Traversing the Renal Pelvis during Percutaneous Nephrostomy Tube Placement (“Kidney Kabob”)

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Case Report

A 32-year-old woman with a history of nephrolithiasis presented to the emergency department with left costovertebral angle tenderness and fevers to 38.8°C. At presentation, the patient had no dysuria, urgency, or increased frequency of urination. A computed tomography (CT) kidney and urinary bladder (KUB) was ordered that demonstrated a 5-mm ureteropelvic junction stone and mild proximal hydronephrosis.

During initial evaluation in the emergency department, the patient had a white blood cell count of $46.1 \times 10^9/L$ and was tachycardic with a heart rate into the 140s. Her tachycardia initially responded to a 5-L bolus of normal saline. Urinalysis performed in the emergency department demonstrated many bacteria, positive leukocyte esterase, and nitrites. The patient was started on ceftriaxone and levofloxacin in the emergency department and admitted to the intensive care unit prior to urgent percutaneous nephrostomy placement.

Given the patient's fevers and tachycardia, anesthesia was consulted to provide hemodynamic support and intubation during the interventional radiology procedure. After placing the patient prone, a posterior calyx was accessed under direct ultrasound guidance using a 21-gauge ultrasound-scored Chiba needle (Cook Medical, Inc., Bloomington, IN) (►Fig. 1). A small amount of contrast was injected to confirm placement, and following placement of a 0.018-inch wire, an AccuStick transitional dilator was placed (Boston Scientific, Natick, MA). The 0.018-inch wire was exchanged for an Amplatz wire (Cook), the tract was dilated to 8F, and an 8F percutaneous nephrostomy tube was placed. A gentle diagnostic nephrostogram was performed prior to suturing the tube to the skin and placing the bag to gravity drainage. The patient was transferred to the intensive care unit for close monitoring and a diagnosis of urosepsis.

In the first 24 hours, the patient had 1875 mL of urine output but only 5 mL of urine output via the percutaneous nephrostomy tube. The patient was brought back to inter-

ventional radiology for a nephrostogram and tube upsizing to 10F to facilitate drainage. Nephrostogram done at that time was suggestive of thrombus within the collecting system (►Fig. 2). In the next 24 hours, urine output through the nephrostomy tube did not increase, and a repeat CT KUB was ordered.

Repeat CT KUB demonstrated the nephrostomy tube completely traversing the kidney, with the pigtail ventral to the renal cortex and some of the sidehole within the collecting system. The patient again returned to interventional radiology, and an unsuccessful attempt was made to salvage the original tract. Using ultrasound guidance, the collecting system was accessed, and using standard technique a new tube was placed in the renal pelvis (►Fig. 3). In the 24 hours after replacement, the new nephrostomy tube drained 1475 mL. The offending stone and nephrostomy tube were ultimately removed by urology 20 days later.

Discussion

Drainage of hydronephrosis secondary to obstruction was first described in 1955 by Goodwin et al.¹ In 1973, Laggard and Fernstrom described placement of a self-retaining balloon catheter following dilatation of the puncture tract.² Pedersen first described using ultrasound for access, which is now the routine imaging modality used in gaining access for dilated collecting systems.³

The most commonly reported systemic complication from percutaneous nephrostomy tube placement is sepsis. Septic complications from percutaneous nephrostomy placement was in the range of 1 to 2% in two large series, although known pyonephrosis can increase this risk to as high as 7%.^{4–6} Well-described risk factors for urinary tract infection include calculi, advanced age, diabetes, bacteruria, indwelling catheters, and oroenteric connections. To help prevent infectious complications (typically due to gram negatives such as *Escherichia coli*, *Proteus* spp., and *Klebsiella* spp.), many operators commonly administer a prophylactic dose of antibiotics prior to intervention.

Figure 1 Initial nephrostogram, anteroposterior projection, after access of the collecting system under ultrasound guidance. Contrast fills the intrarenal collecting system and proximal ureter.

The most common local complication from nephrostomy tube placement is bleeding. Although bloody urine can be seen for 2 to 3 days after nephrostomy, longer bleeding or a drop in serial hematocrit levels may signify a more serious bleeding complication. Hemorrhage that requires transfusion is a known complication that occurs 2 to 4% of the time following percutaneous nephrostomy.⁷ Venous bleeding is usually self-limited or can be treated with catheter upsizing, but arterial bleeding can be more serious and involve either renal arterial branches or intercostal branches if an intercostal route is attempted. In cases of suspected arterial bleeding, early angiography and embolization may be indicated.

Figure 2 Noncontrast computed tomography scan of the abdomen and pelvis obtained after persistent low urine output from the percutaneous nephrostomy tube. Image demonstrates the nephrostomy tube traversing the renal parenchyma and coiling in the intra-abdominal fat anterior to the kidney.

Figure 3 Percutaneous nephrostomy tube, anteroposterior projection, after nephrostomy tube replacement demonstrating tube and contrast within the renal pelvis.

Catheter malposition is a rare complication, although it has been reported in the literature either as intramural dissection or renal pelvis injury. Intramural dissection can result from a guidewire dissecting underneath the urothelial lining. On follow-up nephrostograms, the tube may appear to reside in the renal pelvis, although no urine output is present.⁸ Filling defects within the renal pelvis, assumed to be thrombus, actually represent the outline of the renal pelvis itself with contrast tracking beneath the urothelium and outlining the entire pelvocaliceal system. CT scan is diagnostic, with contrast outlining portions of the collecting system.⁸ Renal pelvis injury has been reported from over-advancement of a dilator using a kinked guidewire.⁹ In this report, the postulated mechanism was the kinked portion of the guidewire tearing through the renal pelvis during serial dilation.

In the current case, at least two potential mechanisms could account for the initial catheter malposition. The first possibility is that the AccuStick dilator system was advanced through the urothelium after placement of the 0.018-inch wire, and then the Amplatz wire was passed through the urothelial rent prior to placement of the nephrostomy tube. This possibility could be avoided by more judicious visualization of the dilator tip when inserting. A second possibility is that the floppy-to-stiff transition point of the Amplatz wire may have been forced through the urothelium that was ill defined with some contrast surrounding the kidney. To eliminate this possibility, a Bentson wire (Cook) or Rosen wire (Cook), both of which have longer tapers, may have been useful.

References

- 1 Goodwin WE, Casey WC, Woolf W. Percutaneous trocar (needle) nephrostomy in hydronephrosis. *J Am Med Assoc* 1955;157(11): 891-894

- 2 Laggard LE, Fernstrom I. Percutaneous nephropylotomy. *Acta Radiol Diagn (Stockh)* 1974;15(3):288–294
- 3 Pedersen JF. Percutaneous nephrostomy guided by ultrasound. *J Urol* 1974;112(2):157–159
- 4 Farrell TA, Hicks ME. A review of radiologically guided percutaneous nephrostomies in 303 patients. *J Vasc Interv Radiol* 1997;8(5):769–774
- 5 Wah TM, Weston MJ, Irving HC. Percutaneous nephrostomy insertion: outcome data from a prospective multi-operator study at a UK training centre. *Clin Radiol* 2004;59(3):255–261
- 6 Larsen EH, Gasser TC, Madsen PO. Antimicrobial prophylaxis in urologic surgery. *Urol Clin North Am* 1986;13(4):591–604
- 7 Hausegger KA, Portugaller HR. Percutaneous nephrostomy and antegrade ureteral stenting: technique-indications-complications. *Eur Radiol* 2006;16(9):2016–2030
- 8 Michaelides M, Dimarelos V, Stratilati S, Tsitouridis I. Intramural dissection of the renal collecting system during percutaneous nephrostomy: computed tomography findings of a rare complication. *Cardiovasc Intervent Radiol* 2011;34(Suppl 2):S324–S327
- 9 Lewis S, Patel U. Major complications after percutaneous nephrostomy-lessons from a department audit. *Clin Radiol* 2004;59(2):171–179