CASE REPORT

A rare presentation of Matrix Stone and a short review of the literature

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Abstract

Matrix stones are extremely rare. An unusual case of coexistence of matrix stone with a conventional, calcified stone is reported. A 63-year-old female was admitted to our department because of a sizable, radiopaque, right renal stone. Her medical history included recurrent urinary tract infections. Preoperative Computed Tomography scan demonstrated a 2 cm calculus and a radiolucent, soft tissue mass in the dilated, right renal pelvis, without enhancement after the intravenous administration of contrast agent. The patient underwent right Percutaneous Nephrolithotomy. Intraoperatively, we found that the renal pelvis was occupied by matrix stone with a centrally located core of solid calculus.

Introduction

Matrix stones are also known as fibrinomas, fibrinous or colloid calculi and albumin calculi [1-3]. Their atypical clinical presentation and imaging features constitute a diagnostic and therapeutic challenge for the practicing urologist [2]. Our aim is to present an uncommon case of diagnosis of matrix and solid, calcified stone simultaneously, as well as to present a short review of the literature about matrix stone.

Case Report

A 63-year-old female was admitted to our department because of a sizable right renal stone. Her medical history included hypertension, hypothyroidism and recurrent urinary tract infections (UTIs) by Escherichia Coli. Twenty-eight days before her admission, she presented urinary tract obstruction and infection, an indwelling double-J stent was inserted in another hospital and she received cefuroxime axetil for 15 days. She did not
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bring to us any past urinary culture, but her urinary culture three days before her admission was negative.

Preoperative plain X-Ray of the kidney, ureter and bladder region demonstrated a sizable, radiopaque, right renal stone and an indwelling, right double-J stent (Fig. 1). Computed Tomography (CT) scan revealed a 2 cm, renal pelvic calculus and a radiolucent soft tissue mass in the dilated, right renal pelvis, without enhancement after the intravenous administration of contrast agent. Hounsfield Units (HU) measurement of renal calculus and soft tissue mass was 1300-1500 and 30-50, respectively. There was gas in the right renal pelvis, possibly due to the recent surgical intervention (Fig. 2).

The patient underwent Percutaneous Nephrolithotomy (PCNL) in prone position, under general anesthesia. Firstly, we replaced indwelling double-J stent by a 6-Fr ureteral catheter, in lithotomy position. We started injection of contrast agent via ureteral catheter and the patient was put in prone position. A single tract at the right, posterior, lower pole calyx was created under fluoroscopy. After tract dilation with a balloon dilator, a 30-Fr Amplatz sheath was positioned inside the calyx of puncture. Rigid nephroscope was positioned inside and we found that the renal pelvis was occupied by grayish, putty-like, matrix stone with a centrally located solid calculus (Fig. 3). Matrix stone was removed using grasping forceps. Afterwards, we fragmented the solid stone with a pneumatic lithotripter and the fragments were removed using grasping forceps (Fig. 4). An 18-Fr nephrostomy tube was inserted for postoperative drainage. The patient was stone free (Fig. 5). Foley and ureteral catheters were removed on the 1st postoperative day, nephrostomy tube was removed on the 2nd postoperative day and the patient was discharged. The patient received ciprofloxacin for 10 days prophylactically. We asked her to analyze chemically both types of stones, as our laboratories do not perform this procedure, but she did not do it. The patient did not develop UTI or stone during the first 10 months postoperatively.

Discussion

Matrix stones are a rare form of renal calculi, which were firstly described 100 years ago by Gage and Beal [2-4]. In contrast to the conventional stones, matrix stones are encountered more frequently in females, perhaps due to the increased incidence of UTIs in females [3-6].

Macroscopically, their colour is usually gray-white or

Figure 1. Preoperative plain X-ray of the kidney, ureter and bladder region demonstrating a sizable, radiopaque, right renal stone and an indwelling, right double-J stent.

Figure 2. Preoperative non-contrast CT scan demonstrating a dilated right renal pelvis, totally occupied by soft tissue mass. There is gas within soft tissue mass. We can discriminate the sizable, calcified stone of the right renal pelvis and the trace of double-J stent in front of the stone.
yellow-tan and they are soft, amorphous and putty or rubbery-like on palpation [1,3,5]. Matrix is an organic substance composing of approximately two-thirds mucoprotein and one-third mucopolysaccharide by weight [2]. Matrix is thought to promote stone's formation functioning as a foundation or inducer for the deposition of crystalline component [2,3,5]. Matrix encountered in matrix stone is similar to that encountered in calcified urinary stones [2,4-6]. However, in contrast with normal urinary stones which contain mainly crystalline salt and a small amount of matrix (approximately 2.5% of the dry weight), the organic component of matrix stones comprises approximately 65% of the stone's dry weight, while their crystalline component is minimum [1-6]. It is still unknown why some matrix stones fail to be calcified [2-6]. It was theorized that reduced urinary calcium levels are responsible for matrix stone formation, but recent studies demonstrated formation of matrix stones in patients with normal urinary calcium excretion [2].

The most common predisposing factors of the formation of matrix stones are recurrent UTI by urea-splitting bacteria, previous stone formation, previous surgery due to urolithiasis and obstructive uropathy [1-6]. Urinary cultures usually reveal Proteus species and Escherichia Coli [1-5]. Moreover, there is increased risk of matrix stone formation in chronic kidney disease patients undergoing dialysis and in patients with glomerulonephritis due to proteinuria [2-6]. Patients usually present with renal colic or symptoms of UTI [1,3]. Our patient had a history of recurrent UTIs by Escherichia Coli.

Imaging studies may contribute to the diagnosis of matrix stone, although the diagnosis is often made intraoperatively [3,5]. Matrix stones are radiolucent on X-Ray [1-6]. Ultrasonography reveals a solid, hypoechoic mass without acoustic shadowing, which may occupy the entire pelvicalyceal system [1-3,5,6]. CT scan demonstrates a soft tissue mass of the renal pelvis, without contrast enhancement [1,6].

CT Urography, as well as intravenous and retrograde pyelogram, demonstrates filling defects in the renal collecting system [2-4,6]. Occasionally, indistinct calcified materials may be shown within matrix stones [1,2,6]. Gas within the layers of matrix stone was also reported [2]. According to the literature, the HU measurement of matrix stones varies between 15-80 on the unenhanced CT scan, proportionally to the content of matrix stone's crystalline component [1,6]. On Magnetic Resonance Imaging, matrix stones appear hypointense signal in T1-weighted images, without enhancement after gadolinium administration, and slightly hyperintense signal in T2-weighted images [1,3,5]. In our case, HU of the matrix stone was 30-50. Furthermore, there was gas in the right renal pelvis, which was attributed to the recent surgical intervention.

The differential diagnosis includes other causes of radiolucent filling defects of the renal collecting system.
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(malignant tumours, radiolucent renal stones, blood clots etc) [1-3,6]. Imaging studies and retrograde ureterorenoscopy contribute to valid diagnosis [2].

Complete stone's removal, correction of coexisting obstructive uropathy and administration of antibiotics according to the results of the urinary culture ensure treatment and prevent recurrence [1,5]. Minimally invasive surgical techniques, such as percutaneous nephrolithotomy and retrograde ureterorenoscopy, can remove matrix stones successfully and have replaced open surgery, which was the treatment of choice in the past [1,3,5]. Extracorporeal shock wave lithotripsy has no place in the treatment of matrix stone [2,3,5,6]. The choice of each surgical technique depends on stone burden and location [3].

In our case, the renal pelvis was occupied by matrix stone and was obstructed by a sizable, calcified stone. PCNL was the treatment of choice and our patient is stone free and did not suffer any UTI during the last 10 months.

We need to mention that in our case we observe the coexistence of sizable, calcified, radiopaque stone with a poorly-calcified stone in the same renal unit. We cannot explain the reason why matrix stone fail to calcify in this case and we do not know stones' chemical analysis for the reason we already mentioned. A possible hypothesis is that the solid, calcified stone is a carbonate apatite stone. Firstly, the macroscopic and radiologic
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Appearance of our stone is similar to carbonate apatite stone’s. Secondly, our patient suffered recurrent UTIs, which favor carbonate apatite stone’s formation. In such circumstances, carbonate apatite stone could be formed and grew up and secondarily could worsen UTI and urinary stasis, which favor the formation and aggregation of matrix stone.

**Conclusion**
Matrix stone constitute a diagnostic and therapeutic challenge due to their rarity and atypical clinical and imaging features. A high index of suspicion is required to diagnose this uncommon clinical entity. PCNL is a well-established and effective surgical procedure to treat matrix stone and to eliminate the possibility of recurrence.

**Conflict of interest**
The authors declare that there is no conflict of interest regarding the publication of this paper.

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**References**