

Top-Notch Minimal Invasive approach for Nephrostomy Tube Misplacement in the Inferior Vena Cava: Solving an unimaginable Problem

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ABSTRACT

Introduction: Percutaneous nephrostomy tube placement is a procedure performed on the daily basis in the urological practice. The main indication is to relieve urinary tract obstruction. Most series report a complication rate of 10% with a mortality rate between 0.05-0.3%. Intravenous misplacement of a nephrostomy catheter is a rare complication of PCNT, the inadequate treatment can lead to fatal consequences. **Case Presentation:** A 49-year-old woman who presented with a clinical diagnosis of right pyelonephritis and hydronephrosis. A nephrostomy tube catheter was misplaced in the inferior vena cava. Accommodation into the collecting system was achieved by an endovascular approach. No complications were recorded. **Conclusion:** Misplacement of a nephrostomy catheter in the venous system is an extremely rare complication. The ideal treatment is to remove the catheter with a minimally invasive technique. An endovascular approach to accommodate the catheter in the collecting system or even remove it is a safe approach.

Key words: Inferior vena cava, nephrostomy, misplacement, endovascular approach, percutaneous nephrostomy.

INTRODUCTION

Percutaneous nephrostomy was first described by Gowdein et al in 1955 as a minimally invasive treatment for urinary obstruction(1). Percutaneous nephrostomy tube (PCNT) placement is a procedure performed on the daily basis in the urological practice. There are four main indications which are: diagnostic testing, access for interventions, urinary diversion, and relief of urinary obstruction, being the most common representing 85 to 90% of patients(1,2). Although PCNT is a common procedure there are no extents from complications and the clinician should be aware of these and be able to manage them(3). Most series report a complication rate approximately of 10% with a mortality rate between 0.05-0.3%(4,5). The major complications, defined as the ones that require prolonged hospitalization, are injury to adjacent organs/structures, severe bleeding, or infection; presenting approximately in 4% of patients (1,6) percutaneous nephrostomy (PCN). Rates for complications

related to vascular injury requiring interventions are between 0.1-1% and misplacements leading to injury of other organs or structures present in less than 1% of patients (4). Intravenous misplacement of a nephrostomy catheter is a rare complication of PCNT, the inadequate treatment can lead to fatal consequences including embolization, perforation, infection, or even death(3). In this paper, we will describe the treatment of the misplacement of a nephrostomy tube in the inferior vena cava, which is an extremely uncommon complication.

CASE PRESENTATION

A 49-Year-old woman consulted to the emergency department because of pain in the upper right abdominal quadrant, malaise, and fever. She had a past medical history of right ureteropelvic junction obstruction, bilateral nephrolithiasis that was managed with multiples interventions, and retirement of a right double J stent 2 months earlier. A clinical diagnosis

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of right pyelonephritis was made and started broad-spectrum antibiotics. A computer tomography (CT) revealed bilateral nephrolithiasis, right hydronephrosis, and a right perirenal collection. Due to her past medical records, we decided to place a right nephrostomy tube to relieve the obstruction. A right nephrostomy tube placement was done under conventional technique guided by ultrasound (US). The window puncture to the collecting system was not clear due to low grade hydronephrosis, when we placed the needle into the collecting system, we confirmed adequate position in the renal pelvis through US and drainage of clear urine was seen. Afterwards, we advanced the dilators and then the nephrostomy catheter with significant drainage of blood, so we retract a little bit the catheter and subsequently the bleeding stopped. Thereafter we closed the nephrostomy tube to prevent any further bleeding. After the procedure, a CT was taken due to the suspicion of a misplaced catheter. The image confirmed the catheter traversing the collecting system and the proximal loop of the catheter in the inferior vena cava (IVC) (image #1). During the postoperative period, the patient was hemodynamically

stable, with no changes in the hemoglobin levels and there were no signs of active bleeding in the nephrostomy tube. After consulting with the vascular surgery team, we decided to remove the catheter by an endovascular approach as described as follows. Three days after misplacement, a right antegrade pyelography was performed identifying the distal end of the catheter in the IVC. Thereafter the security system of the nephrostomy catheter was released, and the catheter was uncurled. A Rosen guidewire of 0.035x2.6cm was introduced through the nephrostomy catheter and successively the catheter was completely straightened, this was confirmed by fluoroscopy vision. Afterward, under fluoroscopic guidance, the catheter was pulled from the IVC. Next, the Rosen guidewire was retired and by fluoroscopic guidance the catheter was placed in the collecting system, returning clear urine. There was no need for a new puncture, as the same nephrostomy catheter was repositioned under fluoroscopic guidance in the collecting system. At the end of the procedure, there was no extravasation of the contrast agent, and the procedure ended with no complications associated.

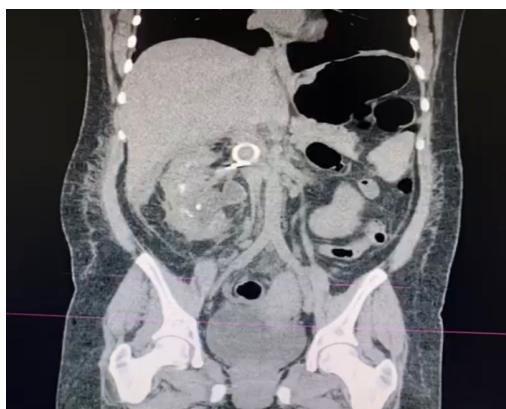


Image #1. Simple Computer tomography. Nephrostomy tube placement in the inferior vena cava (blue arrow).

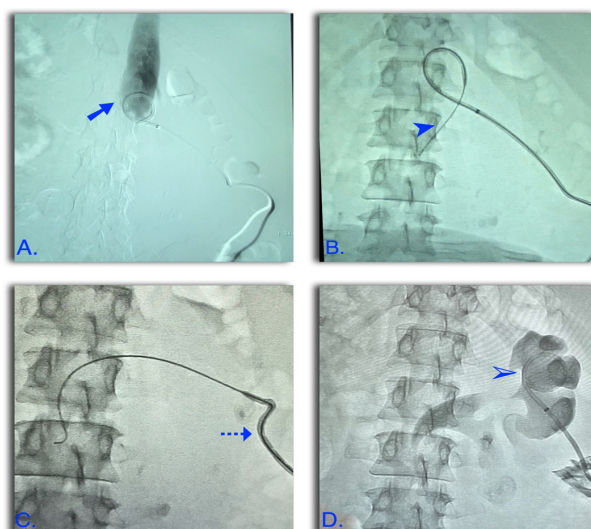


Image #2: A. Nephrostomy pig tail catheter lodge in the inferior vena cava (arrow) being painted with contrast medium. B. Nephrostomy catheter being straighten with a guidewire (Arrowhead). C. Nephrostomy catheter being pulled out of the venous system (dash arrow). D. Nephrostomy catheter placed in the collecting system (arrowhead)

DISCUSSION

Percutaneous nephrostomy tube placement is one of the most common urological procedures performed to relieve urinary obstruction. Intravenous misplacement of PCNT into the IVC is an extremely rare complication(7). The incidence of intravenous misplacement of PCNT after percutaneous nephrolithotomy (PCNL) was 0.5% in the series of chen et al and 0.23% described by Fu and colleagues(3,8). This complication is most often seen in the left-sided procedure as noted by Li and collaborators. They described three possible risk factors that can lead to intravenous misplacement of the catheter: altered anatomical structure, weak vessel wall or parenchyma, and unclear vision during the procedure due to bleeding or chronic inflammation(9)sex, relevant history,

operation, location, method of retrieval, and prognosis. Results: The patients were a median age of 48.5 years (range, 29-63 years. Additionally, there's evidence suggesting having a solitary kidney is a risk factor for misplacement of the catheter in the vascular system(7). Moreover underestimating the length or the depth of the nephrostomy tube are described to be common underlying causes for this catastrophic complication(10).

The inadequate treatment of this complication can lead to fatal consequences including severe hemorrhage, embolization, perforation, infection, or even death while managed incorrectly(3,10) . To our knowledge, there have been 10 cases reported in the literature of PCNT misplacement in the inferior vena cava. Table #1 summarizes all cases.

Table 1. Management of nephrostomy tube catheter's misplaced in the inferior vena cava

| First Author | Sex | Relevant history | Original procedure | Side | Steps for removal | Treatment | Complications |
|--|--------|--|--|------|-------------------|---|---------------|
| Dongjie Li(9) sex, relevant history, operation, location, method of retrieval, and prognosis. Results: The patients were a median age of 48.5 years (range, 29-63 years | Female | Left surgical lithotomy 5 years prior to the original procedure. Left renal calculus | Percutaneous nephrolithotomy. The procedure was interrupted because of bleeding and a nephrostomy tube was placed. | Left | 2 | Ultrasound guidance to withdraw the tip into the renal sinus. 6 days after, under general anaesthesia, the catheter was removed under ultrasound guidance | No |
| Weijin Fu (8) | Male | 1.2 cm ureteral calculi | Percutaneous nephrolithotomy. The procedure was interrupted because of bleeding and a nephrostomy tube was placed. | Left | 1 | Exploratory laparotomy (the catheter had transverse the left renal parenchyma into the IVC) on the 14 th postoperative day | No |
| Ahmed Fouad Kotb(5) | Male | Renal pelvic stone and an obstructed infected system that needed a nephrostomy tube | Nephrostomy tube exchange for a 12 FR silicon catheter | Left | 1 | Withdraw of the catheter under general anaesthesia | No |

| | | | | | | | |
|----------------------|--------|---|---|-------|---|---|----|
| Ypusof Al Zahrani(7) | Woman | Past medical history of left nephrectomy. She presented with obstructive renal unit, needing a nephrostomy tube. She presented to the hospital with misloaded nephrostomy and urosepsis. Two attempts for nephrostomy reposition. | Nephrostomy tube exchange | Right | 1 | Endovascular approach with IVC and renal Vein balloons. | No |
| Eduardo Mazzuchi(12) | Female | Staghorn stone | Second Percutaneous nephrolithotomy. The procedure was interrupted because of bleeding and a nephrostomy tube was placed. | Left | 1 | Nephrostomy tube repositioned into the collecting system under fluoroscopy guidance. | No |
| Tsung-His Lee (13) | Female | Bladder cancer cT4N2M1 with bilateral hydronephrosis. Right nephrostomy tube | Nephrostomy tube exchange | Right | 1 | The nephrostomy catheter was withdrawn with direct right abdomen compression | No |
| Xiao-Feng Chen (3) | Male | Staghorn renal calculi and mild hydronephrosis | Percutaneous nephrolithotomy. The procedure was interrupted because of bleeding and a nephrostomy tube was placed. | Left | 2 | On postoperative day 12 the nephrostomy tube was pulled in the renal vein under CT monitoring. On postoperative day 15 the catheter was removed under ultrasound guidance | No |

| | | | | | | | |
|-----------------------|-------|--|--|-------|---|--|----|
| Xiao-Feng Chen (3) | Woman | Staghorn renal calculi and moderate hydronephrosis | Percutaneous nephrolithotomy. The procedure was interrupted because of bleeding and a nephrostomy tube was placed. | Left | 2 | The tube was immediately repositioned in the renal vein. On postoperative day 7 the tube was removed under ultrasound monitoring | No |
| Skolarikos et al (11) | NA | NA | Ultrasound-guided percutaneous nephrostomy tube insertion. | NA | 1 | The tube was removed under fluoroscopic guidance | No |
| Liu J (14) | Male | Right kidney calculi | Percutaneous nephrolithotomy. The procedure was interrupted because of bleeding, a nephrostomy tube was placed. | Right | 2 | A CT was performed postoperative day 5, with the nephrostomy tube withdrawn to the collective system 2 weeks later under angiographic guidance | No |

Sholarikos et al made one of the first report of this complication in their 10 years study of ultrasound-guided percutaneous nephrostomies performed by urologists, with catheter misplacement into the IVC presented in 1 of 480 patients included, requiring removal under fluoroscopic guidance(11).

Li and colleagues reported the case of a woman who underwent a left PCNL due to renal calculus. A double j stent and a nephrostomy tube were placed at the end of the procedure. Two days later severe bleeding was noticed during nephrostomy tube removal. A CT revealed the tip of the tube was placed in the IVC. The tube was removed in a two-step approach(9)sex, relevant history, operation, location, method of retrieval, and prognosis. Results: The patients were a median age of 48.5 years (range, 29-63 years).

Fu et al described two cases of misplacement of a nephrostomy catheter into the venous system after PCNL. One in the IVC and the other in the renal vein. They performed open surgery in both cases mainly to remove the residual calculi and to prepare for major bleeding. The procedure was successful(8).

Kotb and collaborators mentioned a case of a silicon catheter misplaced in the IVC following nephrostomy tube exchange.

They manage the case by pulling out the catheter without any bleeding or complications associated(5).

Zahrani and co-workers presented the case of a woman with obstructive uropathy. She had a nephrostomy tube placement by the radiology team. The procedure was complicated by insertion into the IVC. The tube was safely removed using an intravenous balloon tamponade(7).

Mazzucchi et al. described two cases of percutaneous nephrostomy tube misplacement, one in the left renal vein and the other one in the IVC after PCNL. In the first case, the catheter was safely removed under general anesthesia. In the latter case it was repositioned in the collecting system under fluoroscopy and 48 hours later removed(12).

Lee and colleagues reported the case of a female patient with advanced bladder cancer and bilateral hydronephrosis. She had a right percutaneous nephrostomy and underwent nephrostomy tube exchange. After the revision procedure bloody drainage was noted, a CT confirmed the balloon in the IVC. Before removing the catheter, they injected haemostasis agent, and a blood transfusion was made. Then the catheter was withdrawn with direct right abdomen compression, the

compression was held for 12 hours. They took an abdominal CT ten hours after the procedure and no abnormalities were seen(13).

Chen et al reported three cases of nephrostomy catheter misplacement in the venous system following PCNL. Two patients had their catheter misplaced in the IVC and one in the renal vein. One of the patients had a solitary kidney. All three patients were treated with bed rest, intravenous antibiotics, and one-step or two-step catheter withdrawal successfully(3).

Liu J. and collaborators published a case report of a man with right renal calculi admitted for a PCNL, with excessive bleeding during procedure that was then confirmed to be due to nephrostomy tube misplacement into de IVC. The catheter was later withdrawn into de collecting system 2 weeks after de initial procedure (14) .

Intravenous migration of a PCNT is a rare complication in urological practice(9)sex, relevant history, operation, location, method of retrieval, and prognosis. Results: The patients were a median age of 48.5 years (range, 29-63 years. As described above, most of these cases were following PCNL or nephrostomy tube exchange(7). The recommendations in the management of this complication are stated by Li and colleagues as the following: bed rest, antibiotics due to increased risk of infections and sepsis; thromboprophylaxis since there have been some cases reported with thrombosis and pulmonary embolism can be a fatal complication. The removal or accommodation of the catheter is accomplished using a minimally invasive technique, therefore this method should be preferred as long as it is feasible(9)sex, relevant history, operation, location, method of retrieval, and prognosis. Results: The patients were a median age of 48.5 years (range, 29-63 years.

Our patient didn't have a previous PCNL intervention or underwent a nephrostomy tube exchange. Although, currentlyshe had a urinary tract infection leading to an acute inflammatory process in the renal parenchyma; therefore, this being a risk factor for misplacement of the nephrostomy tube in the vascular system. In our case, the catheter was successfully accommodated in the collecting system by an endovascular approach. During follow-up, no complications were reported one month after the procedure and the nephrostomy was functional.

CONCLUSION

Misplacement of a nephrostomy catheter in the venous system is an extremely rare complication. The ideal treatment is to remove the catheter with a minimally invasive technique. An endovascular approach to accommodate the catheter in the collecting system or even remove it's a safe approach.

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