IJKD KIDNEY DISEASES

Silica Urinary Stones: A Case Report and A Brief Review of Literature

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Keywords. nephrolithiasis, kidney stone, silicate, silica, obstructive uropathy

Case Report

Silicate stones are extraordinarily rare in human beings, but when present, they are often associated with ingestion of Magnesium Trisilicate, an antacid medication. However, there have been few case reports of patients who developed silicate stones, without ingestion of Magnesium Trisilicate. Hereby, we present the case of a 67-year-old man who developed acute kidney injury due to obstructive uropathy, detected during his scheduled chemotherapy for his relapsing multiple myeloma. Abdominal ultrasound and CT scan imaging demonstrated multiple non-mobile calcifications in the bladder neck/prostate bed. Stone analysis showed a material resembling silica. This case with silicate urinary tract stone highlights this extra-rare urinary stone in a patient without any identified source of silicate.

IJKD 2022;16:266-8
www.ijkd.org
DOI: 10.52547/ijkd.7044

INTRODUCTION

The prevalence of kidney calculi has increased in the USA (3.8% in 1970s to ~10% in 2013 to 2014), due to changes in diet and lifestyle.[1-3] Most commonly, nephroliths are composed of calcium oxalate, followed by calcium phosphate, struvite, and uric acid.[1-3] Silicate stones are extraordinarily rare in humans and are often associated with ingestion of magnesium trisilicate antacid.[4,5] Silicate reacts with gastric acid, forming a gel and colloid solution. The alkaline environment in the intestine modifies silica colloid into a more soluble and absorbable composite, that will be excreted in urine.[6-8] High silicate intake increases urinary silicate excretion.[7,8] There have been few case reports of silicate stones with no history of taking magnesium trisilicate antiacid.[5] We present a 67-year-old man who developed AKI due obstructive uropathy caused by silica stones in the bladder neck/prostate bed. .

CASE REPORT

A 67-year-old man with a past medical history of hypertension, prostate cancer, prostatectomy/radiation therapy, IgG-kappa multiple myeloma and autologous stem cell bone marrow transplantation presented to our hospital for scheduled chemotherapy for relapsed multiple myeloma. He had passed two urinary stones for the first time in the same week. He denied ingestion of any antiacid containing magnesium trisilicate. He was first visited by a urologist in 2018, for radiation therapy for prostate carcinoma, which was complicated with radiation cystitis and hematuria. There was no evidence of urinary tract stones at that time. His medications included daily acyclovir 800 mg, aspirin 81 mg, dexamethasone 4 mg, famotidine 20 mg, furosemide 20 mg, metoprolol 25 mg, simvastatin 40 mg, and weekly ergocalciferol 1.25 mg. Physical examination showed a blood pressure of 158/58 mmHg and a heart rate of 80 /min, with no fever and trivial bilateral ankle edema. Laboratory tests were as follows blood urea nitrogen (BUN) = 32 mg/dL, serum creatinine = 2.7 mg/dL, plasma sodium = 144 mmol/L, plasma = 3.7 mmol/L, serum

uric acid = 6.1 mg/dL, blood $HCO3^-$ = 26 mmol/L. Urinalysis showed more than100 RBCs/HPF.

His baseline serum creatinine was 1.1 to 1.2 mg/dL. Abdominal ultrasound and computed tomographic scan demonstrated a distended urinary bladder, bilateral moderate hydroureter/hydronephrosis, and multiple coarse calcifications/calculi in the bladder neck and prostatic urethra measuring 2.7 × 5.1 cm (Figures 1 and 2).

Cystoscopy showed that bladder neck and prostatic urethra were filled with a white stringy rough tissue (non-viable tissuecaused by prior radiation), carpeted with stones measuring about 2 cm, each. A lithotrite crushed the stones and fragments were drained from the bladder. Stone analysis determined that the stones resemble silica (ARUP Laboratories, Fourier Transform Infrared [FTIR] spectroscopy). However, matrix components were not reported. The patient achieved full recovery from his AKI.

Figure 1. CT scan of abdomen/pelvis demonstrated a distended urinary bladder, bilateral moderate hydroureteronephrosis and multiple coarse calculi in the neck of the urinary bladder/prostatic urethra that measured 2.7 × 5.1 cm.

Figure 2. CT scan of pelvis demonstrated multiple coarse calculi in the neck of the urinary bladder/prostatic urethra.

DISCUSSION

Silicate urinary tract stones have been reported to be formed due to excessive intake of silica-containing antacids (e.g., magnesium trisilicate).[4-8] However, formation of silicate stones without any history of known silicate exposure is extremely rare.[5] Ichiyanagi *et al.* reported two cases of silica stones from Japan, without any previous history of magnesium trisilicate ingestion.[5] In one of the cases, a 64-year-old woman with bilateral kidney stones, infrared spectrophotoscopy revealed that one of the fragments consisted of silicate and the others consisted of calcium oxalate. The second case was a 75-year-old woman with right kidney stones, one of them was a mixture of silicate and unspecified matrix. The authors concluded that, silicate urinary stones may not be always related to the intake of silicate-containing antacids.[5] Silica is an essential trace element in the metabolism of mammals. Its deficiency causes disorders in bone, cartilage, and connective tissue metabolism.[9] Water, beer, coffee, cereals and vegetables are the main sources for silica. The mean daily intake of dietary silicon, as silica, is estimated to be 19 mg and 40 mg in adult women and men, respectively.[9] Silica is excreted in urine at approximately 10 mg/day, proportional to its dietary intake.[9] Silica-rich diets include vegetables, whole grains, and seafood. Urine pH, and concentration of silicate and some matrix constituents are responsible for silica stone formation.[10] However, one study found no significant difference in urinary silicate concentration or its daily excretion between patients with urinary silicate stones and a control group.[11] Therefore, urinary concentration of matrix constituents may be the major factor for silicate stone formation. In the present case we could not find any source of silicate.

In conclusion, silica deposits as urinary stones may be more common than generally believed, and a history of using silica containing antacids is not always necessary for their formation, as observed

in the present case. Our patient also highlights the importance of urinary stone analysis.

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Received March 2022
Revised May 2022
Accepted June 2022