Percutaneous Nephrostomy Catheter Misplacement into Inferior Vena Cava in a Patient with a Horseshoe Kidney

Alberto Abrate, MD,¹ Gabriele Tulone, MD,¹ Rosa Giaimo, MD,¹ and Alchiede Simonato, MD^{1,2}

Abstract

Background: Percutaneous nephrostomy (PCN) is commonly indicated for upper urinary tract drainage in case of obstruction or fistula. Only a few cases of PCN catheter misplacement into the inferior vena cava (IVC) have been published.

Case Presentation: We report a case of a PCN catheter misplaced into the IVC through a fistula between the urinary tract and an ipsilateral renal vein in a patient with horseshoe kidney, after bedside urgent replacement for hemorrhage and hemorrhagic shock.

Conclusion: Although a nephrostomy Foley catheter can be used for adequate urinary drainage and hemostatic purposes after percutaneous nephrolithotomy, its placement should be always verified through antegrade pyelography and particular care should be used for horseshoe kidneys. In case of massive hemorrhage, after temporary closure of the PCN catheter, the cause of bleeding should be investigated with urgent angiography or contrast-enhanced CT scan and promptly treated.

Keywords: complication, emergency, hemorrhage, horseshoe kidney, percutaneous nephrostomy

Introduction and Background

PERCUTANEOUS NEPHROSTOMY (PCN) is commonly indicated for permanent or temporary drainage of the upper urinary tract in case of obstruction (e.g., stones, tumors, or iatrogenic causes), with hydronephrosis or pyonephrosis, and urinary fistula. However, non-negligible rates of complications have been described. In particular, a risk of 1% to 4% for vascular lesions or hemorrhage has been reported.¹ We report a rare case of intravenous misplacement of a PCN catheter in a patient with a horseshoe kidney.

Presentation of Case

A 59-year-old man with spina bifida, kyphoscoliosis, abdominal aortic aneurysm, and horseshoe kidney (subjected to left heminephrectomy in childhood for unknown causes) underwent urgent PCN for right hydroureteronephrosis (Fig. 1A), caused by extrinsic ureteral compression, and acute kidney failure (Hb 10.9 g/dL, white blood cells [WBCs] 12,950/ μ L, platelet [PLT] 339,000/ μ L, creatinine 5.49 mg/dL).

According to an internal standardized protocol, under local anesthesia, after the echo-guided puncture of a mediorenal calix with an 18-gauge needle at the posterior axillary line below the costal arch, a 6F pigtail catheter was positioned over a 0.038" Lunderquist guidewire into the pyelocaliceal

system. Over the following days, an antegrade right ureteral 6F 26 cm Double-J stent was also placed, with the aim of finally removing the PCN tube, although without significant passage of urine to the bladder. After renal function improvement, an infiltrating bladder cancer was diagnosed through a contrast abdominal CT scan (Fig. 1B). Considering the high surgical risks, neoadjuvant chemotherapy was indicated.

After 3 months, the patient was hospitalized urgently for right flank pain and fever, WBCs 22,190/ μ L, Hb 10.5 g/dL, PLT 507,000/ μ L, serum creatinine 3.53 mg/dL, and international normalized ratio (INR) 1.05, secondary to obstruction of the right PCN 6F pigtail catheter, which was replaced by an 8F pigtail catheter draining pyuria with benefit. The contrast thoracoabdominal CT scan confirmed the correct placement of the PCN catheter (Fig. 1C). In the following days, after appearance of hematuria with clots from the PCN tube, obstruction of the PCN pigtail catheter, and active bleeding around it, the pigtail catheter was replaced urgently at bedside by a 14F Foley catheter on a 0.038" polytetrafluoroethylene (PTFE)-coated guidewire under ultrasound guidance with hematuria resolution, and almost clear urine was drained for a few days.

After 3 days, there was an acute spontaneous massive bleeding from the PCN Foley catheter with hemorrhagic shock (Hb 5.8 g/dL); thus it was replaced, placed in traction after balloon inflation with 5 mL of sterile water, and closed

¹Section of Urology, Department of Surgical, Oncological and Oral Sciences, University of Palermo, Palermo, Italy.

²Urology Unit, Department of Surgery, S. Croce e Carle Hospital, Cuneo, Italy.

FIG. 1. CT scan showing (A) third grade hydronephrosis of the right kidney; (B) markedly thickened bladder walls caused by bladder tumor, infiltrating the seminal vesicles, the prostate and the anterior rectal wall, and secondary pelvic lymphadenomegaly; (C) PCN pigtail catheter correctly placed in the right renal pelvis. (D) Axial and (E) coronal CT scan reconstructions showing distal end of the right nephrostomy catheter in the lumen of the inferior vena cava, dilation of the right renal pelvis and ipsilateral ureter. PCN, percutaneous nephrostomy.

at bedside, with stabilization of the hemodynamic parameters. An urgent contrast abdominal CT scan was performed, showing the distal end of the right nephrostomy catheter in the lumen of the subhepatic inferior vena cava (IVC; Fig. 1D, E). The patient underwent an emergency open right nephrectomy through an anterior transperitoneal approach. During the surgical procedure, it was evident that the PCN catheter had transversed the renal pelvis, misplaced from the upper one of two right renal veins, directly into the IVC; intraoperative blood loss was 600 mL.

The patient was then transferred to the intensive care unit where the clinical picture progressively worsened because of hemodynamic instability, pulmonary embolism, and *Klebsiella* and *Candida Albicans* pneumonia, until death because of cardiorespiratory arrest on the 9th postoperative day.

Discussion

Only few cases of misplacement of a PCN catheter into the IVC have been published.² We have described for the first time a rare case of a misplaced PCN catheter into the IVC through an ipsilateral renal vein, in a patient with horseshoe kidney, following its bedside urgent replacement caused by gross hemorrhage.

The two most frequent major complications after PCN are sepsis and hemorrhage with a risk of 1% to 9% and 1% to 4%, respectively.¹ An anatomically correct and prompt needle

insertion is important, as risk increases after a first failed endoscopic or percutaneous instrumentation and after delayed drainage.³ In contrast, the size of the inserted needle or catheter is not related to hemorrhage incidence. Also, the PCN technique (echo-, fluoroscopically guided, or combined) seems not to affect the success rate.⁴ The intravenous misplacement of the PCN catheter can be managed through staged withdrawal under fluoroscopic guidance and close monitoring.² Urgent laparotomy and nephrectomy are rarely (0.1%) needed after hemorrhage.

Massive hemorrhage is a critical condition that necessitates immediate treatment. In case of bleeding from the nephrostomy tract, the Kaye nephrostomy tamponade catheter is usually considered the gold standard, but it is not always available in clinical practice. In contrast, a nephrostomy Foley catheter has been traditionally used for adequate urinary drainage and hemostatic purposes after percutaneous nephrolithotomy.⁵ Accordingly it was used in this case with quite good hemostasis, but its misplacement into the IVC required active surgical treatment.

The most probable hypothesis is that the PCN catheter stay and the substitution maneuvers caused the formation of a small fistula between the urinary tract and a venous sinus tributary to one of the two ipsilateral renal veins leading to a first self-limiting episode of bleeding and subsequently to massive hemorrhage. In fact although the first bedside urgent maneuvers lead to effective hemostasis, the second urgent

substitution of the PCN catheter did not change the quality and quantity of bleeding until balloon inflation, traction, and closure of the catheter. Only during surgery, it was clear that the PCN catheter was inadvertently pushed through the fistula and one of the two ipsilateral renal veins into the IVC.

It is an interesting discussion point whether the use of fluoroscopy could have highlighted the fistula after the first episode of bleeding, considering the resolution of hematuria after the PCN catheter substitution. On the contrary, we think that the use of the fluoroscope would have not avoided the subsequently massive bleeding already in place, but it would have only highlighted the fistula, perhaps making the procedure stop without changing the final therapeutic decisions. In contrast, the balloon inflation associated with traction and closure of the catheter in the IVC resulted indeed in the temporary control of bleeding.

Conclusion

The risk of hematuria and hemorrhage after PCN should not be underestimated; antegrade pyelography should be always performed to verify the correct positioning of the puncture needle, guidewire, dilators, and nephrostomy catheter introduction. Particular attention should be given to the anatomy of the kidney in case of congenital malformations such as horseshoe kidney. Massive hemorrhage represents a real emergency: a fluoroscopically guided substitution of the PCN catheter to control bleeding could be controversial in this case. The presence of direct vascular lesions, arteriovenous fistula, and urinary tract–vascular fistula should be investigated with urgent angiography or contrast-enhanced CT scan, after temporary PCN catheter closure, and promptly treated.

Disclosure Statement

No competing financial interests exist.

Funding Information

No funding was received for this article.

References

1. Ramchandani P, Cardella JF, Grassi CJ, et al. Quality improvement guidelines for percutaneous nephrostomy. *J Vasc Interv Radiol* 2001;12:1247–1251.
2. Fu W, Yang Z, Xie Z, et al. Intravenous misplacement of the nephrostomy catheter following percutaneous nephrostolithotomy: Two case reports and literature review. *BMC Urol* 2017;17:43.
3. Lewis S, Patel U. Major complications after percutaneous nephrostomy—lessons from a department audit. *Clin Radiol* 2004;59:171–179.
4. Carrafiello G, Lagana D, Mangini M, et al. Complications of percutaneous nephrostomy in the treatment of malignant ureteral obstructions: Single-centre review. *Radiol Med* 2006;111:562–571.
5. Tirtayasa PMW, Yuri P, Birowo P, et al. Safety of tubeless or totally tubeless drainage and nephrostomy tube as a drainage following percutaneous nephrolithotomy: A comprehensive review. *Asian J Surg* 2017;40:419–423.

Address correspondence to:
 Alchiede Simonato, MD
 Urology Unit
 Department of Surgery
 S. Croce e Carle Hospital
 Via Michele Coppino 26
 12100 Cuneo
 Italy

E-mail: alchiede@gmail.com

Abbreviations Used

CT = computed tomography
 IVC = inferior vena cava
 PCN = percutaneous nephrostomy
 PLT = platelet
 WBCs = white blood cells

Cite this article as: Abrate A, Tulone G, Giaimo R, Simonato A (2020) Percutaneous nephrostomy catheter misplacement into inferior vena cava in a patient with a horseshoe kidney, *Journal of Endourology Case Reports* 6:3, 202–204, DOI: 10.1089/cren.2020.0012.