Renal matrix stone managed by ureteroscopic holmium laser lithotripsy

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Introduction: *Matrix stones are rare types of urinary calculi composed of mucoproteins and mucopolysaccharides. Since isolated flank pain may be the only presenting symptom and routine radiographic studies are usually non-informative, diagnosis of such urinary calculi represents a clinical challenge. Traditionally, these matrix stones have been managed by either open pyelolithotomy or percutaneous nephrolithotomy (PCNL). Ureteroscopic management of a patient with matrix renal stones and review of literature is presented.*

Case report: *A 34-year-old woman presented with chronic right flank pain. Abdominal ultrasound found a 5.3 cm heterogeneous right renal pelvic mass with 9.7 mm stone. CT urogram confirmed the filling defects. Diagnosis of matrix stones was made using ureteroscopy. During ureteroscopy and holmium laser lithotripsy, a 13/15F ureteral access sheath was placed and the matrix stones were irrigated out. She required outpatient shockwave lithotripsy for the residual radio-opaque stone. A second-look ureteroscopy confirmed stone free status.*

Comment: *Matrix renal stones present a diagnostic challenge. Although PCNL is the gold standard of therapy for large renal matrix stones, ureteroscopy could also be used for both diagnosis and laser lithotripsy. In the present case, ureteral access sheath was used to irrigate the mucinous matrix stone material.*

Key Words: kidney stones, ureteroscopy, Ho-YAG lasers, laser lithotripsy

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Introduction

Matrix urinary stones, first described a century ago by Gage and Beal, are rarely encountered in clinical practice.[1] They are composed of 65% mucoproteins and 35% mucopolysaccharides.[2,3] These stones tend to grow and take the shape of the renal collecting system, and may even extend down to the ureter leading to obstruction and renal failure.[4-6] Since isolated flank pain may be the only presenting symptom and

that routine radiographic studies are usually non-informative, diagnosis of such urinary calculi represents a clinical challenge. Traditionally, these matrix stones have been managed by either open pyelolithotomy or percutaneous nephrolithotomy. Ureteroscopic management of a patient with matrix renal stones and review of literature is presented.

Case report

A 34-year-old healthy woman presented with recurrent episodes of intermittent right flank pain. Microscopic urine analysis showed the presence of 3-5 erythrocytes, > 10 leukocytes, and moderate bacteria. Urine cytology was negative. Urine culture was positive for pan-sensitive *E. Coli*. Ultrasound of the kidneys showed moderate right hydronephrosis containing a heterogenous mixed echogenicity avascular mass measuring 5.3 cm × 4.0 cm and containing a 9.7 mm echogenic stone, Figure 1. Differential diagnosis of fungal bezoars, radiolucent stones, pyonephrosis, xanthogranulomatous pyelonephritis and urothelial neoplasm were considered. To better elucidate this mass, CT urogram was performed. Pre-contrast scans showed scarred small right kidney with air in the upper pole calyx. The dilated renal pelvis contained the 10 mm × 7 mm radio-opaque stone. On the delayed scans, there were multiple filling defects in the right renal pelvis, Figure 2. Lasix renal scan showed 30% function in the right kidney with moderately decreased flow and function. However, there was no evidence of obstruction.

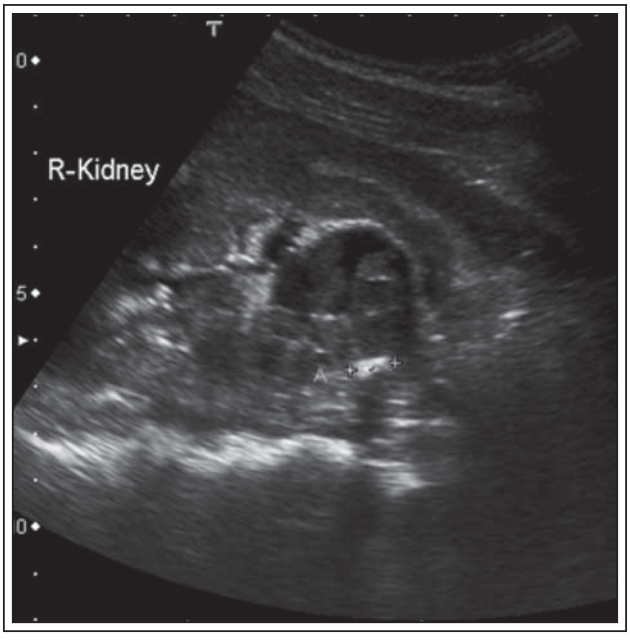

Figure 1. Ultrasound of the right kidney shows a heterogenous mass with a stone in the pelvis.

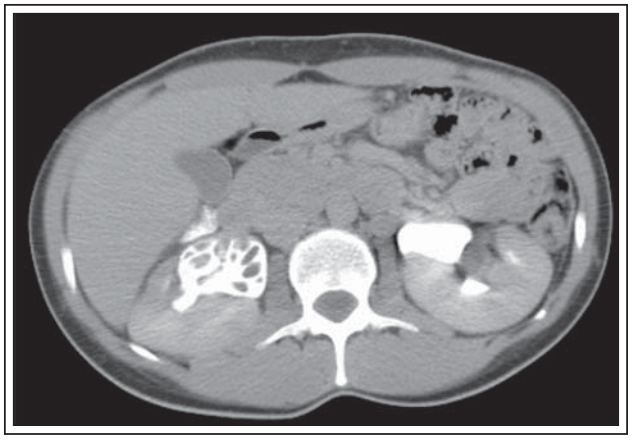

Figure 2. Excretory phase of a CT urogram shows filling defects within the right renal pelvis.

Diagnostic right ureteroscopy was then performed. Procedure started with right retrograde pyelogram that confirmed the filling defects. Selective cytology from the right collecting system was negative. Semi rigid ureteroscopy confirmed absence of ureteral pathology, but revealed multiple brown mucinous materials within the renal pelvis. Differential diagnoses of fungal bezoars or matrix stones were entertained. Urine sample for gram stain showed pleomorphic gram negative rods without evidence for fungi. At this point, a 13/15F ureteral access sheath was placed and flexible ureteroscope was used to perform complete nephroscopy and confirm the absence of suspicious urothelial lesions. Using 200 µm Holmium laser fiber, the matrix stones were fragmented at a setting of 1.0J and 10Hz. Total energy of 46.34KJ was used. The friable viscous matrix stone material was irrigated out using the ureteral access sheath. At the end of the procedure, a 6F × 24 cm double pigtail indwelling ureteral stent was placed. Operative time was 140 minutes. The patient was admitted for observation and pain control. She was maintained on ampicillin, gentamicin and fluconazole.

Fungal cultures and acid fast stains were negative. Final cultures of stone material were positive for *E. coli*. Stones were mainly composed of proteinaceous materials. She underwent outpatient extracorporeal shockwave lithotripsy for a residual radio-opaque fragment 2 weeks later. A second look ureteroscopy was performed and confirmed absence of renal pelvic lesions and stones. She has been asymptomatic since then for 2 years.

TABLE 1. **Presentation and management of renal matrix stones in the literature**

Reference	Patient	Presenting symptoms	Urine culture	Treatment
Simpson et al[7]	68 M	Left flank pain	E. coli	Simple nephrectomy
Cadeddu et al[8]	53 M	UTI	P. aeruginosa	Ureteroscopic holmium laser lithotripsy*
Singh et al[6]	60 F	Bilateral flank pain Acute renal failure	E. coli	Pyelolithotomy
Liu et al[9]	42 F	Right flank pain	Negative	Pyelolithotomy
Bani-Hani et al[10]	68 F	Left flank pain Pneumaturia	E. coli	Pyelolithotomy
	65 F	Right flank pain Gross hematuria	Negative	Pyelolithotomy
	76 F	Microhematuria	Negative	Percutaneous ultrasonic lithotripsy
	78 M	Right flank pain Acute renal failure	Negative	Percutaneous ultrasonic lithotripsy
	63 M	Right flank pain Microhematuria	Negative	Percutaneous ultrasonic lithotripsy§
Okochi et al[11]	74 F	Fever and chills	E. coli	Simple nephrectomy
Kono et al[12]	32 M	Left flank pain	Not available	Percutaneous ultrasonic lithotripsy
Rowley et al[13]	Age: 2-70 Sex: 2M, 7F	Flank pain (6/9) Hematuria (5/9)	Positive (5/9) Negative (4/9)	Percutaneous nephrostolithotomy
Shah et al[14]	Age: 26-71 Sex: 6M, 11F	Flank pain (15/17) Recurrent UTI (5/17)	E. coli (6/17), Proteus (2/17), Klebsiella (1/17), Pseudomonas (1/17), Negative (5/17)	Percutaneous nephrostolithotomy
Present Case	34 F	Right flank pain	E. coli	Ureteroscopic holmium laser lithotripsy‡

*Stone fragments were irrigated using nasogastric tube inserted under fluoroscopic guidance.
§Ureteroscopic holmium laser lithotripsy attempted but unsuccessful.
‡Stones were successfully removed by ureteroscopic holmium laser lithotripsy and irrigation through ureteral access sheath.
UTI = urinary tract infection

Discussion

Diagnosis of matrix stones is a clinical challenge. Flank pain is the most common complaint. However, it is mostly the secondary symptoms (hematuria, pneumaturia, renal failure or fever) that lead to further investigation.[4-6] Plain radiographs as well as routine blood and urine analysis are usually normal. Urine cultures may be positive for *E. coli*, Table 1. Therefore, prevalence of matrix stone may be significantly under estimated since many stone carriers with isolated intermittent flank pain may not be diagnosed until the evolution of secondary symptoms.

Open pyelolithotomy and percutaneous nephrostolithotomy (PCNL) have been the mainstay of management for matrix renal stones , Table 1. There are two previous reports of ureteroscopy and holmium laser lithotripsy of matrix stones. The first is a successful use of a nasogastric tube placed under fluoroscopic guidance to irrigate and aspirate mucinous stone fragments.[8] The second is a failed ureteroscopic attempt in a case within the series reported by Bani-Hani et al.[10] In the present study, a 13/15F ureteral access sheath was used to successfully irrigate out viscous matrix stone material. The gelatinous nature of the matrix stones does not make them suitable for holmium laser pulverization as evidenced by the excessive holmium laser energy used in the present case. Although ureteroscopy offers a minimally invasive option in both diagnosing and treating renal matrix stones, PCNL remains the gold standard since gelatinous matrix stones could be easily "peeled off" and aspirated. □

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