Case Series

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Misplaced drainage tube inserted in the vein in a percutaneous nephrostomy: a case series

Yuanming Song, Changyong Zhao, Zhongyi Zhang, Shun Zhan, Zuze Qiu and Daobing Li

Abstract

Percutaneous nephrostomy is a critical procedure for establishing surgical pathways from the skin to the renal collecting system. The drainage tube involved in the procedure rarely deviates into the renal vein. Herein, we report three cases in which the related drainage tube was mistakenly inserted into the renal vein and inferior vena cava after the renal vein was injured during percutaneous nephrostomy. In the three cases, the nephrostomy tube and double-J tube were gradually withdrawn from the renal pelvis or renal calyces under computed tomography (CT) monitoring. In case 1, the fistula tube was not completely withdrawn in time into the renal, causing multiple thromboses in the vein. The fistula was successfully withdrawn from the vena cava after the filter was placed. Finally, the stones were cleared in two cases and one case was discharged without complications after substantial renal function recovery. A safe and reliable approach is to gradually withdraw, within a short timeframe and under CT monitoring, an ectopic renal vein or inferior vena cava drainage tube into the renal pelvis. Removal of the catheter to the renal pelvis or calyces within 3 days can reduce thrombotic complications.

Keywords

Percutaneous nephrostomy, renal vein injury, nephrostomy tube, double-J tube, thrombus, case report

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Department of Urology, Affiliated Hospital of Zunyi Medical University, Zunyi, Guizhou, China

Corresponding author:
Daobing Li Department of Urology, Affiliated Hospital of Zunyi Medical University, No. 149 Dalian Road, Huichuan District, Zunyi, Guizhou 563000, China.
Email: lidaobing6080@163.com

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Introduction

Percutaneous nephrostomy (PCN) is a critical procedure for establishing surgical pathways from the skin to the renal collecting system. Relevant literature has reported a 23.3% incidence of PCN complications;[1] intra- and postoperative bleeding remain among the most serious complications.[2] Nephrostomy tube misplacement into the renal vein or inferior vena cava rarely occurs (incidence rate, 0.023%–0.050%)[3,4] during puncture and channel establishment. To provide clinicians with a practical approach to this issue, we describe three cases of drainage tube misplacement into the renal vein and inferior vena cava after renal vein injury during a percutaneous renal technique. One of these cases was complicated by venous thrombosis.

Case reports

Case 1

A 64-year-old man was diagnosed with multiple right kidney stones and right hydronephrosis. Thus, right-side percutaneous nephrolithotomy (PCNL) was planned. The patient was unable to tolerate anaesthesia because of acute exacerbation of chronic bronchitis. Hence, the right kidney was temporarily punctured to form a fistula with the patient in a recumbent position under local anaesthesia. The patient was advised to return to the hospital every month for a right kidney fistula tube replacement; however, he did not comply with the order. Three months later, the patient returned to the outpatient clinic. After chest computed tomography (CT) and pulmonary function evaluation, the patient remained unable to tolerate anaesthesia and the right nephrostomy tube was replaced. After replacement, 200 mL of dark red blood was drained from the fistula tube, which was immediately clamped. No discomfort, e.g. waist pain, chills, fever and gross haematuria, was noted. Given CT scans indicated that the nephrostomy tube was in the renal vein (Figure 1a), the patient was hospitalised. Auxiliary examination on admission showed that urine leukocytes were 89 white blood cells/μL and haemoglobin was 152 g/L. The catheter was gradually withdrawn by 2 cm on days 1, 3, and 5. Given the patient did not experience back pain or haematuria discomfort, he was discharged. CT was not performed to confirm whether the fistula tube had retreated into the renal pelvis. Nine days after discharge, an auxiliary examination in a different hospital showed multiple thromboses in the inferior vena cava, femoral vein and popliteal vein. Notably, after being discharged from hospital, auxiliary examination data from the external hospital were not provided to the patient; these imaging data were therefore not available to us. On admission, the fistula tube was withdrawn after filter placement because the right nephrostomy tube had remained in the renal vein. The patient was discharged after receiving symptomatic treatment including anticoagulation and thrombolysis. A few months later, re-examination showed the disappearance of thrombus. The stones were then successfully removed and the patient was discharged.

Case 2

A 51-year-old man underwent PCNL on the left kidney at a local hospital. The operation was stopped because of intraoperative bleeding. A double-J tube was placed for drainage and the patient was admitted to our hospital for further treatment. At admission, CT showed that the double-J tube had entered the left renal vein and the hepatic segment of the inferior vena cava through the anterior calyx in the middle of the left kidney (Figure 1b and 1c). Based on the catheter withdrawal

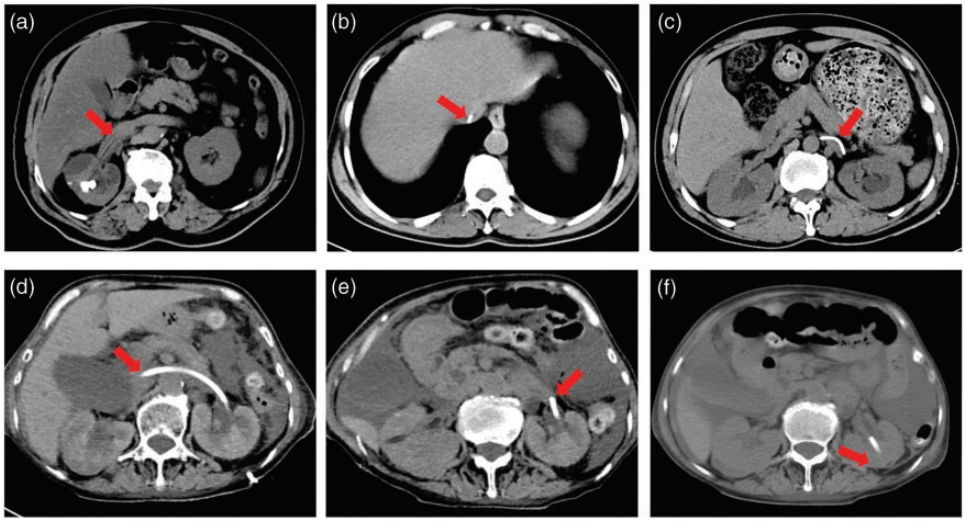

Figure 1. (a) Case 1: Computed tomography shows the tube in the right renal vein after replacement of the fistula tube (red arrow). (b and c) Case 2: Double-J stents entered the renal vein and the hepatic segment of the inferior vena cava (red arrow). (d) Case 3: The nephrostomy tube entered the renal vein, vena cava, and contralateral renal vein (red arrow). (e) Case 3: The nephrostomy tube was retreated to the renal vein rupture site on day 2 (red arrow) and (f) Case 3: The nephrostomy tube was retreated to the renal pelvis on day 3 (red arrow).

experience acquired in case 1, the catheter was withdrawn once every 2 days. Withdrawals were 8 and 4 cm on days 2 and 4, respectively, and 2 cm thereafter. The double-J tube was withdrawn to the renal pelvis after 1 week and the patient was monitored. The patient did not experience discomfort and the double-J tube slipped out of the renal pelvis of its own accord. No bleeding or venous thrombosis was noted, the left kidney stone was successfully treated and the patient was discharged.

Case 3

On CT, and a 70-year-old woman was diagnosed with a pelvic cyst—a solid tumour causing bilateral lower ureteral obstruction with hydronephrosis. The patient's creatinine level was 660 µmol/L and urine diversion and drainage to improve renal function were required. Bilateral percutaneous pyeloscopy and double nephrostomy were performed. Colour Doppler ultrasound positioning in revealed the puncture point near the posterior axillary line of the lower edge of the 12 left ribs and the punctured middle calyx of the left kidney. Liquid overflowed when the needle was inserted 7 cm deep and the dilator expanded accordingly. Blood flowed out from the indwelling puncture sheath, making the bleeding site unclear. After clamping the indwelling F12 catheter, the puncture point was re-selected for puncture and drainage, which were successful. Postoperative CT indicated that the left fistula tube was mistakenly inserted into the renal vein, vena cava and contralateral renal vein (Figure 1d). The gradual catheter withdrawal method based on the experience acquired in cases 1 and 2 was adopted. On day 1, the catheter was withdrawn 8 cm from the left renal vein. On day 2, the catheter was pushed to the renal vein rupture site (Figure 1e). The tube was withdrawn into the renal pelvis on day 3 after

observing no discomfort in the patient (Figure 1f). No bleeding or venous thrombosis was identified during the withdrawal process and the patient's creatinine level was 135 μmol/L. She was discharged 5 days after admission without any discomfort.

Discussion

Anatomical, operative and local factors can cause ectopic drainage into the drainage tube after renal vein injury during a percutaneous renal technique.[3,5,6] In case 1, causes may have included physician inexperience in performing fistula tube replacement, increased fragility caused by serious infection and the hard tip of the newly replaced balloon catheter directly injuring the renal vein. In case 2, the patient was transferred to our department after experiencing bleeding in a local hospital (the operation process is unknown). Bleeding may have been attributable to physician inexperience and damage to the mucosa of the renal collecting system during lithotripsy. Bleeding in case 3 may have been caused by the limited experience of the operator, who may have selected an inappropriate puncture direction and angle that resulted in excessive dilator expansion. For this report, the puncture and expansion processes were simulated using dynamic CT images. We believe that the main factors responsible for renal vein injury are operator inexperience, inappropriate puncture site and angle, and excessive expansion. Extremely deep insertion of a fascial dilator resulting in entry into the renal vein was the most common cause of nephrostomy tube misplacement.[3] Infection was the most significant risk factor for drainage tubes straying into the renal vein.[7] Other risk factors included solitary kidney, ectopic kidney and spinal deformity.

Preventing the drainage tube from entering the renal vein and inferior vena cava remains a key goal in clinical practice. The identification of an individualised puncture point, angle, depth, and route is required. The puncture channel should enter the collecting system as far as possible through the calyx fornix to avoid kidney column injury. Expansion should not be too deep or too severe when establishing a skin–kidney channel with the dilator. The depth and direction of the dilator can be adjusted under direct vision by inserting a ureteroscope or nephroscope into the dilator until the kidney stones are located. Clinicians should avoid blind lithotripsy of the stone during surgery and reduce mucosal damage caused by excessive mirror body tilting. Moreover, excessive force should be avoided during fistula tube replacement. If necessary, a colour Doppler ultrasound or radiograph should be used to indwell a drainage tube under real-time direct vision.

Case 1 developed venous thrombosis and the fistula remained in the renal vein. Thrombosis was possibly caused by incomplete fistula tube retraction into the long-term ectopic renal vein in the renal pelvis. In case 2, the double-J tube had completely withdrawn into the renal pelvis after 1 week. Because of the catheter withdrawal experience acquired in cases 1 and 2, complete withdrawal into the renal pelvis within 3 days was possible without venous thrombosis in case 3. Some clinicians have provided prophylactic anticoagulation therapy for patients with an ectopic renal vein and inferior vena cava drainage tube.[3,8] In cases 2 and 3, thrombus formation was avoided without prophylactic anticoagulation therapy for drainage tube removal. If the relevant drainage tube is removed from the collecting system and bleeding or delayed bleeding persists, complicated pseudoaneurysm must be avoided with diagnosis and treatment with interventional angiography. Wang et al.[9] reported a case of intravenous misplacement of the nephrostomy tube and pseudoaneurysm after PCNL. Some clinicians remove the drainage tube

misplaced in the renal vein during the operation.[3,7] In our study, the drainage tube was removed in all three cases without the need for surgical intervention. Finally, renal stones were cleared in two cases while one case was discharged without any complications after considerable renal function was recovered.

Therefore, we believe that if experienced clinicians are fully prepared for a rescue, gradually withdrawing a misplaced drainage tube to the renal pelvis under CT guidance is safe and reliable. Gradual removal of an ectopic drainage tube in the renal vein or vena cava to the renal calyx or renal pelvis within 3 days can help reduce thrombotic complications.

Authors' contributions

SYM, LDB, ZCY, ZS, ZZY, and QZZ contributed to the study concept, design, data collection, and interpretation. SYM wrote the manuscript. LDB reviewed and edited the manuscript. All authors read and approved the submitted manuscript.

Declaration of conflicting interests

The authors declare that there is no conflict of interest.

Ethics statement

Written informed consent was obtained from the patients for the publication of this case report. Ethical approval was not required because of the nature of this study (case report). The reporting of this case conforms to CARE guidelines.[10]

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ORCID iD

Yuanming Song https://orcid.org/0000-0001-9635-680X

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