Case Report and Literature Review

Gas-Containing Renal Stones: A Case Report and Literature Review

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ABSTRACT

We report the 11th case of gas containing renal stone. A 92-year-old Chinese female presented with fever and lower urinary tract symptoms. Urine culture grew Escherichia coli (E. coli). CT abdomen pelvis showed a large gas containing partial staghorn stone. She was managed conservatively with two weeks of antibiotics. Follow up plain kidney, ureter and bladder (KUB) radiograph at 3 months showed that the stone was stable in size. She remained asymptomatic at follow up.

Background

Gas-containing renal stones are very rare. There have been only 10 cases reported in the literature worldwide. We aim to describe the clinical presentation, microbiological and radiological findings of the case and a review of literature.

Case

A 92-year-old Chinese female presented with fever and lower urinary tract symptoms. Her past medical history includes Parkinson’s disease and hypertension. Functionally she is non-ambulant, and bed bound due to previous bilateral hip fractures. She is under follow up with urology for neurogenic bladder requiring clean intermittent catheterization twice per day.

Initial Evaluation

Physical examination revealed a non-tender abdomen and bilateral renal punch was negative. Her blood investigation revealed a normal total white cell counts but the procalcitonin level was markedly raised at >100microgram/L. Her renal function, calcium phosphate uric acid levels were within normal limits. Urinalysis showed hemopyuria and urine culture grew Escherichia coli. Blood culture had no bacterial growth. A plain KUB X-ray was performed showed a markedly fecal loaded colon and rectum. There were no obvious urinary tract calculi. She was empirically treated with intravenous piperacillin-tazobactam. A non-contrasted CT abdomen and pelvis revealed a large gas containing partial staghorn stone measuring 5.2 x 3.4 x 2.6 cm within the right renal pelvis. The Hounsfield unit for the stone ranges between450 to 650. There was no significant perinephric fat stranding or hydronephrosis. The kidney was not edematous and gas was not seen within collecting system or ureter to suggest emphysematous pyelonephritis. There was no fluid collection, perinephric stranding or stones within the left kidney and ureter.

Management

She responded well to antibiotics and was afebrile after two days of antibiotics. Her inflammatory markers were down trending. Repeat CT urogram was performed after 2 weeks which showed that the stone was stable in size. There was no evidence of renal abscess, hydronephrosis or pyelonephritis. In view of her age and co-morbidities, the family refused any invasive intervention for the stone. She was discharged after completion of 2 weeks of intravenous antibiotics. At the 3-month outpatient follow-up, she remained asymptomatic.
Table 1: Clinical, radiological and biochemical characteristics of previous cases reports and series.

| Age | Sex | Presentation | Co-morbidities | Metabolic abnormalities | Opacity on KUB xray | CT findings | Stone multiplicity | Largest stone diameter (mm) | Urine culture | Stone Culture | Stone analysis | Management |
|-----|-----|--------------|----------------|------------------------|---------------------|-------------|-------------------|---------------------------|-------------|---------------|----------------|------------|
| 68  | M   | Loin pain, Sepsis, Pyonephrosis | Pituitary insufficiency | NA | Radiolucent | Poorly functioning kidney | Multiple | 18 | E. coli | N/A | Mixed matrix and infected | Nephrectomy |
| 55  | F   | Flank pain, pyonephrosis | N/A | Normal | Radio-opaque | Hydronephrosis | Multiple | NA | E. coli | NA | Uric acid | PCNL |
| 46  | M   | Pneumaturia Recurrent UTI | Hyperparathyroidism | Hypercalcemia | NA | Right to left crossed fused renal ectopia | Single partial staghorn | NE | Klebsiella pneumoniae | Negative | Calcium phosphate | PCNL |
| 65  | F   | Loin pain Sepsis | DM Sarcoïdosis CKD | Hypercalcemia | Radiopaque | Hydronephrosis | Multiple | 10 | E. coli | NA | NA | NA | Retrograde ureteral stenting |
| 31  | F   | Flank pain | Gout | NA | NA | Hydronephrosis | NA | 65 | E. coli | E. coli | Hydroxyapatite | Robotic pyelolithotomy |
| 37  | F   | Sepsis | DM HTN | Hypocitraturia Hypercalciuria Hyperoxaluria Hyperuricosuria Hypermatriuria | NA | Hydronephrosis | NA | 25 | E. coli | Coagulase negative Staph | Hydroxyapatite and calcium oxalate monophosphate | PCNL and subsequent PCNL |
| 42  | F   | Flank pain | HTN | NA | NA | Hydronephrosis | NA | 25 | E. coli | NBG | Hydroxyapatite and calcium oxalate monophosphate | Ureteral stenting and subsequent PCNL |
| 45  | F   | Flank pain | DM HTN | NA | NA | Hydronephrosis | NA | 45 | Staphylococcus | NBG | Hydroxyapatite and Calcium oxalate diphosphat e Matrix | PCNL and subsequent PCNL |
| 47  | F   | Flank pain | DM Hypercalciuria Hyperoxaluria hypercalciuria | NA | Hydronephrosis | NA | 21 | NBG | NBG | Hydroxyapatite | PCNL and subsequent PCNL |
| 32  | F   | Flank pain Recurrent UTI | NA | NA | Radiopaque | Hydronephrosis | Multiple | 20 | E. coli | NA | NA | NA |

F:Female, DM: Diabetes mellitus, HTN: Hypertension, PCN: percutaneous nephrostomy, PCNL: Percutaneous nephrolithotomy, NBG: No bacterial growth, NA: not available.

Figure 1: Initial KUB X-ray performed on admission showed a moderately fecal loaded abdomen.

Figure 2: CT KUB performed during admission showing the gas containing stone within the right renal pelvis.
Gas-containing renal stones is a rare phenomenon. The first case of gas containing renal stones was reported by Simpson et al [1]. The case was managed with simple nephrectomy as the patient was persistently symptomatic with a poorly functioning kidney. Subsequently there have been more cases reported [2-7]. In most of the reported cases, E. coli is the main causative pathogen. Similarly, E. coli remains the most common pathogen in emphysematous pyelonephritis, a severe form of necrotizing infection of renal parenchyma with presence of gas in the renal parenchyma, collecting system or perinephric tissue [7]. The theories postulated for emphysematous infection in urinary tract is combination of presence of gas forming bacteria, impaired tissue perfusion, high glucose level and defective immune system [8]. Our patient was managed conservatively in view of her co-morbidities. Aggressive antibiotic therapy in carefully selected patients coupled with surgical intervention, when necessary can lead to excellent outcomes. Drainage in the form of ureteral stenting of percutaneous nephrostomy is required when there is concomitant pyonephrosis. When the patient is out of sepsis, definite management of the stone would include surgical removal through either Percutaneous Nephrolithotomy or pyelolithotomy.

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