CASE REPORT

Hydroperitoneum: A Unique Complication of Supine Percutaneous Nephrolithotomy on An Ectopic Solitary Pelvic Kidney

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A 47-year-old male complained of anuria for 2 days with elevated creatinine of 14 mg/dL on admission. Patient underwent emergent hemodialysis. Non-contrast CT showed a solitary ectopic pelvic kidney with a 2 cm. pelvolithiasis and a 1 cm upper pole calyceal stone with obstructive hydronephrosis. He therefore underwent ultrasound-guided nephrostomy tube placement. Once clinically stable, the patient underwent a multi-tract supine PCNL. Intraoperatively, the authors noted tense abdominal distention accompanied by hypotension during the procedure. A diagnosis of compartment syndrome secondary to hydroperitoneum was considered. An indwelling stent and a nephrostomy tube were placed. An abdominal pigtail drain was placed removing three liters of fluid. The patient remained intubated for 3 days. He underwent blood transfusion. He required two 2 sessions of hemodialysis postoperatively. The patient was discharged in stable condition on postoperative day 22. Hydroperitoneum is a potential complication of PCNL in ectopic pelvic kidneys. Its prompt recognition, followed by immediate aspiration of intraabdominal fluid and drain placement is life-saving.

Key words: ectopic kidney, solitary kidney, supine PCNL, hydroperitoneum, compartment syndrome

Introduction

Ectopic kidney is a rare congenital anomaly due to failure of the kidney to ascend properly between sixth and ninth weeks with incidence of 1:12,000.[1] It may be seen in the pelvis, iliac, abdomen or thorax. A unilateral renal agenesis has a prevalence rate of 1:2000 births and is due to the failure of the ureteral bud to form or the absence of the nephrogenic ridge.[2]

Ectopic unilateral kidney with lithiasis is a therapeutic challenge to the urologist due to the kidney's unusual location. PCNL remains the standard of care because of its minimally invasive nature. However, whilst PCNL may seem easier to do when the kidney in the pelvic region because of its anterior location, potential problems may arise related to intraabdominal entry, bowel injury, and extravasation.

Presented here is a case of multi-tract PCNL on an ectopic solitary kidney with nephrolithiases, which complicated intraoperatively with hydroperitoneum. The importance of early recognition of this life-threatening condition and the need for prompt intervention to obviate any serious sequelae are also discussed.

The Case

A 47-year-old male presented with anuria for two days. A Foley catheter was inserted but

no urine output. He had an elevated creatinine (14 mg/dL) and underwent emergent hemodialysis. Non-contrast CT showed an obstructing 2 cm pelvolithiasis and 1 cm upper calyceal stone in a solitary ectopic pelvic kidney with moderate hydronephrosis (Figure 1). Ultrasound-guided percutaneous nephrostomy tube was inserted (Figure 2). He was scheduled for definitive surgery after stabilization.

Figure 1. Coronal view of CT KUB showing the ectopic pelvic kidney with pelvolithiasis and superior calyceal calculus.

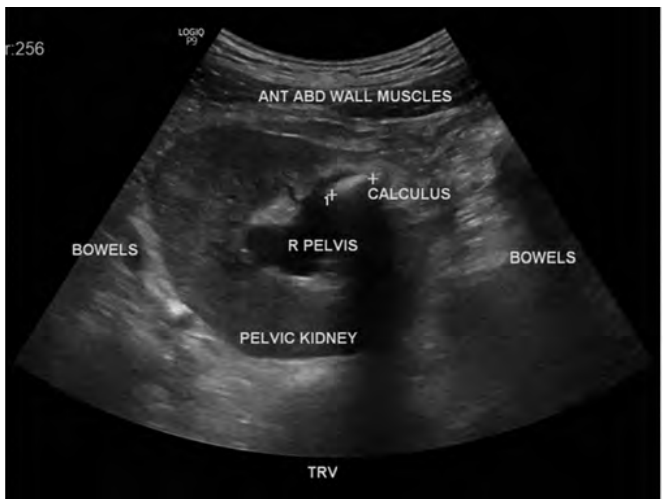


Figure 2. Ultrasound image of the pelvic kidney with adjacent structures.

The patient was placed in supine position and nephrostogram was done (Figure 3). The NT was removed over an Amplatz super stiff® (Boston Scientific, USA) guidewire and the tract was dilated to 28Fr, followed by the application of Amplatz sheath. Intracorporeal fragmentation was performed using EMS Swiss Lithoclast Master® ultrasonic lithotripter (Nyon, Switzerland.) An additional tract was obtained at the superior calyx with ultrasound and fluoroscopic guidance. However, upon culmination of the procedure, the abdominal girth was markedly distended and tense, associated with hypotension and bradycardia. Compartment syndrome was suspected due to hydroperitoneum. A JJ stent was immediately placed, followed by insertion of NT (Figure 4).

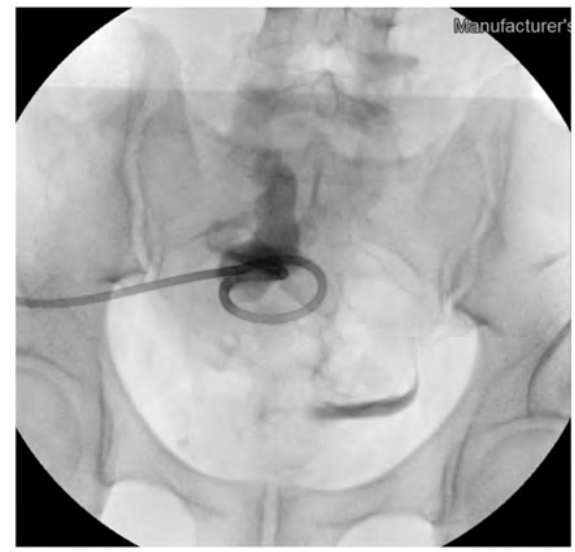
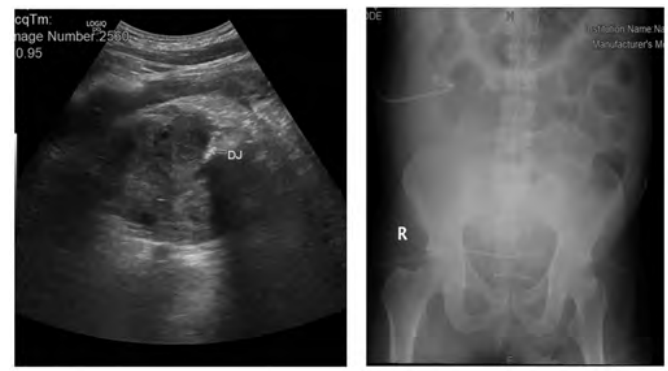


Figure 3. Nephrostogram: the tip of the NT is in the pelvis.



A B

Figure 4A. Postoperative ultrasound showing no residual stone. **4B**. Postoperative KUB showing the indwelling ureteral stent in the ectopic kidney.

An abdominal pigtail drain was placed removing 3L of hydroperitoneum (Figure 5). Patient was stabilized, and transferred to the intensive care unit, extubated 3 days post-operatively. A total of 4 units each of packed red cells, fresh frozen plasma and platelet concentrate were transfused.

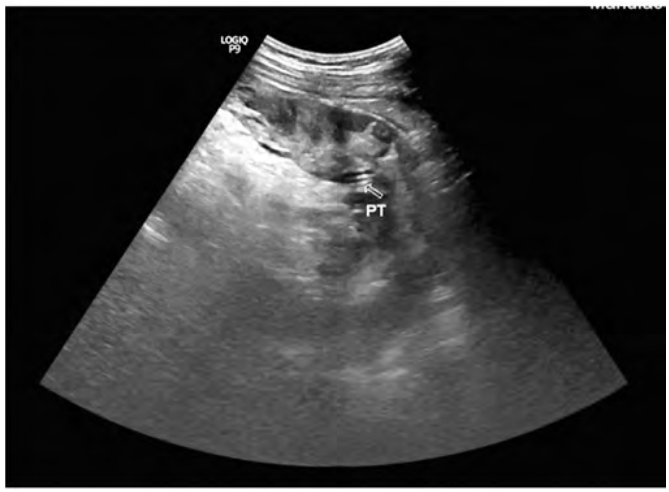


Figure 5. Hydroperitoneum with insertion of pigtail for drainage; PT: pigtail.

The patient required temporary dialysis for 2 sessions. Creatinine decreased to 2.0 mg/dL with an average urine output of 600-800 mL/day per NT and 1 liter/day from foley catheter. Pigtail drainage had an average daily output of 50-100 mL. Patient was discharged on postoperative day 22 with NT clamped and both foley and pigtail catheters opened. Patient followed up after 2 weeks, with an average daily urine output of 1.5L and pigtail output of 10-30 mL/day. The NT and foley catheter were removed, and patient was voiding freely. The pigtail was also removed after whole abdomen ultrasound confirmed minimal hydroperitoneum (Figure 6).

Discussion

Nephrolithiasis in ectopic kidneys is a unique therapeutic challenge. This is because the kidney is in the lower abdomen, which makes the surrounding bowel, blood vessels and other visceral organs more susceptible to injury. The choice and success of

Figure 6. Ultrasound showing the coiled tip of the pigtail (arrow).

therapy depends on renal anatomical features and stone characteristics and surgical expertise.

Ultrasound guidance for obtaining percutaneous renal access in ectopic kidneys offers many advantages. It is radiation-free, allows real time monitoring of needle entry into the renal collecting system while avoiding adjacent viscera, bowel or vasculature. It also helps in selecting the best calyceal system to puncture to access the stone.[1]

There are several therapeutic options for urolithiasis in ectopic kidneys. These include Extracorporeal shockwave lithotripsy, Retrograde intrarenal surgery, and open surgery. Unfavorable factors for ESWL success includes stone density of ~1000 HU, lower pole stone location, long and narrow infundibulum and acute infundibulopelvic angle. Di Franco, et al, concluded that stone size is an important factor in the success of the treatment.[1]

RIRS is a reasonable option for managing stones <2cm in solitary kidneys. Challenges include the need for preoperative ureteral stenting in non-compliant ureters, the need to perform a staged procedures, and the lower stone clearance rate compared to PCNL.[4]

Laparoscopic guidance is sometimes used for PCNL in ectopic kidneys to obviate inadvertent injury to the bowel and viscera during the percutaneous renal access. Real time monitoring of entry of needle into the kidney as well as suctioning of intraabdominally extravasated fluid may also

be done in order to prevent hydroperitoneum and compartment syndrome.[5]

Hydroperitoneum is a rare complication of PCNL, and is due to the extravasation of irrigant fluid into the intraabdominal space, when a tear in the peritoneum occurs. Most reported cases are those occurring after PCNL of orthotopic kidneys. In this case however, the anterior albeit retroperitoneal location of the ectopic pelvic kidney makes it susceptible to an intraabdominal extravasation. This may occur when a rent in the anterior visceral peritoneum is sustained during the percutaneous access and tract dilation.

The estimated blood loss was 1750cc with total operative time of 3 hours 37 minutes. The increased blood loss was likely attributable to the dual access tracts that the authors employed during the PCNL. The unusual anterior and malrotated position of the kidney made it difficult to perform the surgery in the familiar manner that is usually encountered in the prone or supine approach.

One must be keen in its early detection and treatment for hydroperitoneum secondary to extravasation, to prevent morbidity and mortality.[6] Signs and symptoms that may show impending compartment syndrome include: increased abdominal girth, difficulty breathing, decreased urine output, difficult ventilation and hypovolemia. Timely management of pigtail for drainage of fluid to decompress the abdomen quickly is highly recommended.[6]

With surgical decompression, organ dysfunction is expected to recover. With less tension in the abdomen, the diaphragmatic excursion can increase, leading to improved ventilation and reduction of peak airway pressures. Compression of the IVC and circulatory system is relieved, leading to improved cardiac output and the ability to wean patients off of vasopressor support. Acute kidney injury is reversed with less compression of the renal arteries and ureters.[7]

The patient in this case recovered fully after resolution of the acute hydroperitoneum, acute kidney injury and sepsis. A concerted effort by the different specialists such as radiologists and nephrologists is extremely significant in the management. Communication among the different disciplines will improve the successful treatment of such rare cases.

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