



## Case Report

# Inadvertent insertion of nephrostomy tube into the renal vein following percutaneous nephrolithotomy: A case report and literature review

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**Abstract** Percutaneous nephrolithotomy (PCNL) is an effective and well accepted procedure for the treatment of large and complex renal calculi. We encountered a patient with a misplaced percutaneous nephrostomy drainage tube (PNDT) into the contralateral renal vein resulting thrombus formation after undergoing right side PCNL. We placed a temporary filter to prevent embolism and started anti-coagulation therapy immediately and finally the PNDT was removed without bleeding.

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## 1. Introduction

Percutaneous nephrolithotomy (PCNL) is a technically intricate procedure with a relatively long learning

curve, and was first introduced by Fernström and Johansson in 1976 [1]. The reported complication rate was about 7% [2]. Placement of a percutaneous nephrostomy drainage tube (PNDT) at the completion of PCNL is a common procedure. Inadvertent insertion of PNDT into ipsilateral renal vein or inferior vena cava (IVC) is a rare but very serious complication. Complications such as severe hemorrhage, embolism, perforation of the vein, and infection might turn out while PNDT is not managed properly [2–6].

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## 2. Case report

A 31-year-old female with congenital scoliosis underwent right side PCNL for a staghorn stone in another hospital. The procedure was abruptly terminated because of severe bleeding. A PNDT was placed to stop bleeding.

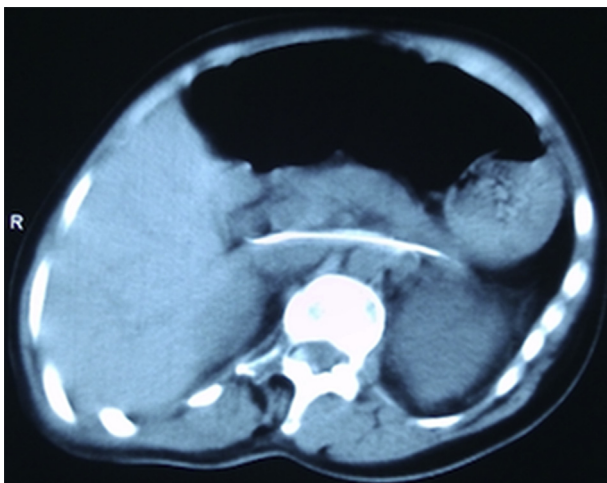
A computed tomography (CT) was immediately performed to confirm the position of the PNDT. It showed that the tip of PNDT had traversed through the right renal parenchyma, the right renal vein, the IVC, and entered the left renal vein (Fig. 1). The patient was hemodynamically stable and was urgently transferred to our hospital, a tertiary referral center, for further treatment.

The CT and magnetic resonance images (MRI) at our hospital showed that the PNDT had retracted into the IVC. There was a thrombus formation in the IVC associated with the PNDT (Fig. 2). To avoid thrombus detachment which could lead to pulmonary embolism, the patient was taken to the vascular suite for intervention. An IVC venography was performed through right femoral vein access first, confirming that the PNDT was in the IVC. A second access sheath was then inserted through the right jugular vein, and a temporary filter was implanted just above the tip of PNDT (Fig. 3). Then, anticoagulation therapy was started immediately.

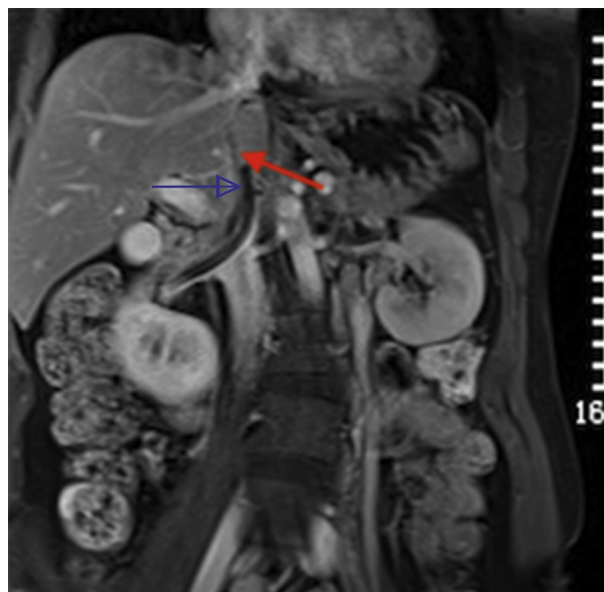
A repeat IVC venography 10 days later showed that there was no filling defect left in either the IVC or the filter. The temporary filter was removed.

The patient was then taken to the operation room for the remove of the PNDT. The PNDT was slowly withdrawn into the renal pelvis under fluoroscopic guidance. The tube was unclamped and clear urine drained.

After the procedure, the patient was noted to be hemodynamically stable. The next day, the CT confirmed that the PNDT was in the renal pelvis (Fig. 4) and the anti-coagulation therapy was discontinued.



**Figure 1** Computed tomography showing that the nephrostomy tube pierced through the right renal parenchyma and traversed across the right renal vein and the inferior vena cava, and ended in the left renal vein.

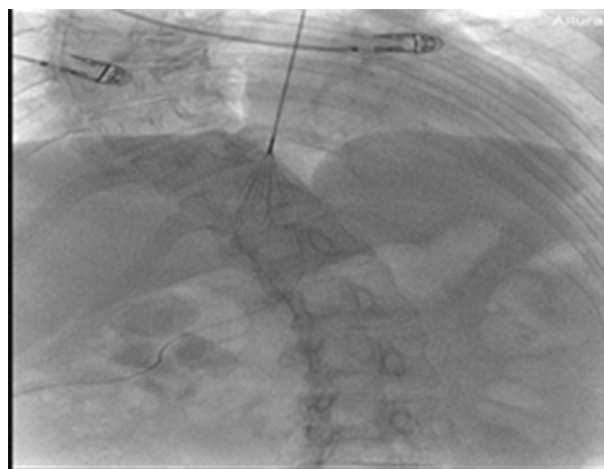


**Figure 2** Contrast enhanced T1-weighted coronal imaging showing the end of the nephrostomy tube (blue arrow) and a thrombus (red arrow) in the inferior vena cava.

The patient was scheduled for placement of a second percutaneous access for treatment of the staghorn stone 5 days after repositioning of the PNDT. We believed that the original PNDT was not in the best location to perform a second PCNL. A new percutaneous access tract was obtained under CT guidance through an upper calyx, and the original PNDT was removed without sequelae. A successful PCNL was performed 2 weeks later through the new access with complete removal of the staghorn stone.

## 3. Discussion

Misplacement of PNDT into the venous system is extremely rare. The catheter can pierce through the kidney and enter into the renal vein or even into the vena cava [7]. Only 12



**Figure 3** In inferior vena cava venography revealing that the temporary filter was implanted above the tube.



**Figure 4** Computed tomography confirming the nephrostomy tube was in the renal pelvis.

cases have been reported, and all of the PNNT were either in the ipsilateral renal vein or extended into the IVC. One of them ended in the atrium [8]. As we know, it is the first case to report that the PNNT misplaced into contralateral renal vein.

There are various reasons which can cause these complications. Misjudging the length of the nephrostomy tube or the depth of the tube insertion seems to be the common underlying causes. Complication of misplaced PNNT into the venous system could be catastrophic, and it will be life threatening due to severe hemorrhage, embolism, or systemic infection while managed improperly.

Mazzucchi and colleagues [2] reported two cases of nephrostomy catheter misplaced into ipsilateral renal vein and IVC during PCNL. The nephrostomy tube was removed at 48 and 72 h respectively with a surgical team standing by, ready to perform emergency open surgery in the event of uncontrolled bleeding. No bleeding occurred.

Chen and colleagues [8] reported three cases with misplaced nephrostomy tube into the venous system following PCNL. All of these patients were managed with strict bed rest, intravenous antibiotics, and accomplish a one-step withdrawal (remove the offending tube) in the case of one patient, a two-step withdrawal (first withdraw the tube to renal pelvis, then, remove the offending tube after confirming the patients were stable) in the other two patients, under close monitoring. The decision between the one-step or two-step withdrawal was based on the depth of tube penetration. No major bleeding encountered.

Unlike the others, Kotb et al. [9] and Tarhan et al. [10] managed their cases through open surgery. They removed the nephrostomy tubes without hemorrhage event.

Several publications have presented the rare complications with PNNT misplacement into the vessel after PCNL in the PubMed database. The data from these publications are summarized in Table 1.

In our case, the PNNT was withdrawn into the renal pelvis under fluoroscopic guidance after 10 days of anti-coagulation therapy due to the thrombus formation. Upon unclamping of the PNNT, clear urine drainage was noted. The patient was hemodynamically stable, and her hemoglobin was in the normal range following this procedure. A CT confirmed that the PNNT was in the renal pelvis the next day. Five days after correctly repositioning the PNNT, a new access was placed in the upper calyx for a second PCNL procedure. The original one was removed without sequelae at this time so that the original PNNT would not interfere with the second PCNL.

According to our experience if the misplaced PNNT in the venous system results in thrombus formation, we recommend implanting a temporary filter and starting anti-coagulation therapy as the first step. Definitive treatment should follow the resolution of thrombus. On the other hand, if the misplaced PNNT in the venous system did not cause thrombus formation or major venous injury, we believe the tube can be removed immediately, but the patient should be prepared for potential emergency surgical intervention.

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

No.	Author	Age (year)	Sex	Side	Location	Management
1	Mazzucchi et al. [2]	52	M	L	Renal vein	Removed 1-step
2	Mazzucchi et al. [2]	35	F	L	Renal vein, IVC	Removed 2-step
3	Chen et al. [8]	48	M	L	Renal vein	Removed 1-step
4	Chen et al. [8]	38	F	L	Renal vein, IVC	Removed 2-step
5	Chen et al. [8]	32	M	L	Renal vein, IVC	Removed 2-step
6	Kotb et al. [9]	50	M	L	Renal vein, IVC	Removed 1-step (open pyelotomy)
7	Dias-Filho et al. [3]	63	F	L	Renal vein, IVC	Removed 1-step
8	Shaw et al. [4]	54	M	R	Renal vein	Removed 2-step
9	Li et al. [11]	32	F	L	Renal vein, IVC	Removed 2-step
10	Wang et al. [12]	66	F	L	Renal vein	Removed 1-step
11	Fu et al. [13]	68	M	R	Renal vein	Removed 1-step (open pyelotomy)
12	Fu et al. [13]	26	M	L	Renal vein, IVC	Removed 1-step (open pyelotomy)

M: Male; F: Female; L: Left; R: Right; IVC: Inferior vena cava.

## 4. Conclusion

Misplacement of PNTD into the venous system is extremely rare. Once it happens, it will be life threatening. How to treat misplaced PNTD should be based on whether it enters venous system with thrombus formation, if so, temporary filter and anti-coagulation therapy should be given, followed by definitive treatment. Otherwise, the tube can be removed immediately with potential emergency surgical intervention prepared.

## Author contributions

*Study design:* Gonghui, Guangju Ge.

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*Data analysis:* Zuhao Xu, Yukun Wang.

*Drafting of manuscript:* Guangju Ge, Shawpong Wan.

*Critical revision of the manuscript:* Zhenghui Wang, Mingchao Wang.

## Conflicts of interest

The authors declare no conflicts of interest.

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