Successful Retrograde Intrarenal Surgery for a Large Kidney Stone in a Pelvic Ectopic Kidney: A Case Report and Review of Literature

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Summary

An ectopic kidney is a condition in which one or both kidneys are located outside of their normal anatomical position, typically lower than usual, and are prone to stone disease. In the past, most patients required open surgical treatment, but nowadays, laparoscopy-assisted percutaneous nephrolithotomy and multisession retrograde intrarenal surgery (RIRS) facilitate minimally invasive approaches. A 42-year-old male presented to the urology clinic with complaints of intermittent lower midabdominal pain near the suprapubic area for a year. A computed tomography scan evaluation of the abdomen without contrast was then performed, showing incomplete staghorn with multiple calyceal stones in the ectopic kidney, with the largest stone measuring 2 × 1.2 cm and mild hydronephrosis. A single-session RIRS was performed which successfully disintegrated the stone. This pelvic kidney, although situated within the retroperitoneum, has the bowels positioned between the front wall of the abdomen and the kidney. The successful navigation of the flexible ureteroscope through the deformed urinary tract made RIRS applicable in the presence of a urinary tract deformity. This case was managed with RIRS, which offers advantages in visualization and is considered a safer option compared to other methods.

Keywords: RIRS, Ectopic pelvic kidney, Stone disease, Case report

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Introduction

Anomalies in the urinary tract, especially in the kidneys, are common, with variations occurring in the number, position, shape, size, and rotation of the kidneys. These anomalies are typically asymptomatic and are often discovered incidentally during physical or radiological investigations. Pelvic kidneys, a rare anomaly with an incidence of about 1 in 2200–3000, are particularly prone to stone disease due to abnormal anatomical conditions and malrotation (1, 2). Studies have shown that stone formation in ectopic kidneys is not solely dependent on malformation; a significant percentage of patients experience complications such as obstruction and infection. Ectopic kidneys, including pelvic ectopic kidneys with a prevalence of approximately 1:3000, are often associated with ureteropelvic junction obstruction, leading to conditions such as nephrolithiasis. Other

anomalies, such as horseshoe kidneys and duplex renal collecting systems, contribute to the complexity of stone disease in patients with congenital urinary tract abnormalities (3).

The surgical treatment of kidney stones has evolved significantly in the last decade. In the past, open surgical procedures were commonly needed, but nowadays, minimally invasive approaches are preferred. One such approach is the retrograde intrarenal surgery (RIRS), which has proven to be a valuable and effective treatment option for managing large kidney stones in pelvic ectopic kidneys (4,5). We present a case of a large staghorn calculus in a patient with a right ectopic pelvic kidney which was successfully treated with a single-session RIRS.

Case presentation

A 42-year-old male presented to the urology clinic with complaints of intermittent lower midabdominal pain near the suprapubic area for 1 year. The patient felt intermittent dull pain scoring 3–4 out of 10 on a visual analogue scale without a history of fever, chills, or vomiting. The patient denied any history of kidney stone or surgery. His vital signs as well as physical examination of the head, neck, thorax, abdomen, and extremities were within normal limits. Flank fist percussion revealed no tenderness, but the patient felt pain during suprapubic palpation with no mass detection.

Laboratory results of complete blood count and kidney function were within normal limits. An Blass Nier Overzicht Intravenous Pyelogram (BNO-IVP) was performed about 6 months before the patient presented to the hospital which showed the presence of a collecting system in the pelvic area suggesting a right ectopic pelvic kidney (Figure 1). A computed tomography scan evaluation of the abdomen without contrast was then performed which showed incomplete staghorn (pyelum to inferior calyx) with additional multiple superior calyceal stones in the ectopic kidney with the largest stone measuring 2 × 1.2 cm (Hounsfield unit: 624) and mild hydronephrosis (Figure 2). Due to the lack of a laparoscopy device, we decided to perform a transureteric endoscopic procedure.

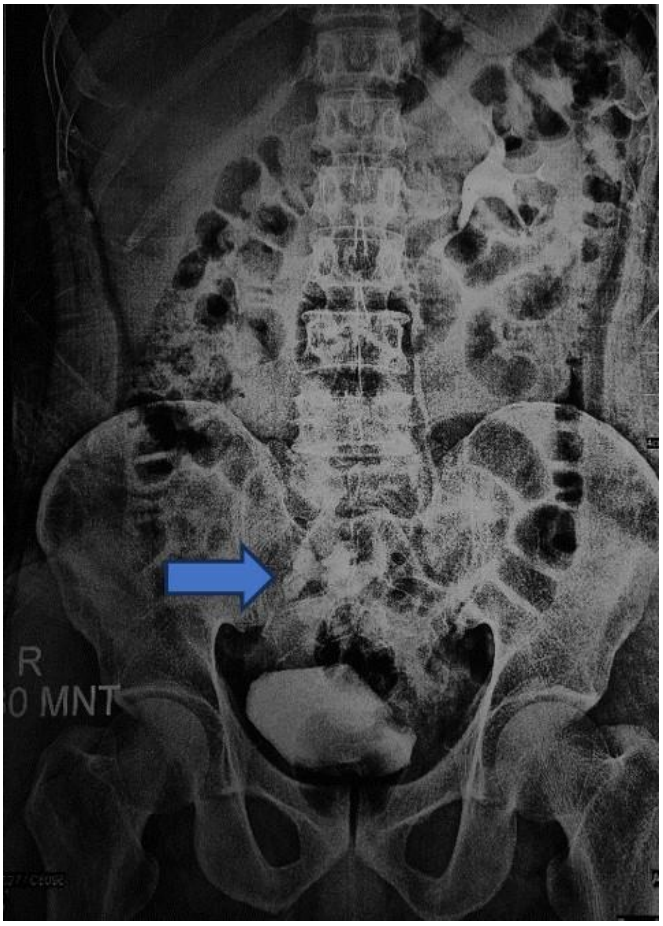

Figure 1. Blass Nier Overzicht Intravenous Pyelogram (BNO-IVP) showed the collecting system of the right kidney at the pelvic area (blue arrow).

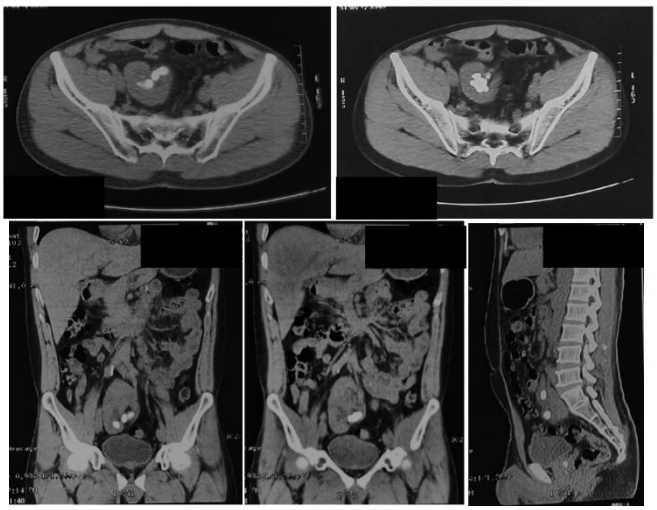

Figure 2. Computed tomography scan without contrast of abdomen pelvis showing the stone in the ectopic pelvic kidney.

Initially, semi-rigid ureterorenoscopy (URS) with lithotripsy was performed in the lithotomy position under general anesthesia to analyze the anatomy and successfully clear the stone at the renal pelvis. However, we encountered difficulty negotiating the scope further and thus decided to proceed with flexible URS. A hydrophilic guide wire was placed, and a ureteric access sheath was inserted over the guide wire. A flexible URS was introduced which found multiple stones in the superior and inferior calyces (Figure 3).

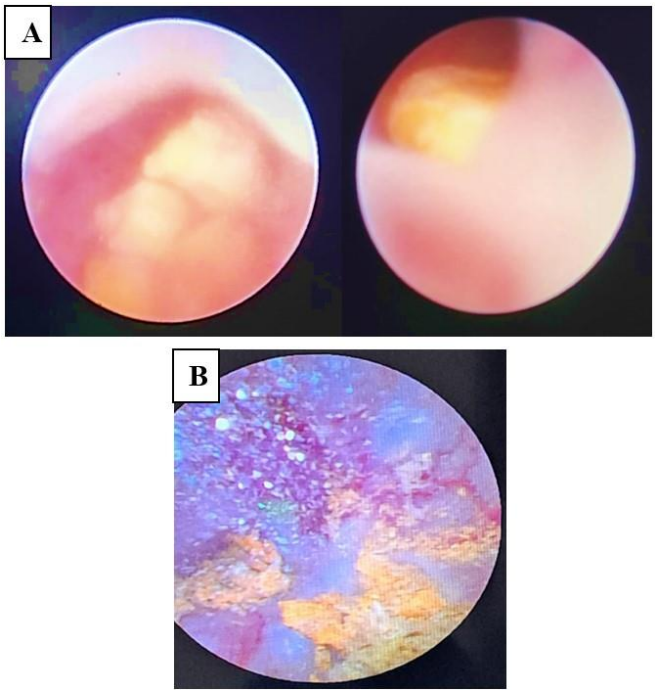

Figure 3. Intraoperative image showing the stone at the superior calyx (A) and disintegration by a holmium laser (B).

Using a holmium laser (at 8 Hz and 0.8 kJ energy) the stones was successfully disintegrated and then evacuated with a stone basket. All remaining calyces were checked with the full range of flexible URS to ensure renal clearance. A 5-French (Fr) ureteral catheter was inserted, and the patient was catheterized with a 16-Fr Foley catheter. All procedures took around 1.5 hours and the patient was discharged on the second postoperative day without any noticeable complication. Two weeks later, the patient came to the outpatient department for follow-up without any noticeable complaints. We performed another plain abdominal X-ray and found no noticeable opaque structure at the previous stone location (Figure 4).

Figure 4. Postoperative plain abdominal X-ray.

This case has been reported in line with the Surgical CAse REport (SCARE) criteria (6, 7). Ethical clearance is not required for this case report, according to our institution's research ethics committee. The committee has verified that the report adheres to standard clinical practices and does not involve experimental interventions or the need for additional data collection. Written informed consent was obtained from the patient for publication and any accompanying images.

Discussion

Ectopic kidneys, kidneys that are in an abnormal position in the body due to a disruption in their normal ascent during development, present unique anatomical challenges and an increased risk for conditions such as kidney stones. Various surgical options are available for managing calculi (stones) in ectopic kidneys, including extracorporeal shock wave lithotripsy, mini-percutaneous nephrolithotomy (PCNL), laparoscopic pyelolithotomy, and open surgery (8).

RIRS has emerged as a promising method for addressing kidney stones in patients with upper urinary tract anomalies such as ectopic kidneys. This signifies that RIRS has been established as an effective and viable option for treating kidney stones in individuals with anatomical variations in their urinary system, particularly when the kidney is not in its usual position or exhibits other abnormalities. The procedure has demonstrated high stone-free rates and low complication rates when dealing with kidney stones in anomalous kidneys such as ectopic kidneys. This underscores the significance and effectiveness of RIRS in managing kidney stones in patients with upper urinary tract anomalies (4). During endourological procedures on kidneys with upper urinary tract anomalies, certain anatomical challenges may arise, making the procedures more difficult. For instance, the ureteropelvic junction may be positioned higher than normal, and a flexible ureteroscope may have reduced ability to bend or deflect properly. These anatomical obstacles can create difficulties in reaching and treating kidney stones in patients with anomalies such as ectopic kidneys (5).

This case study further demonstrates the effectiveness of RIRS in treating kidney stones in patients with upper urinary tract anomalies such as ectopic kidneys. The successful treatment of a large staghorn calculus in a patient with a right ectopic pelvic kidney in a single session of RIRS reinforces the feasibility and success of this procedure in managing such challenging cases. This highlights the potential of RIRS as a valuable treatment option for kidney stones in patients with anatomical variations in their urinary system.

The success of RIRS as an alternative surgical method, particularly in patients with pelvic ectopic kidneys, can be attributed to significant technological advancements. The evolution of thin and flexible endoscopes, laser fibers, and nitinol stone baskets has elevated RIRS to a highly effective treatment option for kidney stones in anatomically abnormal kidneys such as pelvic ectopic kidneys (9).

The utilization of the holmium laser during RIRS in this patient with a pelvic ectopic kidney showcased its effectiveness in disintegrating stones, even in the presence of anatomical challenges such as a kink at the ureteric junction. This underscores the dependable outcomes achievable with RIRS, especially when addressing kidney stones in an abnormal kidney anatomy. Furthermore, the safety and efficacy of this procedure in managing stones in pelvic ectopic kidneys were further highlighted by the successful outcome, despite encountering difficulties.

Additionally, the effectiveness of RIRS as a preferred treatment modality for calculi in ectopic kidneys is emphasized. RIRS is highlighted as a favorable option due to its minimal complications, safety, and the ability to disintegrate stones effectively using a holmium laser. It suggests that despite the anatomical challenges presented by ectopic kidneys, RIRS remains a reliable and successful procedure for treating stone-related issues in such cases (10).

Patients with pelvic kidney, although situated within the retroperitoneum, has the bowels positioned between the front wall of the abdomen and the kidney. Due to its placement, the pelvic kidney benefits from additional protection from the pelvic bones and may have less room for movement (11). When compared to a normally positioned kidney, an ectopic kidney is considered to be more prone to stones and hydronephrosis, but not other kidney diseases (2). Due to the heightened risk of damaging aberrant blood vessels or overlying internal organs and nerves, managing a pelvic kidney poses supplementary treatment complexities for urologists. Hence, utilizing alternative methodologies for addressing nephrolithiasis in pelvic kidneys may yield more favorable outcomes compared to conventional approaches applied to anatomically normal kidneys (2). A laparoscopy-guided treatment of stones in the pelvic kidney enables direct visual access to the kidney, thus improving the safety of puncture and proper channel placement integral to PCNL. Nephroscopy is used in conjunction with laparoscopy to assist in achieving percutaneous access, enabling ongoing visual monitoring and facilitating the displacement of the bowel above it. Although considered more invasive than sole endoscopic methods, this approach may entail more complications, such as urinary leakage (2).

Additionally, there have been reports of using RIRS alone to treat large renal stones, including staghorn

calculi, with successful outcomes. In this case, the patient was managed with RIRS, which yielded good results. Another case report by Xu et al. also reported the usage of RIRS for a staghorn renal calculus in a patient with a solitary kidney and a deformed urinary tract (11). Complications associated with RIRS for the management of large renal stones are generally minor and include issues such as post-surgical fever and pain. A case reported by Birowo et al. highlighted an occurrence of steinstrasse following RIRS in a large staghorn kidney stone and suggested it as a less preferred option for the removal of large calculi compared to other modalities (12). Another systematic review by Lavan et al. studied 117 cases of ectopic kidneys and stated that endourological techniques are still effective but challenging in patients with an ectopic kidney (5).

High-power holmium lasers have long been available for the management of upper urinary tract stones, including staghorn or large renal stones. High-power holmium lasers, such as the Moses Technology, are beneficial in producing tiny particles of stone dust through two forms of ablation: the photothermal effect and the photomechanical effect. Moreover, with advancements in technology, the stone management strategy during RIRS has shifted toward less stone basketing or no stone basketing, allowing for the treatment of larger stones (>2 cm) and creating large amounts of stone dust, making it suitable for staghorn or large renal stones. High-power holmium lasers have improved stone fragmentation capacity by reducing stone retropulsion and creating a large amount of tiny stone dust fragments, known as the "snow globe effect." Ultimately, these advancements in laser technology, specifically high-power holmium lasers, have made them a promising treatment option for patients with staghorn or large renal stones undergoing RIRS (13). The use of high-power holmium laser technology has significantly improved the disintegration of stones in our case study. By utilizing high energy settings (8 Hz and 0.8 kJ), the laser successfully broke down the stones, allowing for a thorough clearance of the remaining calyces during the flexible URS procedure. This demonstrates the effectiveness of high-power holmium lasers in managing large renal stones, as evidenced by the successful outcome of our case study.

In this case, RIRS with the use of a flexible URS effectively removed a kidney stone in a patient with a pelvic ectopic kidney, causing a urinary tract deformation, while maintaining a normal postoperative renal function. Given the existence of a pelvic ectopic kidney, RIRS was preferred for two primary reasons. Initially, RIRS with multiple sessions demonstrated a comparable stone-free rate to PCNL for the management of kidney stones. Furthermore, the successful navigation of the flexible ureteroscope through the deformed urinary tract made RIRS applicable in the presence of the urinary tract deformity. Consequently, our case suggests that, with technological advancements, RIRS can be adopted in complex cases.

Postoperative care following the placement of a double J (DJ) stent includes monitoring for any signs of infection such as fever, chills, or increased pain. It is important to maintain good hydration to help flush out any remaining stone fragments and to prevent urinary tract infections. Patients should also be advised to avoid strenuous activities during the recovery period to prevent dislodging of the stent. Regular follow-up appointments with the urologist are crucial to monitor the progress of the recovery and to ensure that the stent is removed at the appropriate time. It is important for patients to follow the urologist's instructions regarding when to return for stent removal and any postoperative testing that may be required to assess the success of the procedure. In cases where the patient experiences persistent pain, bleeding, or signs of infection, immediate medical attention should be sought. Patients should communicate any concerns or unusual symptoms to their healthcare provider to ensure prompt and appropriate management of any complications that may arise during the postoperative period (14, 15).

In our case study, postoperative care appears to have been successful, as evidenced by the patient's discharge on the second postoperative day without any noticeable complications. Two weeks later, the patient's follow-up appointment without any complaints is also a good sign of a smooth recovery process. It is essential for the patient to continue following the urologist's

instructions for the remainder of the recovery period to ensure a successful outcome. If any concerns or symptoms arise in the future, including the possibility of a stone reformation in the ectopic kidney, it is crucial for the patient to promptly communicate with their healthcare provider for appropriate management.

Conclusion

Based on the case report discussed, it can be concluded that RIRS is a promising and effective option for treating large kidney stones in patients with anatomical variations such as pelvic ectopic kidneys. The successful management of a staghorn calculus in a patient with a pelvic ectopic kidney through a single session of RIRS demonstrates the feasibility and success of this minimally invasive procedure in addressing complex cases especially in a health facility lacking laparoscopy modalities to perform a laparoscopy surgery or a laparoscopy-guided PCNL. Technological advancements, including the development of thin and flexible endoscopes, fiber lasers, and nitinol stone baskets, have significantly contributed to the success of RIRS in treating kidney stones in an abnormal kidney anatomy. The utilization of high-power holmium lasers during RIRS has enhanced stone disintegration and management, making it a promising treatment option for patients with staghorn or large renal stones. Overall, the case study emphasizes the efficacy and safety of RIRS in managing kidney stones in patients with unique anatomical variations, highlighting it as a valuable option for challenging cases such as staghorn calculi in pelvic ectopic kidneys in a limited-resource facility.

Ethical consideration

Informed consent was acquired from the patient for publication of the case report.

Author contributions

Conceptualization: AAL, AF; data curation: AAL, SS; formal analysis: AF, AAL; funding acquisition: not applicable; project administration: AF, AAL; supervision: AF; validation: AAL, SS; writing—original draft preparation: AAL, SS; writing—review and editing: AF, SS. Guarantor: AAL.

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