

Case Report and Literature Review

—Successful Single-Stage Retrograde Ureteroscopy for an Extreme Localized Burden of over 1000 Ureteral Micro-Calculi

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Abstract

Background: Obstructive ureterolithiasis typically manifests as a single or limited number of migrating renal calculi. An accumulation of over a thousand individual, distinct micro-calculi isolated entirely within a single ureter represents an extreme case of primary *steinstrasse*-like obstruction without a preceding history of shockwave lithotripsy. Managing such a severe localized stone burden poses clear clinical challenges regarding mucosal preservation, operative duration, and stone-free clearance rates (SFR). **Case Presentation:** A 56-year-old male with an *E. coli* urinary tract infection—pre-treated with targeted antibiotics—presented with acute left lumbar colic indicative of severe upper tract obstruction. Radiological workup identified a continuous column of tightly packed 2 - 3 mm micro-calculi and occasional 5 - 6 mm stones spanning from the vesicoureteral junction (VUJ) to the mid and upper ureter, alongside multiple ipsilateral renal calculi. The patient underwent an urgent, single-stage retrograde semirigid transurethral ureteroscopy (URS). A total stone burden estimated at over 1000 individual micro-calculi was successfully cleared using a manual volumetric sampling extraction technique combined with endoscopic suction. **Conclusion:** Complete endourological clearance was achieved without mucosal avulsion, urosepsis, or secondary complications. The patient was safely discharged in excellent clinical condition, demonstrating that single-stage endourological extraction via a semirigid scope remains highly effective even when facing an extreme localized physical count of stones.

Keywords

Ureterolithiasis, Ureteroscopy, Steinstrasse, High Stone Burden, Endourology

1. Introduction

Nephrolithiasis and secondary ureterolithiasis remain major sources of global urological morbidity, frequently necessitating surgical intervention to relieve acute urinary obstruction. While international clinical guidelines—such as those from the European Association of Urology (EAU) [1] and the American Urological Association (AUA) [2]—thoroughly delineate treatment algorithms for large or impacted solitary ureteral calculi, specific protocols for managing thousands of free-floating micro-calculi within a single segment are virtually absent from standard literature.

Historically, massive localized stone burdens frequently required open surgery or laparoscopic ureterolithotomy to guarantee direct, comprehensive evacuation. However, advancements in endourological design—including small-caliber semirigid scopes, specialized high-flow irrigation systems, and flexible nitinol extraction baskets—have revolutionized minimally invasive extraction, aligning with contemporary clinical guidelines for optimal ureteroscopy [3]. This manuscript documents the clinical presentation, intraoperative methodology, and successful resolution of an extreme localized stone burden handled completely via an endoscopic retrograde approach.

2. Patient Information and Clinical Presentation

A 56-year-old male presented to the urological emergency service at Nabd Al Hayat Hospital in Rashid, Beheira Governorate, Egypt. The patient reported a chief complaint of severe, escalating left-sided flank and lumbar pain radiating downward toward the ipsilateral groin, accompanied by nausea and mild lower urinary tract irritation.

- **Comorbidities & Medication History:** The patient had no chronic comorbidities (e.g., no history of diabetes mellitus or systemic hypertension) and no prior personal history of urolithiasis. He was not taking any regular long-term medications.
- **Physical Examination:** Revealed sharp, localized costovertebral angle (CVA) tenderness on the left side. The patient was hemodynamically stable upon admission.
- **Admission Laboratory Values:**
 - *Serum Creatinine:* Within normal baseline limits (0.85 mg/dL), demonstrating preserved global renal function.
 - *Urinalysis:* Demonstrated 10 - 15 pus cells/HPF and +1 calcium oxalate crystals.
 - *Urine Culture:* Positive for *Escherichia coli*.
- **Preoperative Stabilization:** Because the patient was hemodynamically stable and showed no clinical signs of systemic sepsis or high-grade fever, the urinary tract infection was immediately pre-treated with a targeted course of intravenous Cefepime prior to scheduled theater access.

3. Diagnostic Assessment

A non-contrast computed tomography (NCCT) scan of the kidneys, ureters, and bladder (KUB) was performed as THE IMAGING SHOWING in **Figure 1** to determine the source of the acute colic. The imaging revealed severe left-sided hydronephrosis.

The underlying etiology was a dense, continuous column of radio-opaque shadows extending completely from the left vesicoureteral junction (VUJ) upward through the mid and upper ureteral segments.

This extensive, tightly packed formation mimicked a classic “*steinstrasse*” appearance, despite the patient having no history of shockwave lithotripsy (SWL) or prior fragmentation therapies. In addition to the ureteral column, multiple distinct radio-opaque calcified shadows were noted within the ipsilateral (left) kidney. No major structural duplicate systems or ureteroceles were present.

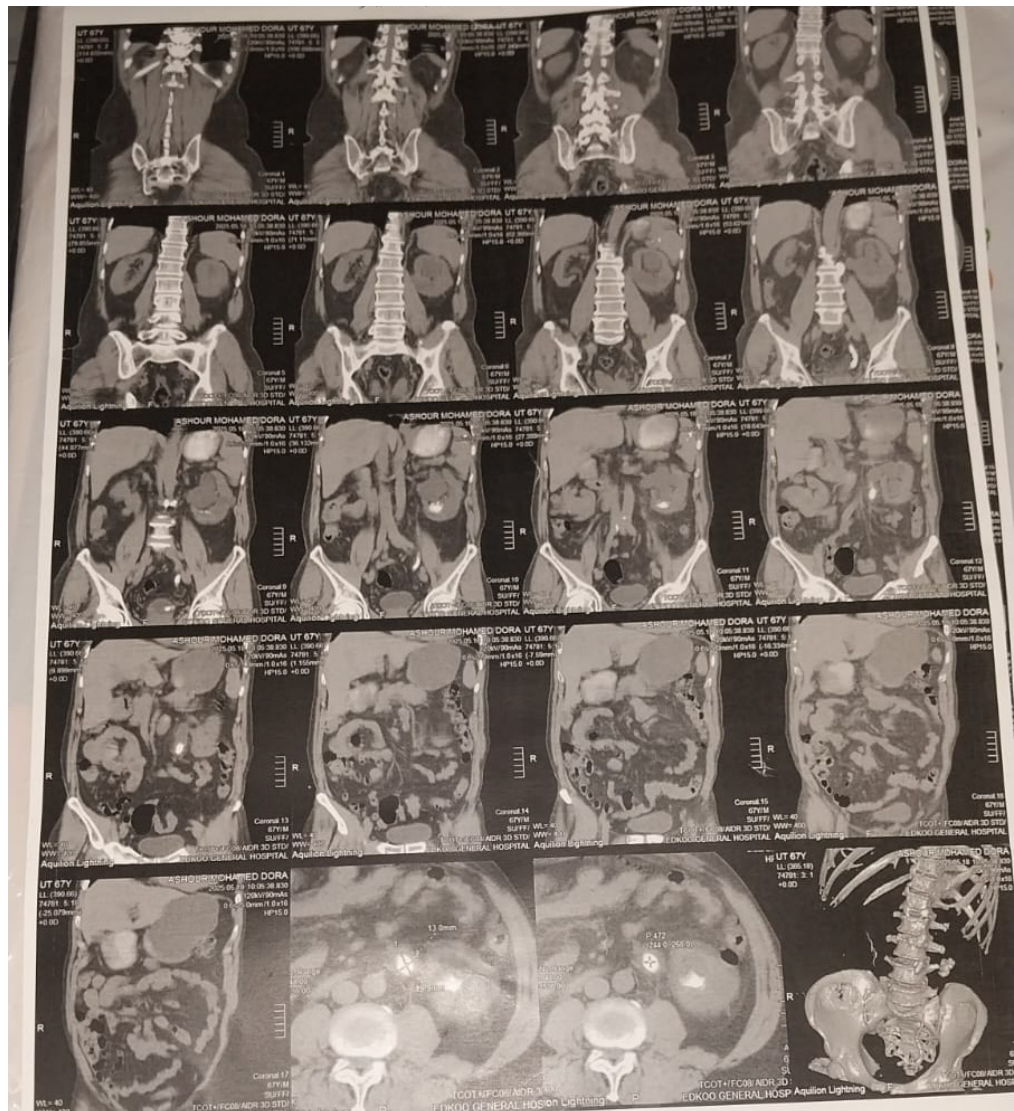


Figure 1. NCCT scan shows LT hydronephrosis and stienstrassee.

4. Therapeutic Intervention & Treatment Decision Pathway

Clarification of the Decision Pathway

When managing a completely obstructed upper urinary tract system, standard algorithms often call for temporary decompression via a percutaneous nephrostomy (PCN) tube or isolated retrograde double-J stenting. For this patient, a single-stage definitive ureteroscopic clearance was safely chosen over initial decompression due to several key indicators:

- 1) The patient remained fully hemodynamically stable with no clinical parameters indicating systemic urosepsis.
- 2) Global renal function was entirely normal (normal serum creatinine).
- 3) The localized *E. coli* urinary tract infection had been proactively covered with a targeted course of Cefepime.
- 4) Excellent intraoperative visibility allowed the surgical team to maintain direct visual control for a safe, continuous, and single-stage extraction.

Operative Technique

The procedure was performed under spinal anesthesia with the patient in the dorsal lithotomy position. A 1 g intravenous dose of Cefepime was administered perioperatively as targeted antimicrobial prophylaxis. Following standard antiseptic preparation, a cystoscope was advanced into the bladder. The left ureteral orifice at the VUJ was identified and dilated. A 0.035-inch hydrophilic safety guide-wire was successfully navigated past the massive obstruction under real-time fluoroscopic guidance.

The entire procedure was performed exclusively using a thin-profile semirigid ureteroscope; no flexible ureteroscopy or advanced access devices were utilized. Upon crossing the VUJ, the surgical team encountered a massive, closely packed cluster of individual crystalline stones, as seen in **Figure 2**.



Figure 2. Picture of multiple stones seen during ureteroscopy.

To optimize visibility and safeguard the delicate mucosal borders, high-flow continuous irrigation was maintained under careful visual control. Rather than executing extensive intracorporeal laser or pneumatic lithotripsy—which would have

degraded the micro-calculi into an unmanageable muddy paste, obscured the surgical field, and increased intrarenal pressures—the team chose active, systematic mechanical extraction.

Bulk extraction of the massive micro-calculi burden was achieved using a Dormia stone retrieval basket, complemented by multiple rounds of endoscopic suction to accelerate clearance. The bulk of the burden consisted of small crystalline micro-calculi averaging 2 - 3 mm in diameter, interspersed with a smaller number of larger individual stones measuring 5 - 6 mm.

- **Volumetric Quantification Methodology:** To determine the definitive stone count without excessively prolonging operative time, a systematic volumetric sampling technique was utilized. A baseline sample of approximately 100 to 150 extracted micro-calculi was collected, visually segregated, and volumetrically measured in a sterile container. The remaining mass of retrieved stones was then measured against this index volume. The total stone mass exceeded 10 equivalent volumes of the sample index, confirming a final comprehensive count of more than 1000 individual micro-calculi.

The total operative time was approximately 75 minutes from the initial dilation of the ureteral orifice to stent placement. Any minor residual micro-calculi within the upper tract subsequently passed spontaneously and safely over the stent. After ensuring comprehensive tract clearance, a 6 Fr, 26 cm Double-J (DJ) stent was deployed to facilitate downstream drainage and minimize the risk of post-procedural stricture. Seen in **Figure 3**.

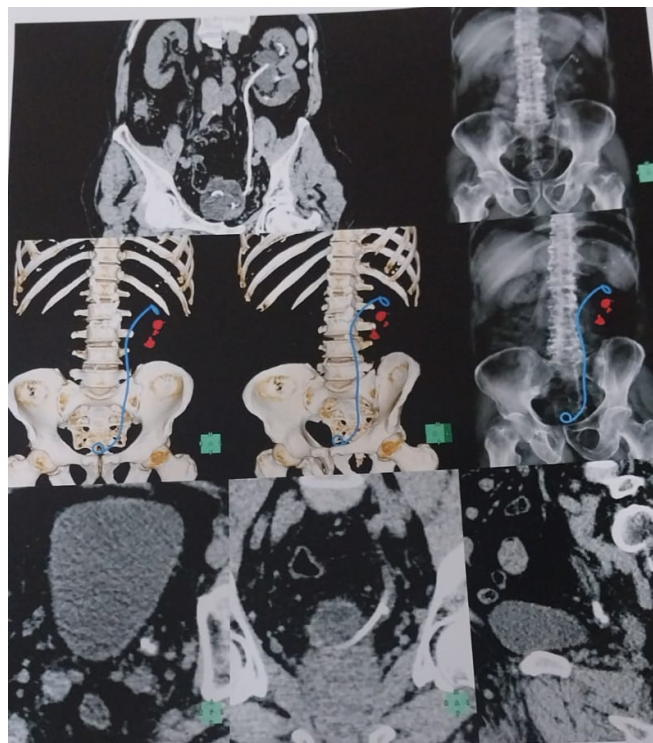


Figure 3. Shows post ureteroscopy NCCT shows left DJ stent inserted in the left ureter which is stone free.

5. Discussion and Pathophysiological Review

The encounter of more than 1000 distinct uroliths tightly aggregated and localized within a single ureteral tract represents an extraordinary variant of primary urolithiasis. In classic clinical presentations involving extensive ureteral burdens, the volume is typically dominated by a solitary “giant” impacted calculus exceeding 5 cm in longitudinal diameter. Conversely, the presentation of a dense, multi-calculi column mimicking a post-lithotripsy “stone street” in a patient with zero history of external shockwave or laser fragmentation is exceedingly scarce in current endourological literature.

Literature Comparisons and Contradictions

A comprehensive review of literature spanning high-burden ureteral pathology reveals distinct management paradigms. For instance, massive stone lines or giant single calculi are frequently relegated to open surgery, laparoscopic ureterolithotomy, or multiple staged endourological interventions to safeguard the tract. Contemporary reports from Banerjee *et al.* [4] and Zhu *et al.* [5] highlight that while a cooperative laparoscopic or multi-stage approach successfully resolves immense burdens, they inherently carry a dual burden of longer institutional stays and heightened risk profiles.

The primary management contradiction resolved in this case lies in the successful execution of an aggressive, single-stage *retrograde* extraction for a multi-calculi column. While traditional teachings suggest that complete upper-tract stone blockage mandates an initial percutaneous or stented decompression window, this case proves that in a stable, optimized patient, definitive primary ureteroscopy is highly effective.

Deep Pathophysiological Analysis

The underlying pathophysiology behind the formation of over 1000 discrete micro-calculi (2 - 3 mm), rather than a solitary consolidated stone mass, warrants examination. It requires an isolated microenvironment characterized by severe, localized **mechanical urinary stasis** running parallel with **extreme biochemical supersaturation**. In this patient, the baseline urinalysis revealed a +1 calcium oxalate crystalline concentration.

It is hypothesized that a small index micro-calculus initially became logistically arrested near the vesicoureteral junction (VUJ), triggering a localized, chronic smooth-muscle spasm or segmental aperistalsis within the downstream ureter. As highly supersaturated urine continuously filtered down from the left kidney, it was held in a state of prolonged stasis above the index block. Rather than coalescing into a single uniform calculus, the rapid and continuous embryonic crystal nucleation yielded a massive cascade of independent, overlapping stones. This ongoing cascade eventually backed up into the upper ureteral segments and left renal pelvis, forming the extensive column captured on the non-contrast CT scan.

Critical Analysis of Safety, Techniques, and Limitations

Performing over 75 minutes of retrograde manipulation inside an occluded ureteral lumen demands precise technical execution to mitigate catastrophic long-term

morbidity. The primary intraoperative risks associated with repetitive endourological interventions of this scale include:

1) Mucosal Avulsion or Stripping: Caused by the high-friction retrieval of abrasive, jagged stone surfaces against the delicate ureteral epithelium.

2) Ureteral Stricture Formation: A late ischemic complication stemming from chronic mechanical trauma or prolonged scope pressure.

3) Urosepsis: Propelled by the retrodisplacement of infected urine under high intrarenal pressures during continuous irrigation.

In this case, the decision to avoid laser dusting or fragmentation was a crucial safety pivot. Utilizing high-power thermal energy on a column of over 1000 micro-calculi would have converted the tract into a dense, unmanageable stone paste, or “stone mud”. This mud would drastically obscure visibility, increase the operative timeline, and elevate intrarenal fluid pressures, creating an environment ripe for endotoxin migration. Instead, the surgical team capitalized on the small, favorable size of the micro-calculi (2 - 3 mm), using targeted Dormia basket mechanical extractions paired with continuous endoscopic suction through a semi-rigid scope. [6] The suction acted as a low-pressure vacuum, facilitating steady evacuation without the need for a protective ureteral access sheath.

- *Limitations:* Despite the successful outcome, an inherent limitation of this report is the lack of immediate, high-resolution infrared stone composition testing (such as Fourier-transform infrared spectroscopy) during the emergency admission phase due to local technical constraints. Additionally, while the volumetric calculation technique provided a highly accurate logistical estimation (>1000 stones), it does not substitute for an absolute physical count.

6. Postoperative Follow-Up & Preventative Care Protocol

The immediate postoperative course was completely uneventful. The patient’s acute flank pain resolved following the clearance of the obstruction, and post-procedural urine output remained within normal physiological ranges. The patient was safely discharged from the hospital in stable and good condition.

- **Interval Imaging & Clearance Verification:** At 4 weeks postoperatively, the patient returned for follow-up evaluation. Prior to stent removal, a complete stone-free status (100% clearance) was rigorously confirmed using both a plain Kidney-Ureter-Bladder (KUB) radiograph and a non-contrast computed tomography (NCCT) scan. No residual stone fragments or secondary strictures were detected.
- **Stent Removal & Status:** Following imaging confirmation, the 6 Fr, 26 cm DJ stent was successfully removed via outpatient cystoscopy. The patient’s renal function remains perfectly normal (serum creatinine stable at baseline), and he is currently completely asymptomatic.
- **Recurrence Prevention Protocol:** To prevent long-term recurrence, the patient was thoroughly counseled on targeted dietary adjustments and maintaining aggressive hydration habits to consistently yield a daily urine output ex-

ceeding 2.5 liters.

7. Conclusions

This landmark case demonstrates that an extreme, primary *steinstrasse*-like ureteral stone burden exceeding 1000 individual calculi can be successfully, predictably, and safely cleared in a single surgical intervention. When managed by an endourologist utilizing mechanical Dormia basket extraction and controlled endoscopic suction through a semirigid scope, complete stone-free status can be achieved without introducing secondary tissue trauma.

The clinical outcomes achieved here directly challenge the conventional surgical axiom that immense, completely obstructive stone columns require primary percutaneous nephrostomy decompression or open/laparoscopic extraction. Provided that a patient is hemodynamically stable, has preserved baseline renal performance, and has received optimized targeted antibiotic cover for any underlying urinary infections, single-stage retrograde ureteroscopy is a highly effective, safe, and minimally invasive alternative. This technique maximizes immediate stone-free clearance, shortens overall hospitalization, and avoids the systemic morbidity of multi-staged interventions.

8. Declarations

Patient Consent: Written informed consent was obtained from the patient for publication of this case report and any accompanying clinical information.

Ethics Approval: Institutional ethics approval was not required for this single case report involving standard-of-care endourological procedures, provided anonymous reporting and patient consent were maintained.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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