Subcapsular Renal Hematoma Complicating Flexible Ureteroscopy and Laser Lithotripsy: Complex Postoperative Evolution with Infectious and Thromboembolic Sequelae – Case Report

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ABSTRACT

Subcapsular renal hematoma following ureterorenoscopy with holmium:yttrium–aluminum–garnet (Ho:YAG) laser lithotripsy is an uncommon but clinically significant complication. We present the case of a 58-year-old woman with a medical history notable for left renal lithiasis, recurrent renal colic, hypothyroidism, osteoporosis, optic nerve atrophy, and angina pectoris managed with chronic antiplatelet therapy. She underwent flexible ureteroscopy using a reusable digital ureteroscope (Olympus URF-V2) for multiple mid- and lower-pole calculi. The procedure was prolonged and technically challenging due to intraoperative bleeding and impaired visibility, requiring increased irrigation pressure to maintain endoscopic control. A left JJ stent was placed at the end of the intervention.

In the immediate postoperative period, the patient developed flank pain, hematuria, fever, and leukocytosis. Contrast-enhanced abdominal CT revealed a large left subcapsular renal hematoma causing compression of the renal parenchyma, without evidence of active arterial extravasation. Hemodynamic status remained stable throughout hospitalization, and renal function was preserved. The patient was managed conservatively with analgesia, broad-spectrum antibiotics, hemostatic therapy, fluid management, and serial monitoring of hemoglobin, inflammatory markers, and vital signs. No surgical, endovascular, or transfusion intervention was required. Clinical evolution was favorable, with gradual laboratory and symptomatic improvement.

This case underscores that although flexible ureteroscopy is generally considered a safe and minimally invasive procedure, rare complications such as subcapsular renal hematoma can occur, particularly in the presence of predisposing factors such as antiplatelet therapy, vigorous irrigation, difficult visualization, and prolonged laser lithotripsy. Awareness of risk factors and meticulous intraoperative control of intrapelvic pressure and laser fiber positioning may help reduce the incidence of this complication

Key Words: Complications, Flexible ureteroscopy, Laser lithotripsy, Subcapsular renal hematoma

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Introduction

Ureteroscopy has become a cornerstone in the diagnosis and management of upper urinary tract pathology, particularly nephrolithiasis, due to continuous advancements in endoscopic technology and laser lithotripsy systems [1]. Ongoing miniaturization of ureteroscopes and the development of improved deflection mechanisms, enhanced optics, and high-power holmium:YAG and thulium fiber lasers have significantly reduced perioperative morbidity and broadened the spectrum of treatable renal stone burdens [2]. As a result, flexible ureteroscopy is now widely regarded as a safe and effective procedure with consistently low complication rates across large clinical series [3].

Major postoperative adverse events—including sepsis, ureteral injury, and hemorrhagic complications—remain uncommon, with an estimated incidence below 0.1% in contemporary endourologic practice [4]. Despite this generally favorable safety profile, clinically significant renal subcapsular hematoma following ureteroscopy has increasingly been recognized as a rare but potentially serious complication. Although historically associated with trauma, anticoagulation, renal tumors, or extracorporeal shock-wave lithotripsy [5], several case reports and cohort studies have documented renal subcapsular hematoma occurring after retrograde intrarenal surgery, highlighting the importance of early recognition and risk stratification [6].

Multiple contributing factors have been proposed, including elevated intrarenal pressure, prolonged operative time, severe hydronephrosis, intraoperative bleeding impairing visualization, large stone burden, and inadvertent laser energy transmission into the renal parenchyma [4,6]. In this context, documenting new cases contributes valuable insight into the pathophysiology, clinical evolution, diagnostic patterns, and optimal management strategies for this uncommon but clinically relevant complication.

Case

A 58-year-old woman with a medical history of hypothyroidism, optic nerve atrophy, osteoporosis, and recurrent left-sided renal colic due to nephrolithiasis presented with acute flank pain. She had previously experienced Escherichia coli urinary tract infection, although urine culture at admission was negative. Initial laboratory tests showed hemoglobin 12.6 g/dL, normal renal function, and a normal coagulation profile. Contrast-enhanced CT identified multiple mid- and lower-pole calyceal stones in the left kidney.

The patient was maintained on her low-dose aspirin therapy (75 mg daily) prior to the procedure, as the risk of thrombotic events outweighed the relatively low risk of bleeding associated with flexible ureteroscopy.

Flexible ureteroscopy with Ho:YAG laser lithotripsy was performed using a reusable Olympus URF-V2 ureteroscope, a ureteral access sheath was employed to facilitate scope passage, with operative time under 90 minutes. Intraoperatively, visualization became progressively impaired due to bleeding, requiring increased irrigation pressure. A left JJ stent was placed at the end of the procedure.
Within the first 48 hours postoperatively, the patient developed gross hematuria, fever, and flank pain. Hemoglobin dropped to 9.4 g/dL and CRP increased to 171 mg/L. Management included intravenous fluids, anti-inflammatory medication, analgesics, antispasmodics, and escalation of antibiotic therapy from ceftriaxone to meropenem (1 g q8h). A contrast-enhanced CT performed on postoperative day 5 revealed a large subcapsular renal hematoma (approximately 7 × 5 × 10.5 cm) with perirenal extension, inflammatory changes, residual calculi, and a well-positioned JJ stent (Fig. 1) . The patient remained hemodynamically stable and was discharged on postoperative day 9 with hemoglobin 9.5 g/dL.

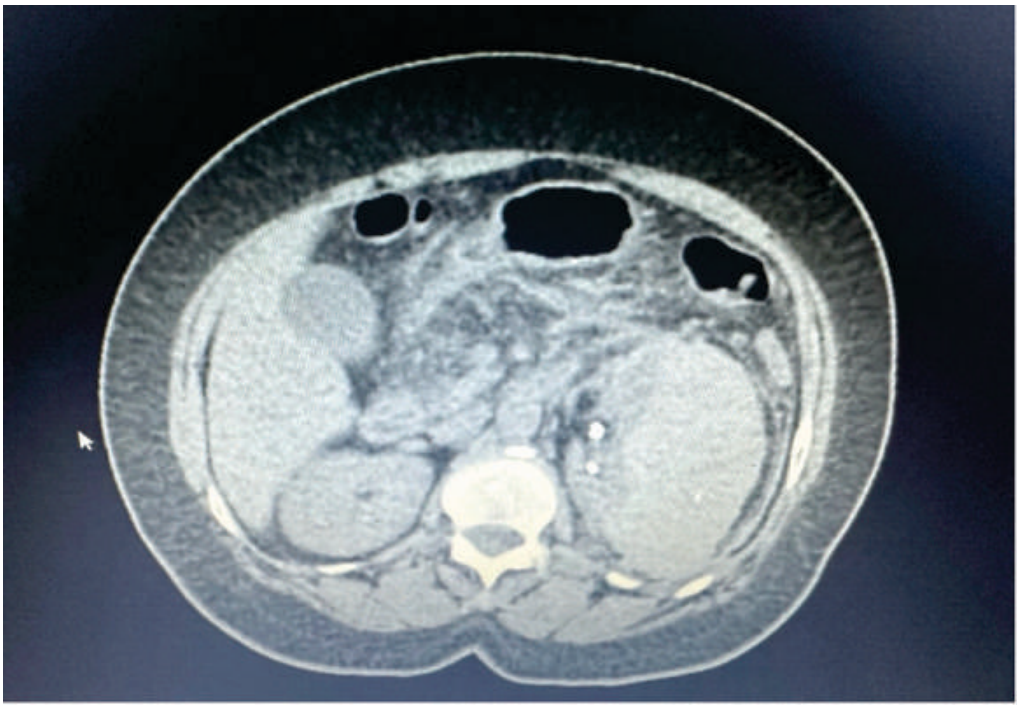


Fig. 1- A contrast-enhanced CT performed on postoperative day 5 revealed a large subcapsular renal hematoma (approximately 7 × 5 × 10.5 cm) with perirenal extension, inflammatory changes, residual calculi, and a well-positioned JJ stent

Two weeks later, she returned in the clinic for a checkup and she presented dyspnea and chest discomfort. Imaging revealed a left-sided pleural effusion with suspected loculation. At the initial follow-up visit, urine culture results had returned a few days later, revealing E. coli resistant to ciprofloxacin and trimethoprim–sulfamethoxazole but sensitive to ceftriaxone, gentamicin, fosfomycin, and carbapenems; in the meantime, she had been discharged home with cefuroxime 500 mg orally twice daily for 7 days. Hemoglobin remained stable around 9.6 g/dL, while WBC increased to 13,400/µL.

Her clinical condition worsened over the following weeks, leading to urgent readmission for fever, flank pain, anorexia, and chills. Laboratory investigations revealed rising inflammatory markers (CRP 250 mg/L), leukocytosis (13,000/µL), hemoglobin 9.3 g/dL, and persistent E. coli infection. A repeat CT scan performed approximately one month after the initial postoperative imaging showed pulmonary embolism in the lower lobar and segmental branches, a large pleural effusion with passive lung collapse, and a mixed-density subcapsular hematoma measuring up to 86 × 57 × 98 mm with inflammatory change. Residual lithiasis persisted (Fig. 2).

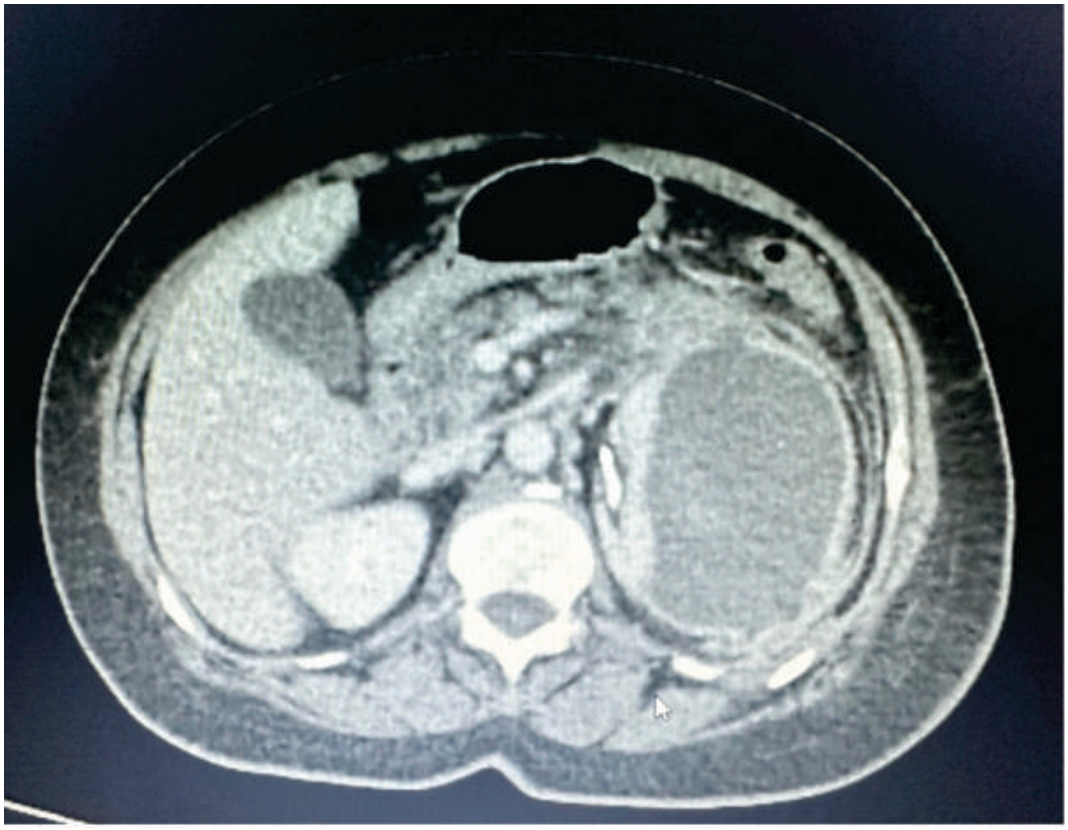


Fig. 2 - A repeat CT scan performed approximately one month after the initial postoperative imaging showed pulmonary embolism in the lower lobar and segmental branches, a large pleural effusion with passive lung collapse, and a mixed-density subcapsular hematoma measuring up

The patient was transferred to cardiology, where she received unfractionated heparin, antibiotics, beta-blockers, and analgesics. Serial CT examinations confirmed persistent pulmonary embolism and pleural effusion but demonstrated gradual reduction in hematoma size.

At one-month follow-up after discharge, inflammatory markers normalized and hemoglobin improved to 10.6 g/dL. The JJ stent was removed.

Subsequent CT scans showed complete radiologic resolution of the pulmonary embolism, regression of the pleural effusion, and significant reduction of the hematoma to 50 × 28 mm, with small interconnected perirenal collections (Fig. 3). The left kidney remained compressed, with delayed but present excretory function, chronic inflammatory changes, and persistent lower-pole microlithiasis. The patient remained on chronic anticoagulation as secondary prophylaxis for thromboembolic disease.



Fig. 3 - Subsequent CT scans showed complete radiologic resolution of the pulmonary embolism, regression of the pleural effusion, and significant reduction of the hematoma to 50 × 28 mm, with small interconnected perirenal collections

At the most recent evaluation, the patient demonstrated full clinical recovery, normalization of inflammatory markers and hemoglobin, and complete radiologic resolution of the subcapsular hematoma and associated collections. No further infectious, respiratory, or thromboembolic complications occurred.

This case illustrates a rare but severe complication of flexible ureteroscopy: a large subcapsular renal hematoma, potentially influenced by the patient's antiplatelet therapy, further complicated by persistent E. Coli infection, loculated pleural effusion, and pulmonary embolism. Despite extensive radiologic abnormalities, treatment remained conservative with broad-spectrum antibiotics, fluid resuscitation, analgesia, anticoagulation, and delayed stent removal. This case also highlights the critical importance of multidisciplinary teamwork in managing complex postoperative complications and underscores that treatment strategies should be individualized according to the patient's specific needs and overall clinical context, rather than strictly following disease-based protocols.The patient ultimately achieved full clinical and radiologic recovery with preserved renal function.

Discussion

According to the review by Nuttall et al. (2010), upper urinary tract stone ablation using the holmium:YAG laser has a very low rate of major complications (0.1%), suggesting that the procedure is both safe and reliable, and routine postoperative imaging does not appear to be necessary [7].

Renal subcapsular hematoma is a recognized complication in settings such as extracorporeal shock wave lithotripsy, renal trauma, angiographic interventions, and in patients with malignancy or anticoagulation disorders. However, Bansal et al. reported one of the earliest documented cases of this complication following ureterorenoscopy—an event previously unreported in the literature, thereby highlighting its relevance within endourological practice [4].

Ordon et al. (2014) reported a modest but notable rise in post-treatment morbidity, highlighting the potential for rare but serious complications such as subcapsular hematoma, which should be considered when counseling patients and planning

postoperative monitoring [8].

Salvadó et al. described subcapsular renal hematoma as a rare yet potentially severe complication following retrograde intrarenal surgery, emphasizing that certain clinical and intraoperative factors may predispose patients to this outcome. Reported risk factors include larger stone burden (≥1.4 cm), significant ipsilateral hydronephrosis, prolonged operative time (>45 minutes), elevated intrarenal irrigation pressures, and persistent urinary tract infection [6]. These findings align with our case, where extended procedural duration, reduced intraoperative visibility requiring increased irrigation pressure, and substantial stone burden may have contributed to hematoma formation.

Bai et al. conducted a retrospective analysis of 2,848 patients undergoing Ho:YAG laser lithotripsy and identified 11 cases of subcapsular renal hematoma, corresponding to an incidence of 0.4%. Affected patients tended to have larger stones (1.4 cm vs. 0.9 cm), more advanced ipsilateral hydronephrosis, longer operative times (41 vs. 33 minutes), and higher intrarenal irrigation pressures (176.8 vs. 170.2 mmHg) compared with those without hematoma [9].

Given that Osther (2018) emphasizes how elevated intrarenal pressure and impaired drainage during flexible ureterorenoscopy may underlie septic, hemorrhagic or ureteral-lesional complications, the use of a ureteral access sheath — by facilitating outflow and reducing pressure peaks — could represent an important preventative measure against rare but serious outcomes [10]. Although the use of a ureteral access sheath is recommended to reduce intrarenal pressure and facilitate drainage, subcapsular renal hematoma remains a recognized — albeit rare — complication even when ureteral access sheath is employed. For example, a series of 2098 ureterorenoscopies documented subcapsular renal hematoma in 0.52% of cases, with narrow ureters and severe hydronephrosis as risk factors [11]. Similarly, retrospective data comparing flexible and rigid ureteroscopy found subcapsular renal hematoma in 1.5% of flexible ureteroscopy cases (all using 12 Fr ureteral access sheath) — showing that ureteral access sheath usage does not fully eliminate the risk [12]. A case report also described subcapsular renal hematoma after ureteroscopy and laser lithotripsy despite a 12/14 Fr ureteral access sheath, likely related to temporary elevated irrigation pressure and postoperative obstruction ("stone-street") [13]. Therefore, even when ureteral access sheath is used, careful intraoperative management of irrigation pressure and vigilant postoperative surveillance remain crucial, especially in patients with predisposing risk factors.

Harada et al. further emphasized that patient-related factors, including hypertension, active urinary tract infection, and ongoing antiplatelet therapy, may predispose individuals to the development of renal hematomas following ureterorenoscopy [13]. These findings underscore the importance of preoperative optimization and careful perioperative management in patients with comorbidities that may compromise renal parenchymal integrity or hemostasis.

Management of renal subcapsular hematomas after flexible ureteroscopy depends on clinical severity. Small, asymptomatic hematomas typically resolve with conservative treatment, including analgesia, antibiotics, and laboratory and hemodynamic monitoring [5]. Intervention is required in cases of ongoing pain, infection, hemodynamic instability, or significant renal compression. Minimally invasive drainage may be used for large or symptomatic collections, while open surgery is reserved for rapidly expanding hematomas or clinical deterioration [14].

In summary, while subcapsular renal hematoma after flexible ureteroscopy remains rare, awareness of patient- and procedure-related risk factors—including prolonged operative time, elevated intrarenal pressure, hydronephrosis, large stone burden, and ongoing antiplatelet therapy—along with careful intraoperative management and vigilant postoperative monitoring, is essential to minimize morbidity and enable timely intervention.

Conclusion

Prolonged operative time combined with increased irrigation pressure, intraoperative bleeding and history of infections are key risk factors for post-URS

renal hematoma. Patients with cardiovascular comorbidities on antithrombotic therapy may be at increased risk. Large hematomas can be managed conservatively in hemodynamically stable patients. Regular imaging follow-up and bloodwork is essential to document resolution and guide timing of definitive stone treatment. This case additionally emphasizes the importance of multidisciplinary teamwork to manage hematoma formation, persistent infection, pleural effusion, and subsequent pulmonary embolism. It highlights the principle that management strategies should be tailored to the individual patient's clinical needs rather than solely to the underlying disease, ensuring that interventions optimize outcomes while balancing procedural risks and comorbidities.

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