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Research Article

Extrarenal Stone Migration After PNL and RIRS: Effectiveness of Conservative Follow-up in Light of Literature

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Abstract: This study aims to evaluate rare cases of extrarenal stone migration after endoscopic stone surgery in light of the literature. Complications such as stone migration can rarely be seen after flexible ureterorenoscopy (RIRS) and percutaneous nephrolithotomy (PNL), which are widely used in the treatment of urolithiasis. In this case report, extrarenal stone migration was detected in a 43-year-old man who had previously undergone PNL and RIRS, but since the patient was asymptomatic, conservative follow-up was applied instead of surgical intervention. In the patient's CT scans, it was seen that the stone was lateral to the psoas major muscle and did not cause significant inflammation or edema in the surrounding tissues. When the cases in the literature were examined, extrarenal stone migration is usually associated with symptoms such as pain, infection or loss of renal function and requires surgery, but in this case, surgery was not applied due to the asymptomatic course. This situation shows the importance of conservative approaches and that they can be an alternative to surgery. In conclusion, the increase in such cases reported in the literature may guide the management of extrarenal stone complications. This study emphasizes conservative treatment strategies, especially in patients with asymptomatic extrarenal stone migration.

Keywords: Endoscopic stone surgery, Extraureteral stone, Extrarenal stone migration, Percutaneous nephrolitotomy.

1. Introduction

Urolithiasis is one of the most common pathologies encountered in urology. Endoscopic stone surgery, especially minimally invasive methods such as flexible ureterorenoscopy (RIRS) and percutaneous nephrolithotomy (PNL), are widely used in the treatment of stone disease (Türk et al., 2016). Although complications after endoscopic stone surgeries such as RIRS and PNL are rare, conditions such as stone migration in particular can lead to important clinical consequences (De La Rosette et al., 2008). It has been stated that stone migration is usually observed in the intrarenal calyces or ureter, and extrarenal stone migration is a very rare condition (Harmon et al., 1997).

Extrarenal stone migration is the situation where the stone passes outside the anatomical boundaries of the kidney, usually during or after surgery. It occurs when the stone migrates to tissues outside the kidney without complete obstruction in the kidney or ureter after endoscopic surgery (Seitz et al., 2012). In endoscopic surgeries

such as RIRS and PNL, intrarenal pressure increases during surgery (Ecer et al., 2022). Increased pressure may cause spontaneous perforation and extrarenal stones. Similarly, stones may remain on the access tract for PNL (Wollin and Preminger, 2018).

The clinical presentation of extrarenal stones can vary depending on the severity of symptoms and the extent of damage caused by the stone to surrounding tissues. In some patients, symptoms may not be noticeable, and they may remain asymptomatic (Assimos et al., 2016). However, conditions that can lead to severe pain, infection, or loss of kidney function may also occur (Seitz et al., 2012).

Cases of extrarenal stone migration are typically associated with notable symptoms; however, the absence of findings such as significant pain or infection in our patient sets him apart from previously reported cases. In this instance, a 43-year-old male patient with a history of RIRS and PNL was found to have extrarenal stone migration. Due to the patient being asymptomatic, with stable vital signs and no notable inflammation around the kidney, a decision was made to opt for observation instead of surgical intervention. In this study, we aim to discuss cases of extrarenal stone migration through a literature review based on this case and to draw attention to this rarely addressed patient group.

2. Materials and Methods

This study was conducted in a semi-case report model, combining a detailed presentation of the reported case with a broader discussion supported by relevant literature. The approach allows for a comprehensive exploration of the clinical implications while providing insights into the current knowledge and potential research directions.

2.1. Scope of the study

This study aims to evaluate cases of extrarenal stone migration after endoscopic stone surgery through cases in the literature. In the study, the clinical effectiveness of conservative follow-up methods, especially in patients with asymptomatic extrarenal stone migration, was analyzed. Different approaches were discussed by comparing the cases reported in the literature with the condition of our patient.

2.2. Data collection and literature search

The literature was searched using PubMed, Google Scholar international databases for published cases of extrarenal stone migration after endoscopic stone surgery. The keywords were "extrarenal stone migration," "endoscopic stone surgery," "PNL," and "RIRS." The included studies were analyzed for the presence of symptoms after stone migration, treatment method, and clinical outcomes.

2.3. Case presentation and management

A 43-year-old male presented with occasional back pain. His medical history revealed that he had previously undergone RIRS and PNL operations due to stone disease. No costovertebral angle tenderness was detected on physical examination. Vital signs were stable, and no signs of acute infection or renal dysfunction were observed. There was no sign of infection in the urine test, and renal function tests were within normal limits. Non-contrast computerized tomography (CT) was used to evaluate stone migration after the stone image was observed in the extrarenal region on the direct urinary system radiograph of the patient. Multiple stones were detected in the lower calyces of the left kidney on CT scans, and a stone approximately 7 mm in size was observed in the extrarenal region lateral of the psoas major muscle. No inflammation, edema or significant perirenal contamination was detected around the kidney. Imaging results suggested that the stone did not damage the surrounding tissues. The stone was observed in a more medial location, not along the previous percutaneous tract (Figure 1).

Since the patient did not exhibit any pain, infection or other serious symptoms related to extrarenal stone migration, a decision was made for conservative monitoring. The patient was informed about kidney stone disease and the potential complications of extrarenal stones. Dietary adjustments were recommended to prevent recurrence of urinary stones, and annual imaging was planned. Additionally, the patient was informed that the stone might migrate to the old percutaneous tract over time, potentially leading to infection or fluid collection around the kidney.

The patient was evaluated clinically and with imaging at regular intervals. During the follow-up period, no symptoms developed, and no deterioration in renal function was observed.

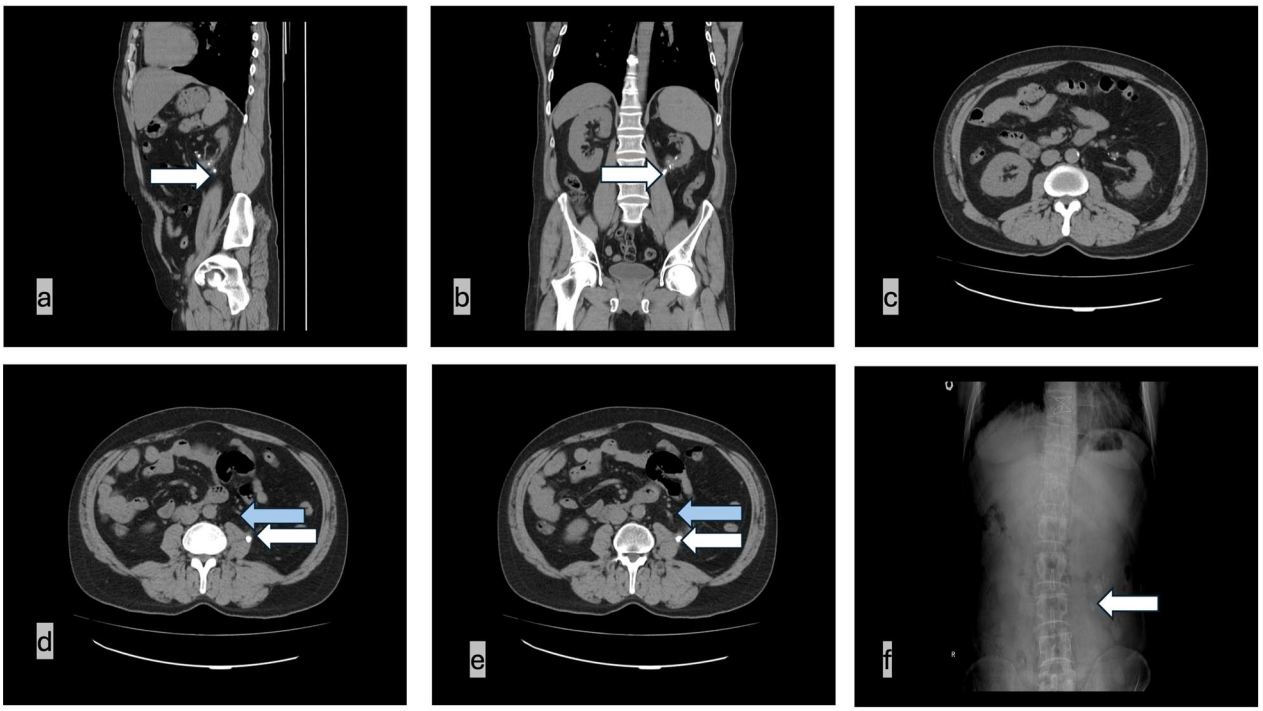

Figure 1. In CT imaging, the extrarenal stone (indicated by a white arrow) is seen lateral of the psoas major muscle, along with the course of the ureter (indicated by a blue arrow). a: Sagittal view (CT), b: Coronal view (CT), c, d, e: Axial views, f: Direct urinary system radiograph.

2.4. Evaluation methods

In order to reveal the similarities and differences between the cases, comparisons were made in terms of stone migration, presence of symptoms, localization of stones and clinical results of conservative follow-up. The findings were evaluated together with the cases in the literature and the disease characteristics and treatment methods were discussed.

Informed consent was obtained from the patient for the use of data in this study, and all procedures were conducted in accordance with patient confidentiality and ethical guidelines.

3. Discussion

In our study, it was determined that the extrarenal stone in our patient, who had a history of PNL and RIRS, remained as a result of previous endoscopic stone surgeries. There was no history of persistent pain or infection after the RIRS procedure that would suggest calyceal perforation. Upon reviewing other studies, it is more likely that the surgery responsible for this complication in a patient with both RIRS and PNL history is the PNL procedure.

3.1 Pathophysiology of extrarenal stone migration

Extrarenal stone migration is a rare condition, and its pathophysiology is not yet fully understood. However, the migration of stones beyond the boundaries of the kidney during or after surgery is generally attributed to factors such as increased intrarenal pressure, excessive use of irrigation fluids, surgical manipulations, tract damage, and the displacement beyond anatomical boundaries during stone extraction (Jung et al., 2008). In addition, the unbalanced and brutal use of energy and pressure methods used in surgery may also cause these stones to move out of the tract. This situation requires the use of antiretropulsion devices, otherwise intrarenal pressure may increase to high levels, increasing the risk of pyelovenous reflux and damage to the kidney tissue (Suh et al., 2010). Post-surgically, inflammation and fibrosis may also develop around the kidney. This resulting fibrosis and inflammation can contribute to the stone becoming a permanent fixture.

3.2. Complications

The most important complications are pain, infection, perinephric abscess, perirenal fibrosis, ureteral stenosis and loss of renal function. As a result of the stone migrating to tissues outside the kidney, irritation or inflammation may develop in the surrounding tissues and this may cause pain. In addition, as a result of stone fragments settling in the surrounding tissues, an inflammatory response and fibrotic reaction may develop around these tissues. Again, stones located around the ureter may disrupt the structure of the ureter, cause stenosis and affect renal drainage. In the long term, this may lead to hydronephrosis, or loss of renal function (Lopez-Alcina et al., 1998).

3.3 Treatment decision

The treatment decision may vary depending on many factors such as the location of the stone, its size, the patient's symptoms, and its effect on the kidney and surrounding tissues. When making a treatment decision, especially in asymptomatic cases, the risks of surgical intervention and the advantages of conservative follow-up should be evaluated.

In patients with symptoms such as pain, infection or urinary tract obstruction, active intervention may be required to prevent the stone from damaging the surrounding tissues. Surgery may be the priority, especially in the perirenal area and around the ureter, as it may cause a tendency for loss of renal function and abscess development. Stones distant from the tract close to the psoas may be more suitable for follow-up. Conservative treatment may be considered as a priority, especially in patients with advanced age or chronic diseases, as surgical intervention may carry a higher risk.

3.4 Literature search

Endoscopic stone surgery is widely used in the treatment of stone disease as a minimally invasive approach. While high success rates are noted in procedures such as RIRS and PNL, some rare complications have also been reported in the literature (Erol et al., 2024). One of these complications is extrarenal stone migration. Extrarenal stone migration is a very underreported complication, and it has been reported that in most cases it is symptomatic and requires surgical intervention (Akman et al., 2010). Such stone migrations are often associated with severe pain, infection or kidney dysfunction, which increases the necessity for surgical intervention (Diri et al., 2014).

A review of the literature reveals a limited number of reported extrarenal stone cases. The most notable among these is a case report by Akbulut et al. In this case, where the upper calyceal perforation seen after micro PNL was evaluated, the most important reason for the stone to reach the extrarenal space was shown to be the increase in intrarenal pressure and the migration of the stones due to the increased pressure during the removal of the stones from the tract. In this case, CT was performed immediately after the extrarenal stone was detected after surgery due to flank pain and urine leakage, and early surgery was performed when urinoma was detected. In surgery, the stones in the perirenal region and the tract were removed by nephroscope (Akbulut et al., 2015).

In the case reported by Moretti et al. an extrarenal stone formed eight years after a partial nephrectomy for a stone in the upper pole of the left kidney, leading to the development of a perinephric abscess. Despite percutaneous drainage of the abscess, the discharge continued. Thereupon, a guide wire was sent to the area where the extrarenal stones were located, and the area was reached with dilatation over it, and the stones and abscess were cleaned by entering with a nephroscope. This procedure can be considered minimally invasive for that period due to the period in which it was performed and the fact that the instruments were much less developed than today. This case shows that extrarenal stones can be symptomatic and can be complicated as perinephric abscess (Moretti et al., 1989).

In another case review by Moretti et al, extrarenal and extra ureteral stone fragments were evaluated after PNL or ureterorenoscopy (URS). Stone migration was noticed during surgery in most patients. Stones ranged in size from 2 mm to 12 mm and multiple stones migrated to the extrarenal space in 7 patients. Stone extrusion was noticed during surgery in 5 patients, while the presence of extrarenal stones was detected in 4 patients at postoperative follow-up. Most patients recovered without complications, but ureteral stenosis developed in two patients. Stones remained in the renal parenchyma in one patient, and stones were observed in the perirenal fat tissue in another patient. In conclusion, it was stated that such stone extrusions do not lead to serious consequences and can be safely managed with conservative treatment (Moretti et al., 1991).

In addition to patients who had urinary tract extrusion after PNL, patients who had urinary tract extrusion after URS have also been identified in the literature. Lopez-Alcina et al studied 11 patients who had extraureteral stone extrusion after endoscopic pulsed-dye laser lithotripsy. All patients were successfully treated with conservative methods, and no serious complications such as ureteral stenosis, urine leakage or infection were observed during the follow-up period. The study emphasizes that extrusion of non-infected stones into periureteral tissues does not cause serious consequences and that surgical removal of stones is unnecessary (Lopez-Alcina et al., 1998).

In a study examining 6 patients who experienced stone extrusion during PNL and ureterolithotomy (URL), all patients were successfully treated with conservative methods. No serious complications such as ureteral stenosis or infection were observed in the patients in the long-term follow-up. The study emphasizes that stone extrusion generally does not cause serious consequences and can be managed with conservative treatment (Verstandig et al., 1986).

When evaluating the studies, surgical intervention is often necessary following stone migration; however, this case was managed differently with conservative monitoring due to the absence of symptoms, rather than opting for surgery (Akbulut et al., 2015; Erol et al., 2024; Seitz et al., 2012). The rare localization of the stone and the asymptomatic course of the patient are the key features that distinguish this case from others in the literature. In previously reported studies, surgical intervention has typically been deemed necessary following stone migration (Akbulut et al., 2015; Diri et al., 2014).

When we evaluate case reports on this topic in the literature, it is generally observed that most publications are from earlier periods. The primary reason for this is that such complications were often related to a lack of experience. Additionally, the occurrence of these types of complications was more likely when endoscopic surgeries were initially performed with larger instruments. Although the frequency of such cases has decreased in recent literature, managing these cases remains important in endourology. Compared to similar reported cases, variations in the frequency and symptomatology of extrarenal stone migrations have been observed.

4. Conclusions

The management of this case provides a new perspective on non-surgical approaches. Conservative treatment for extrarenal stone patients is important, especially in reducing the risks of complications associated with surgical intervention. Additionally, reporting such cases can help clarify strategies for complication management.

In our case, the patient remained asymptomatic, with extrarenal stone migration unassociated with pain, infection, or loss of kidney function, making it a rare case in terms of extrarenal stones managed through observation. The stone, localized lateral of the psoas major muscle, did not cause inflammation or edema around the kidney, and the patient's vital signs remained stable. After previous surgeries, the patient did not experience any significant fever or wound discharge. Therefore, in patients suspected of having residual stones along the tract post-PNL, we believe that removing or at least displacing the stone away from the tract could reduce the need for future surgical intervention and prevent kidney damage.

Conflicts of Interests
Authors declare that there is no conflict of interests

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Statement contribution of the authors
This study's experimentation, analysis and writing, etc. all steps were made by the authors.

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