Recurrent Symptomatic Renal Stones Managed by Repeat Open Nephrolithotomy in a Rural Kenyan Hospital

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ABSTRACT

Kidney stone disease (nephrolithiasis, urolithiasis, and renal calculi) is characterized by the occurrence or formation of calculi in the urinary tract. It is encountered in primary health care settings, with a prevalence of up to 8.8% in a US survey (10.6% among men vs. 7.1% among women) (Scales et al., 2012). Though initially thought to be rare in indigenous African populations, there have been increasing cases of urolithiasis reported in Kenya over the last four decades (Musau, 2010; Ngugi et al., 2010). The incidence of urolithiasis increases with age, from 5.1% in males and 5.8% in females aged 20-39 years to 19.7% in males and 10.6% in females aged 80 years and above (Chewcharat & Curhan, 2021). Symptomatic patients present with renal colic, hematuria, frequency, irritability, dysuria, nausea and vomiting, and features of renal failure in some cases (Khan et al., 2016). 70-80% of all renal stones are composed of calcium oxalate. Other components include calcium phosphate, hydroxyapatite, uric acid, cystine, and struvite (Lieske et al., 2014). Risk factors for urolithiasis include urinary factors such as hypercalciuria (Coe et al., 2016), hyperoxaluria (Owino et al., 2023), hyperuricosuria, hypocitraturia, oliguria, and the urine pH (Ferraro et al., 2024). Dietary factors include a lower fluid intake (Gamage et al., 2020), consuming high levels of oxalate-containing foods, e.g., sweet potatoes, spinach, cabbages, ground nuts, green beans, etc. (Mitchell et al., 2019). Medicinal drugs, e.g., furosemide, acetazolamide, topiramate, laxatives, and long-term steroids, may also promote stone formation (Daudon et al., 2018). Other risk factors include family history, genetic factors, and medical illnesses like hypertension, chronic kidney disease, hyperparathyroidism, diabetes, gout, and obesity (Alelign & Petros, 2018). The American Urological Association and the European Association of Urology have issued guidelines for the diagnosis and management of renal stones (Pearle et al., 2014; Türk et al., 2016). In summary, the diagnostic modalities include a urine analysis (for hematuria and to rule out infections), a non-contrast CT scan of the abdomen and pelvis (the imaging modality of choice), and a kidney-bladder ultrasound (especially in pregnant women). A plain abdominal x-ray may show radio-opaque stones but does not detect hydronephrosis, among other limitations. The management of urolithiasis includes pain control and supportive care, conservative medical expulsive therapy, surgical therapy (i.e., minimally invasive procedures like extracorporeal shock wave lithotripsy, ureteroscopy, and percutaneous nephrolithotomy) (Rodríguez & Sacco, 2015), or open stone removal (Çakici O et al., 2017). The current status of practice prefers minimally invasive procedures, but open surgery remains an option (in large, complex stones, among other indications) as per the guidelines. Renal stones have a high rate of recurrence that increases from 15 percent at 1 year, 35 to 40 percent at 5 years, and 50 percent at 10 years (Ferraro et al., 2017). The risk factors for recurrence include a younger age of onset, male sex, pregnancy, dietary factors, obesity,
diabetes, recurrent urinary tract infections, a high number and size of previous stones, etc. (Vaughan et al., 2019)

Case Summary
A 76-year-old man, a married father of five and a retired head teacher from Nyakach-Koguta, Kisumu County, Kenya, presented to us with a third episode of severe renal colic and recurrent gross hematuria due to symptomatic bilateral renal stones, which were worse on the left side. He had previously undergone two episodes of open nephrolithotomy elsewhere, i.e., in 2014, where he had a bilateral nephrolithotomy, and in 2020, where he had a left nephrolithotomy. In both cases, multiple stones of various sizes were reportedly extracted. Unfortunately, no biochemical analysis of the stones was done then. He had well-controlled hypertension on nifedipine, losartan, and atenolol. Prior to the first episode of kidney stones, he had been on hydrochlorothiazide and nifedipine. He had been regularly using paracetamol and tramadol for pain control. He had no other cardiovascular risk factors and did not smoke or take ethanol. He had no history of recurrent urinary tract infections. He intermittently took tamsulosin-dutasteride tablets for a benign prostate hyperplasia diagnosed two years prior. His vital signs were normal. On physical examination, he was in obvious pain distress, with an abdominal exam showing bilateral posterolateral lumbar scars with marked tenderness over the left lumbar region but no peritonism. A rectal exam showed an enlarged, soft prostate. A urine dipstick showed 3+ blood, and a urinalysis showed no urinary tract infection.

He had a normal creatinine of 0.9 mg/dL, normal random glucose and a complete blood count, and a normal prostate-specific antigen test of 2.4 ng/mL. A prior erect abdominal x-ray showed left-sided radio-opaque renal stones. See figure 1. A plain CT scan of the kidney-ureter-bladder (KUB) showed multiple stones in the left kidney (both obstructive and non-obstructive) and a non-obstructive stone in the right kidney. See figure 2 and the attached CT scan report in figure 3.

Figure 1: A plain, erect abdominal x-ray showing radio-opaque stones in the left kidney (appearing as white crystals, marked with letter L)

Figure 2: A plain CT scan kidney-ureter-bladder showing multiple radio-opaque stones appearing white, predominantly in the left kidney (marked with red arrows)
He had an uneventful postoperative recovery and was discharged six days later. He has remained stable and pain-free four months later. A biochemical analysis of the extracted stones by Fourier-transform infrared spectrometry showed they comprised 80% calcium oxalate, 10% uric acid, and 10% carbonate apatite. See table 1. A detailed dietary history revealed that he is a subsistence farmer who grows and routinely consumes ground nuts, sweet potatoes, spinach, cabbages, and red and green beans. He also routinely takes beef and has variously used over-the-counter calcium supplements. These foods are rich in oxalate and were deemed to be most likely responsible for the recurrent nature of the stones. Besides, he had been taking just about 200-600ml of drinking water on a daily basis. He was advised to avoid oxalate-rich foods, take 2 to 3 liters of drinking water daily, and received a comprehensive nutritional advice to forestall the recurrence of the stones.

Due to personal preference, he underwent a repeat open left nephrolithotomy with the extraction of hard, brownish renal stones, as shown in figure 4.

Figure 3: A report of the CT scan of the kidney-ureter-bladder

Figure 4: Two large renal stones extracted from the left kidney during open nephrolithotomy. Left: the stones covered by fibrous tissue. The largest stone measured about 2.8cm by 1.6cm; Right: the smaller stone measured about 1cm by 0.8cm.
DISCUSSION

Calcium oxalate stones are the most common renal stones in practice. Common foods in rural Kenya that are rich in oxalate include spinach, cabbages, ground nuts, sweet potatoes, bananas, kales (commonly called sukuma wiki in Kenya), green beans, tomatoes, etc. Our patient cultivated and consumed these foodstuffs for all his life. Oxalate released from these foods forms compounds with calcium (calcium oxalate), which leads to increased urinary supersaturation, crystal formation, crystal-cell interaction causing tubular epithelial injury, and further crystal nucleation, aggregation, and stone formation (Tsujihata, 2008). This process is compounded by adverse dietary practices, including low fluid intake with resulting low urine volume and thus supersaturation of urine with lithogenic factors, a high animal protein diet causing high levels of calcium and urate to be excreted, a high salt diet that increases urinary calcium excretion, and excessive calcium supplementation (usually by over-the-counter tablets for osteoarthritis), which further increases urinary calcium. Our patient admitted to taking no more than one liter of fluids daily (including 200-600mls of drinking water), regularly taking beef, and using calcium-vitamin D supplements for his osteoarthritis. The patient was given practical dietary advice that included restricting consumption of oxalate-containing foods, increasing the amount of oral fluids to 2-3 liters daily, reducing dietary salt, and consuming a diet rich in calcium (without calcium supplementation) in order to maintain his skeletal health (Prezioso et al., 2015). The risk of recurrences of renal stones increases with age, two or more previous histories of stones, male sex, family history, diabetes, obesity, a stone-forming diet, chronic kidney disease, etc. (Vaughan et al., 2019). For decades, hydrochlorothiazide has been used to prevent the recurrence of renal stones. However, the recent NOSTONE trial did not show any benefit of hydrochlorothiazide use compared to placebo in preventing the recurrence of stones (Dhayat et al., 2023). Our patient was previously on hydrochlorothiazide, which was stopped due to a prior episode of hyperuricemia. He was not put on preventative hydrochlorothiazide thereafter. Minimally invasive therapy is currently preferred for surgically managing symptomatic renal stones. However, in a rural Kenyan setting, patients must be referred to centers (usually in faraway towns) where such services may be available. The services are costly and not readily affordable. This is why our patient (and his family) chose the cheaper, open stone removal approach at this time and previously. Besides, he was deemed to have a complex stone burden and thus unlikely to fully benefit from less-invasive approaches (El-Husseiny et al., 2023).

CONCLUSION

Renal stones are increasingly being reported in both urban and rural Kenya. Foods that are rich in oxalate, calcium, and urate content; as well as concurrent medical illnesses (among other risk factors), may explain the occurrence and recurrence of renal stones in these populations. Although a minimally invasive surgical approach is preferable for symptomatic stones, open surgery is indicated in selected patients. A biochemical analysis of the stones to determine their exact composition helps guide preventative efforts against stone recurrence.

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