procedure. A report by Ge et al. [4] presented the patient had the nephrostomy drainage tube (NDT) into the contralateral renal vein resulting in thrombus formation. A temporary filter was implanted just above the tip of NDT to prevent displacement of the thrombus and anticoagulation therapy was used. 10 days later, the temporary filter and NDT were removed due

Table 1 – Reports of intravenous misplacement of a nephrostomy tube.

Author	Sex	Age (years)	Side	Catheter	Original surgery	Solitary kidney	Location	Antithrombotic therapy	Manage time	Management	Catheter withdrawn
Dias-Filho et al. [14]	F	63	Left	Foley	Catheter placement	No	Renal vein, IVC, atrium	No	Immediate	One-step under fluoroscopy	Removed
Shaw et al. [7]	M	54	Right	Foley	PCNL	Yes	Renal vein	Yes	Immediate	Two-step under fluoroscopy	Removed
Skolarikos et al. [15]	M	NA	NA	Nephrostomy tube	NA	NA	IVC	NA	NA	One-step under fluoroscopy	NA
Mazzucchi et al. [8]	M	52	Left	Nephrostomy tube	PCNL	Yes	Renal vein	No	72 hours	One-step under fluoroscopy	Removed
Mazzucchi et al. [8]	F	35	Left	Nephrostomy tube	PCNL	Yes	Renal vein, IVC	No	48 hours	Two-step under fluoroscopy	To collecting system, then removed 48 hours later
Li et al. [6]	F	32	Left	Nephrostomy tube	PCNL	No	Renal vein, IVC	NA	>48 hours	Two-step under ultrasound	To renal sinus or parenchyma, then removed 6 days later
Li et al. [6]	F	41	Right	Double-J tube	PCNL	No	Renal vein, IVC	Yes	NA	One-step under fluoroscopy	Removed
Wang et al. [16]	F	66	Left	Nephrostomy tube	PCNL	No	Renal vein	No	2 days	One-step under fluoroscopy	To the renal sinus/parenchyma
Kotb et al. [12]	M	50	Left	Foley	Catheter placement	No	Renal vein, IVC	Yes[a]	NA	One-step open pyelotomy	Removed
Chen et al. [2]	M	42	Left	Nephrostomy tube	PCNL	No	Renal vein, IVC	No	12 days	Two-step under CT guide	Removed
Chen et al. [2]	F	38	Left	Nephrostomy tube	PCNL	No	Renal vein, IVC	No	Immediate	Two-step under fluoroscopy	Removed
Chen et al. [2]	M	48	Left	Nephrostomy tube	PCNL	Yes	Renal vein	No	7 days	One-step under ultrasound	Removed
Tarhan et al. [13]	M	48	Left	Nephrostomy tube	PCNL	No	Renal vein	NA	1 days	One-step open pyelotomy	Removed
Al Zahrani et al. [11]	F	76	Right	Nephrostomy tube	PCNL	Yes	Renal vein, IVC	No	NA	One-step under fluoroscopy	Removed

(*continued on next page*)

Table 1 (*continued*)

Author	Sex	Age (years)	Side	Catheter	Original surgery	Solitary kidney	Location	Antithrombotic therapy	Manage time	Management	Catheter withdrawn
Fu et al. [1]	M	68	Right	Nephrostomy tube	PCNL	No	Renal vein	No	7 days	One-step open pyelotomy	Removed
Fu et al. [1]	M	28	Left	Nephrostomy tube	PCNL	No	Renal vein, IVC	Yes	2 weeks	One-step open pyelotomy	Removed
Liu et al. [3]	M	58	Right	Nephrostomy tube	PCNL	No	Renal vein, IVC	No	2 weeks	Two-step under fluoroscopy	To collecting system
Li et al. [17]	F	35	Right	Nephrostomy tube	PCNL	No	Renal vein, IVC, atrium	No	10 days	Two-step under fluoroscopy	To renal pelvis
Ge et al. [4]	F	31	Right	Nephrostomy tube	PCNL	No	Right renal vein, IVC, contralateral renal vein	Yes	10 days	One-step under fluoroscopy	To renal pelvis
Abrate et al. [9]	M	59	Right	Nephrostomy tube	Percutaneous nephrostomy	Yes (horseshoe kidney with left hem-inephrec-tomy)	Renal vein, IVC	No	Immediate	One-step open surgery	Removed
Potic et al. [10]	F	36	Left	Nephrostomy tube	Renal pelvis trauma	No	Renal vein, IVC	Yes	Immediate	One-step open pyelotomy	Removed
Song et al. [5]	M	64	Right	Nephrostomy tube	PCNL	No	Renal vein	No[a]	1 day	Three-step gradually withdrawn	Removed
Song et al. [5]	M	51	Left	Double-J tube	PCNL	No	Renal vein, IVC	No	2 days	Two-step gradually withdrawn	Removed
Song et al. [5]	F	70	Left	Nephrostomy tube	Pyeloscopy	No	Left renal vein, IVC, contralateral renal vein	No	1 day	Three-step gradually withdrawn	To renal pelvis
AbdelAziz et al. [18]	F	45	Right	Nephrostomy tube	PCNL	No	Renal vein, IVC	No	Immediate	One-step under fluoroscopy	Removed
Esfandiari et al. [19]	M	65	Right	Nephrostomy tube	PCNL	No	Renal vein, IVC, atrium	No	Immediate	One-step under fluoroscopy	Removed
Present study	F	40	Right	Nephrostomy tube	PCNL	No	Renal vein, IVC	No	4.5 days	One-step under fluoroscopy	Removed

[a] The patient developed deep vein thrombosis after withdrawn.
Manage time: time detection bleeding to management.
Antithrombotic therapy: before and immediately after withdrawn.
PCNL, percutaneous nephrostolithotomy; F, female; IVC, inferior vena cava; M, male; NA, not available.

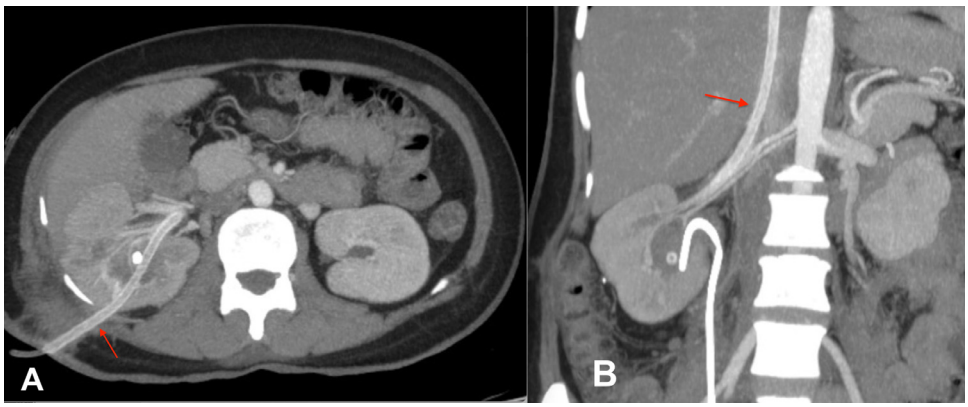

Fig. 1 – Maximum intensity projection CT scan images reformation on axial (A) and coronal (B) views showed the nephrostomy catheter (arrow) transverse the renal calyx then situated in the inferior vena cava.

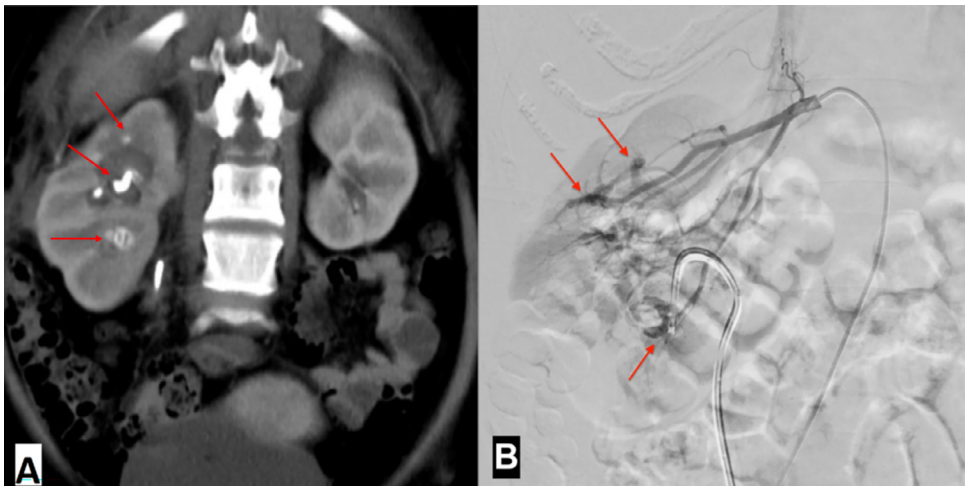

Fig. 2 – CT scanner and angiography images. (A) Multi-pseudo aneurysms found on CT scanner image (arrows). (B) Renal angiography showed the abnormal appearance of renal vascular perfusion (arrows). More selective angiography (not shown) confirmed they were pseudo aneurysms.

to no filling defect left in IVC and the filter. Besides minimally invasive intervention, some authors managed with surgery [1,12,13].

The misplaced NDT in the venous system may result in thrombus, however, anticoagulation therapy is not used in all patients. Some authors used antithrombotic therapy because the rate of massive bleeding of venous is low. Song et al. [5] reported 3 cases, in which 1 patient did not receive anticoagulation, however, multiple thromboses in the inferior vena cava, femoral vein and popliteal vein appeared 9 days after discharge.

In our case, the patient had pseudoaneurysm post PCNL associated with migration of the catheter. Because of percutaneous nephrolithotomy the staghorn calculi, the surgeon performed multiple punctures times to the collecting system resulting in many pseudoaneurysms. On the multi-specialty consultation, the goal of managing severe hemorrhage is to first regardless of whether managing open or endovascular. The advantage of the endovascular method is that it is minimally invasive, the advantage of open surgery would be favorable if massive bleeding after removing the catheter, but it being more invasive makes it less favorable. So, we decided first managing endovascular, however, the surgical team is always ready when the radiology intervention fails. Intravenous nephrostomy catheter misplacement was successfully managed using a 1-step withdrawal under fluoroscopy. The patient had a risk of bleeding after embolized pseudoaneurysms in right renal parenchyma and no venous thrombus, so we decided not to use antithrombotic therapy. To reduce the risk of bleeding, we also push Surgicel into the tunneled nephrostomy catheter after withdrawing the catheter. There are some differences in treatment in our case compared with the reports in the literature. We did not use balloon tamponade while withdrawal or a temporary filter to prevent displacement of the thrombus. Instead, we used Surgicel to reduce the risk of bleeding. There are some limitations of our case report about the management of this complication. This is the extremely rare complication. We plant treatment for the specific

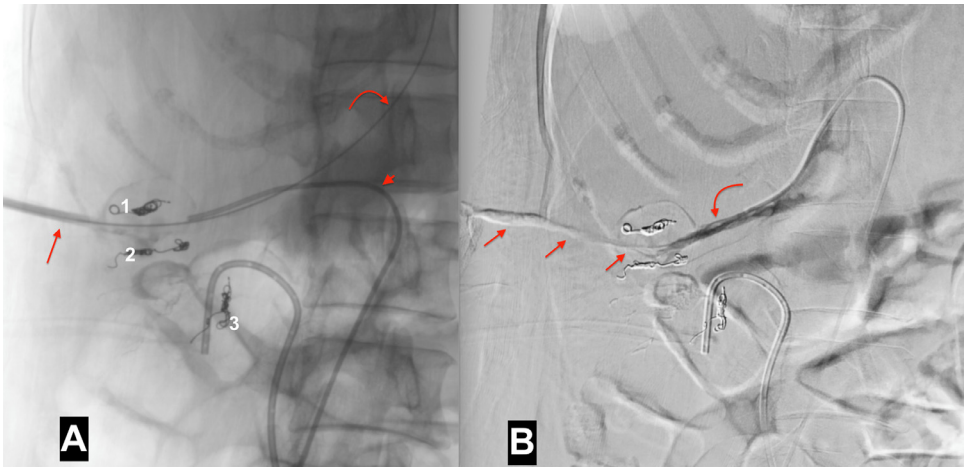

Fig. 3 – Removal of the misplaced drain was performed in the Angio suite after the first intervention for embolization of arterial lesions. (A) The nephrostomy catheter was removed (long arrow) by exchanging the guide wire (curved arrow) into the inferior vena cava. A diagnostic catheter (short arrow) was selectively placed into the renal vein to determine the entry point at which the guide wire pierced the renal vein, this catheter was used for renal venography. The coils (number 1,2,3) were present from the previous intervention. (B) Renal venography showed normal direction of venous flow (curved arrow) without extravasation of contrast into the renal calyx. Tunnel track of the drain was embolized by surgical embolic material (straight arrows).

case without guidelines. The selective of treatment depends on the patient's condition, the available facilities of our center, the experience of interventional radiologists, multi-specialty consultation results. More studies with larger sample sizes evaluate the effectiveness of this method.

Conclusion

Misplacement of PNTL into the venous system is an extremely rare but life-threatening complication. Our patient was managed by tube withdrawal under 1-step fluoroscopic guidance. Our report highlights the importance of prompt diagnosis and minimally invasive management by the catheter withdrawn under fluoroscopic guidance. Patients could be managed conservatively with intravenous antibiotics and drainage tube withdrawal under DSA.

Ethics approval

Our institution does not require ethical approval for reporting individual cases.

Patient consent

We explained the use of the information for this case report to the patient and obtained their consent.

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