

# A Patient with Recurrent Pyelonephritis and Renal Stones Associated with a Bochdalek's Hernia Involving the Proximal Ureter Treated by a Robot Assisted Approach and Retrograde Intrarenal Surgery: A Case Report

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## Abstract

**Background:** Bochdalek hernia is a congenital posterolateral diaphragmatic defect that facilitates displacement of intra-abdominal organs into the thoracic cavity. It constitutes the most prevalent subtype of congenital diaphragmatic hernia with presentation in adulthood being uncommon and often incidental. Right-sided Bochdalek hernias occurs less frequently than left-sided lesions, and involvement of the ureter within the hernia sac is exceedingly rare.

**Case Presentation:** We present a 68-year-old female patient with a history of recurrent urinary tract infections and right renal stones secondary to impaired drainage of her right kidney resulting from an abnormal course of her right proximal ureter into a Bochdalek's hernia. Management of this case required appropriate imaging to confirm the diagnosis, and the application of minimally invasive endourology techniques for a successful outcome.

**Conclusion:** This case highlights the importance of recognising unusual anatomical variations that can promote urinary stasis and to provide insight into minimally invasive surgical approaches to management.

**Keywords:** Renal Stones; Bochdalek's Hernia; Ureteral diaphragmatic herniation; Robotic pyeloplasty

**List of Abbreviations:** UTI- Urinary Tract Infection; ESBL- Extended Spectrum Beta Lactamase; CT- Computed Tomography; HU- Hounsfield Units; ERPF- Effective Renal Plasma Flow

## Introduction

Bochdalek's hernia is a defect of the posterolateral diaphragm that allows abdominal organs to enter the chest cavity. It is the most common congenital diaphragmatic hernia, usually presenting in children with respiratory symptoms, while adult cases are rare and often asymptomatic [1-5]. Here we present an unusual case of an adult female patient with recurrent urinary tract infections secondary to impaired drainage of her right kidney as a result of an abnormal right ureteral course through a Bochdalek's hernia outlining her assessment and management involving minimally invasive endourological interventions to achieve a satisfactory outcome.

## Case Presentation

A 68-year-old female was referred to the urology clinic in a tertiary academic hospital for further management of a right renal lower pole stone

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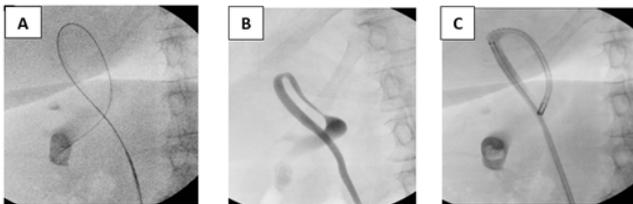
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burden. She had a history of recurrent urinary tract infections (UTIs), including an episode of right pyelonephritis in the past with Extended Spectrum Beta-Lactamase (ESBL) *Escherichia coli*. She had a prior attempt at shock wave lithotripsy, which had led to some fragmentation but no stone clearance. When seen in clinic repeat non-contrast computed tomography (CT) imaging revealed two lower pole renal stones measuring a total of 1.2 cm with Hounsfield Units (HU) of 1300. Given ongoing symptoms and her UTI history treatment options were reviewed, and a recommendation was made to proceed with flexible ureteroscopy and laser lithotripsy. Her preoperative blood work was normal, and a urine culture was negative. Flexible ureteroscopy was attempted in our standard fashion. Under fluoroscopic guidance a 0.035-inch Teflon-coated Bentson guidewire was advanced into the kidney. During guidewire insertion it was immediately noted that the ureter took an unusual course into the kidney (Figure 1A). To further clarify the anatomy a retrograde pyelography was performed (Figure 1B).

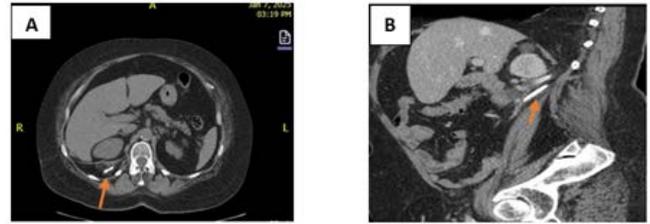
This revealed the ureteropelvic junction was oriented superiorly and the proximal ureter coursed cephalad to the upper pole of the kidney. Flexible ureteroscopy using a 7.5 Fr. digital flexible ureteroscope was attempted, however the loop in the upper ureter could not be negotiated. Despite many manipulations including different guidewires and switching to a smaller calibre fiberoptic flexible ureteroscope, we were unable to overcome the 360-degree ureteral loop (Figure 1C).



**Figure 1A:** Fluoroscopic image with guidewire showing anomalous course of the proximal ureter; (B) Retrograde pyelogram demonstrating anomalous course of the proximal ureter and ureteropelvic junction directed cephalad; (C) Fluoroscopic image of the path of the flexible ureterscope.

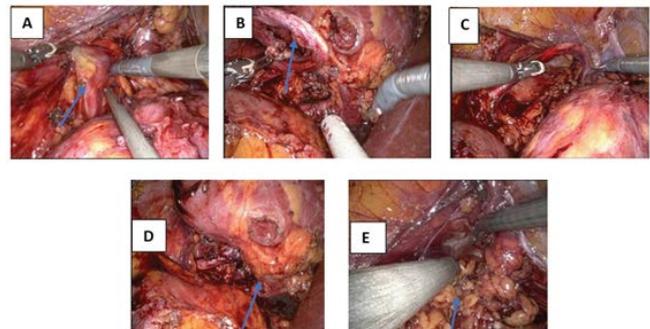
The decision was made to insert a ureteral stent to accurately define the course of the ureter with the intent of proceeding with further imaging post-operatively. A 30 cm 7 Fr ureteral stent was placed, the longest stent in our inventory, but due to the abnormal ureter course, the proximal tip of the stent only reached the upper ureter. A CT urogram was organized revealing the proximal right ureter coursing posterior and superior to the right upper pole renal parenchyma (Figure 2 A). The upper ureter was noted to enter the thoracic cavity within a Bochdalek's hernia. (Figure 2 B).

The renal pelvis was mildly dilated, and the lower pole renal stones were visualized. The ureteral stent was removed and a diuretic renogram arranged to assess for physiological



**Figure 2A:** CT Urogram pre-contrast imaging showing the ureteral stent above the diaphragm in the Bochdalek's hernia. An arrow points to the location of the proximal stent; (B) CT Urogram post-contrast sagittal image showing the upper ureter coursing inferior and cephalad to the renal pelvis. An arrow shows the location of ureter posterior to the renal pelvis.

obstruction. The renogram identified a split renal function of 60% for the right kidney versus 40% for the left, with a normal global effective renal plasma flow (ERPF). There did appear to be stasis of radiotracer in the right kidney, although after Lasix administration the t1/2 was within normal limits bilaterally. Although physiologically there was no obstruction, radiographically there was evidence of stasis resulting in recurrent UTIs and renal stone formation. Given the anomalous orientation of the ureteropelvic junction, pyeloplasty was discussed as a therapeutic option, with repair of the diaphragmatic hernia. The patient was also assessed by thoracic surgery for input on how to best manage the hernia repair. The patient elected to proceed with robot-assisted laparoscopic hernia reduction and reconstruction. A ureteric catheter was placed via flexible cystoscopy. A 5 port transperitoneal approach was utilized using the DaVinci Xi robot (Intuitive Surgical, Sunnyvale, CA). The ureter was identified, followed into the hernia and dissected out (Figure 3 A, B). The redundant ureter was excised and the ureter spatulated, with reanastomosis to the renal pelvis using 3-0 polyglactin sutures (Figure 3 C, D). A 3 cm polyglactin patch was used to cover the Bochdalek defect (Figure 3E).



**Figure 3A, B:** Intraoperative images showing the ureter coursing into the hernia and after it is dissected free. An arrow points to the hernia in figure 5A and the ureter dissected free in figure 5B; (C), (D) Intraoperative images after mobilization and excision of the redundant ureter, and anastomosis to the renal pelvis. An arrow points to the newly reconstructed UPJ (D); (E) Intraoperative image showing placement of a polyglactin patch to cover the Bochdalek hernia defect. An arrow points to the polyglactin patch.

Nephropexy was performed using 2-0 silk sutures. A 7 French, 30 cm double J stent was placed. While in hospital the patient remained well and was discharged home on the second post-operative day. The stent was removed 6 weeks post-pyeloplasty and a CT urogram was performed. This demonstrated a dependant ureteropelvic junction and a normal ureteral course without hydronephrosis (Figure 4).



**Figure 4.** CT urogram post robotic assisted pyeloplasty showing a dependant ureteropelvic junction and non-dilated renal pelvis.

Unfortunately, several week later she developed a febrile UTI, and imaging showed the lower pole stones had migrated into the renal pelvis. She required IV antibiotics and stent reinsertion. Once the UTI was treated, she underwent uneventful right ureteroscopy and Holmium YAG laser lithotripsy using a 6.3 Fr single use flexible ureteroscope and a 10-12 Fr ureteral access sheath. Post-ureteroscopy imaging revealed no significant residual stones.

## Discussion

Bochdalek's hernia was originally described in 1754 by McCauley and was further characterised by the Czech pathologist Vincent Alexander Bochdalek [6]. Its prevalence is estimated to range from 1 in 2000-7000 from autopsy studies, but as high as 6% based on early CT examinations [7-9]. Bochdalek's hernia is most found on the left side in 75-90% of cases where it usually presents at an earlier age and is associated with worse outcomes [10]. Right sided diaphragmatic hernias are not as common because the right pleuroperitoneal canal closes earlier and the liver buttresses the right hemidiaphragm [11]. Right sided Bochdalek hernias are more common in older women with mean age of 58 [12]. While the reason for this is unknown, increased intra-abdominal pressure and tissue laxity with age has been theorized as potential factor. Any abdominal structure may be found in the hernia, with ureteral hernias being the rarest [13]. The first case of a ureteral hernia through a Bochdalek foramen was reported by Swithinbank in 1958 and since then less than 12 similar cases have been reported [12,14,15]. Typical symptoms reported by patients with diaphragmatic ureteral hernias include hematuria, flank pain

or pyelonephritis [13-19].

Various management strategies have been described in the literature. A conservative approach maybe suitable when the patient is asymptomatic and in the absence of complications. Surgery is indicated for obstruction, persistent pain, declining renal function or urinary infection. If urgent intervention is required, ureteral stent or percutaneous nephrostomy insertion have been reported. Definitive reconstruction with open and laparoscopic repair with closure of the diaphragmatic defect has also been described [12,20]. The Da Vinci robotic surgical system has overcome the limitations of traditional laparoscopy, demonstrating improved ease and precision in reconstruction and intracorporeal suturing during pyeloplasty [21]. To our knowledge, this is the first case of right-sided ureteric herniation treated via a transperitoneal robot assisted approach. There has been one prior thoracic kidney treated in a similar manner [22]. The diaphragmatic hernia defect can be repaired by open such as abdominal, thoracoabdominal or thoracic approach or via minimally invasive such as laparoscopic, robotic or thoracoscopic approach. The defect can be usually repaired by simple suture closure or by an implantable mesh [23,24]. A hernial defect of 5 cm is the upper limit for suture closure according to Sato et al [25]. A mesh is preferable for a large hernial defect or when surrounding tissues are very friable. During ureteroscopy lithotripsy in the post pyeloplasty setting we need to take precautions to minimize the risk of injury at the ureteropelvic anastomosis site. Use of a ureteral access sheath proves a particularly beneficial tool as it reduces intrarenal pressures, provide protection of the anastomotic site, facilitates navigation through altered anatomy and provides improved stone clearance. Using a smaller calibre flexible ureteroscope facilitates further this process.

## Conclusion

Bochdalek's hernia presenting in adulthood is an uncommon entity, and even rarer still is involvement of the ureter. Management of this case required appropriate imaging to confirm the diagnosis, and the application of minimally invasive endourology techniques in the successful management of this rare condition.

## Authors Contributions

Solon Ierides: Literature review, writing of original draft

Stephen Pautler: Provision of the intraoperative robotic images. Review and editing

Hassan Razvi: Supervision, provision of intraoperative fluoroscopic images, review and editing.

All authors read and approved the final manuscript

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## Conflicts of Interests

The authors declare that they have no conflicts of interests.

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