

4th Edition of the Clinical Cases Competition related to the non-surgical clinical management of non-surgical clinical management of renal lithiasis

Official template

Title: The importance of urinary pH monitoring in brushite lithiasis: a comprehensive approach to treatment and prevention.

Keywords: urolithiasis, brushite, urinary pH, monitoring, device, prevention

1. Abstract

We present the case of a 45-year-old male with a history of recurrent bilateral urinary lithiasis since adolescence; some resolved spontaneously, others with several sessions of extracorporeal lithotripsy (ESWL) and others with multiple endourological and/or percutaneous interventions. After crystallographic analysis, the composition of the lithiasis was revealed to be brushite-type calcium phosphate. Faced with a very recurrent and demanding lithiasis disease, an integral management was started with exhaustive metabolic evaluations, dietary recommendations and medical treatment with drugs and supplements to avoid lithiasis recurrences. After years of difficult metabolic control of the disease and the need for several surgical interventions, home self-monitoring of urinary pH with Lit-Control® pH Meter has allowed proper follow-up, monitoring and optimization of treatment under the control of the medical team.

2. Introduction

Urinary lithiasis is a very common urological condition with an increasing prevalence. The recurrence rate ranges between 30-40% in the 5 years following the first episode of lithiasis (1). Urolithiasis is a consequence of a pathological change in the conditions of the urinary tract due to urinary supersaturation, alterations in urinary pH values and in the relationship between the molecules that act as promoters or inhibitors of crystallization, favoring the formation of nuclei and crystals that by growth form kidney stones (2,5).

Brushite ($\text{CaHPO}_4 \cdot 2\text{H}_2\text{O}$) lithiasis represents only 1.3% of all urinary calculi, but it is an aggressive form of nephrolithiasis with a very high recurrence rate of up to 75-80% (3), which requires not only specific medical and surgical treatment, but also an exhaustive metabolic evaluation and comprehensive measures for the effective prevention of recurrences (4). The profile of patients who form brushite lithiasis is usually young with age of debut of the first lithiasis event between 29.9 ± 11.9 years (mean \pm SD) and mostly present bilateral disease. In a considerable proportion of these patients, it is characteristic to identify underlying distal renal tubular acidosis, being less frequent the presence of anatomical abnormalities (4).

Phosphocalcic lithiasis comprise a heterogeneous group of compounds highly dependent on urinary pH that usually precipitate in the form of non-polarizing granulations, and whose formation occurs mainly with the association of three risk factors: alkaline urine (at urinary pH > 6.2), hypercalciuria and hypocitraturia (5). The factors and mechanisms leading to brushite stone formation are not yet fully understood, but it has been reported that an alkaline urinary pH between 6.2-6.8 favors brushite crystallization and that hypercalciuria is the most common abnormality among patients who form brushite calculi (4,5). Other urinary factors that can increase the risk of its formation are hypocitraturia, hyperphosphaturia and low urinary volume (4). We know that urinary pH is an important risk factor for urinary stone formation, which makes it a therapeutic target in the management of urolithiasis (5). Urinary pH monitoring is emerging as a fundamental tool for the follow-up and treatment of lithiasis patients, since it provides valuable information on the acid-base balance within the urinary system (5). According to the literature, the correlation between elevated urinary pH and brushite stone formation has been highlighted, underscoring the importance of continuous urinary pH monitoring as part of preventive measures. By tracking changes in urinary pH, urologists can implement tailored interventions to modulate pH levels and mitigate the risk of stone formation.

3. Description of the clinical cases:

We present the case of a 45-year-old male patient with a history of recurrent urinary lithiasis since adolescence. Initially they were expulsive nephritic colic that resolved spontaneously, but later required multiple ESWL with good fragmentation results after several lithotripsy sessions for each stone to be treated. Given the limited efficacy rate of lithotripsy, endourological and/or percutaneous interventions were chosen for the treatment of bilateral and very recurrent renoureteral lithiasis.

At the end of 2019, the patient presented an episode of left obstructive pyelonephritis secondary to a lithiasic street in the sacral ureter, so a left JJ catheter was placed. At 4 months, a left URS/RIRS intervention was performed due to a calcified JJ catheter in the proximal end and distal ureteral lithiasis street, obtaining for the first time the composition of the lithiasis, being of calcium phosphate-phosphate type brushite.



Based on previous metabolic study (MLE), which showed a urinary volume of 2800ml, hypercalciuria (9.7 mmol/24h) normocalcemic (2.36 mmol/L) with normal PTH (22.5 ng/L), normal urinary citrate (2.23 mmol/24h) and long-standing alkaline urinary pHs (6.3-6.8), it was decided to start treatment with hydrochlorothiazide 25mg/day + Lit-Control® pH Down (L-methionine) to acidify pH.

In the control of early 2020, radiologically he presented multiple bilateral calyceal lithiasis and left lower calyceal lithiasis of 10mm. The MLE showed persistent hypercalciuria (9.3 mmol/24h) normocalcemic (2.41 mmol/L) with normal PTH (33.9 ng/L) and urinary pH 6.2, so it was decided to increase the dose to hydrochlorothiazide 50 mg/day and keep Lit-Control® pH Down. In the next control, the MLE showed persistent normocalcemic hypercalciuria (8.9 mmol/24h) (2.69 mmol/L) with normal PTH (34.5 ng/L), mild hypocitraturia (1.58 mmol/24h) and urinary pH of 6.5, so it was decided to start Ameride (Amiloride 5mg + Hydrochlorothiazide 50mg/day) and maintain Lit-Control® pH Down. Given the findings of persistent alkaline urine, a study was also initiated by Nephrology to rule out possible renal tubular acidosis. After performing the furosemide test, after discontinuation of Ameride, normality in the ability to acidify the urine is evidenced, reaching a minimum pH of 5.27, so distal secretory renal tubular tubular acidosis is ruled out.

During the follow-up, there was evidence of renal lithiasis growth, so in August 2020 she underwent surgery of left ECIRS of lower pyeloinfundibulocalicilar lithiasis of 20mm + right URS/RIRS of proximal ureteral lithiasis of 10mm; with subsequent radiological result of persistence of residual bilateral calyceal microlithiasis. It was decided to continue with the same medical treatment: Ameride, Lit-Control® pH Down and periodic radiological controls.

In the control MLE in January 2021, there was persistent evidence of normocalcemic hypercalciuria (7.9 mmol/24h) (2.33 mmol/L) with normal PTH (26.8 ng/L), hypocitraturia (1.11 mmol/24h) and urinary pH of 6, so it was decided to add potassium citrate, in addition to maintaining Ameride and Lit-Control® pH Down.

In January 2022, after an episode of bilateral renal colic, severe bilateral ureterohydronephrosis secondary to left ureteral lithiasis and right juxtavesical lithiasis was identified, so bilateral nephrostomy tubes were placed.



In March 2022, bilateral URS/RIRS was performed without incident, with subsequent radiological result of absence of lithiasis in the right kidney and persistence of left lower calicular lithiasis of 9mm. The control MLE showed persistent normocalcemic hypercalciuria (6.8 mmol/24h) (2.46 mmol/L) with normal PTH (28.2 ng/L), normocitraturia (3.24 mmol/24h) and urinary pH of 6.8, so it was decided to withdraw potassium citrate, maintaining the rest of the treatment.

At the end of the same year, the MLE showed persistent normocalcemic hypercalciuria (6.7 mmol/24h) (2.56 mmol/L) with normal PTH (27 ng/L), normocitraturia (2.65 mmol/24h) and urinary pH of 5.5, so it was decided to withdraw Lit-Control® pH Down, maintaining only Ameride.

In May 2023, he suffered a right obstructive pyelonephritis secondary to right distal ureteral lithiasis of 8mm, so a right JJ catheter was placed. One month later, right URS was performed without incident. At discharge, it was decided to maintain pharmacological treatment only with Amierde and to start continuous monitoring of urinary pH at home using the Lit-Control® pH Meter, twice a day (morning and evening) to adjust treatment.

At the follow-up visit, multiple bilateral calyceal microlithiasis were radiologically evident and the MLE showed a urinary volume of 2500ml, persistent normocalcemic hypercalciuria (6.4 mmol/24h) (2.43 mmol/L) with normal PTH (25.6 ng/L), normocitraturia (2.53 mmol/24h) and urinary pH of 6.2. The patient brings

The patient brings a rhythm of his ambulatory urinary pH measured with the Lit-Control® pH Meter, showing oscillations between 6-6.8, so it was decided to restart Lit-Control® pH Down (L-methionine) and maintain Ameride.

Since then, the patient has not presented any interesting lithiasis episodes, maintains radiological stability of his bilateral calyceal lithiasis and continues with a good self-control of his urinary pH rhythm at home with oscillations between 5.9-6.4 with the proposed medical treatment.

4. Discussion

Brushite nephrolithiasis is a chronic, very recurrent and demanding disease. They are particularly dense and hard lithiasis so that treatment with ESWL is not very effective, being necessary multiple surgical interventions to achieve its elimination, which means an important morbidity and affectation of the quality of life of these patients, as well as an economic impact for the countries. This is why we must use all available tools to try to solve them, advocating a combined treatment that includes dietary measures, medical treatment (drugs and/or food supplements such as Lit-Control® pH Down to lower urinary pH or Lit-Control® pH Up to raise it) and surgical treatment.

For an integral management of these patients, it is not only important to completely resolve the lithiasis, but also to include preventive measures, such as urinary pH control, to avoid its formation and the recurrence of episodes. Accurate and precise self-measurement of urinary pH, which is easily performed by the patient for subsequent evaluation by the medical team, makes it possible to guide and personalize the treatments to be followed.

The "gold standard" tool for the most accurate measurement of urinary pH is a glass electrode and a pH meter, but they are devices for use in laboratories that require constant calibration, are not portable and are not easy to use (5). Therefore, for many years, the most widely used method has been test strips, which are considered to be not very precise, accurate and reliable methods for clinical decision making (5,6,7). Recently, several studies have evaluated the feasibility of new urinary pH measurement devices as an alternative to test strips, demonstrating good results in terms of resolution, precision and accuracy (6,7,8,9). A comparative study between a portable medical device (Lit-Control® pH Meter) and several brands of test strips showed superiority of the device in terms of reliability of urinary pH monitoring, in addition to being an easy-to-use alternative for patients on an outpatient basis (6). The Lit-Control® pH Meter is a medical device that allows accurate and reliable self-measurement of urinary pH on an outpatient basis, quickly and easily by patients (6,8).

As we have seen in the clinical case presented, medical and surgical treatment may be insufficient to keep patients with recurrent lithiasis free of lithiasis due to brushite. It is important to implement preventive measures for a comprehensive management of these patients. Home self-monitoring of urinary pH by the patient is postulated as an effective strategy to monitor and adjust treatment during follow-up.

5. Conclusions and recommendations

Self-monitoring of urinary pH using the Lit-Control® pH Meter can be recommended as an effective supportive method for the follow-up and prevention of patients with recurrent brushite lithiasis disease, in an attempt to avoid the high number of recurrences, avoid invasive surgical procedures and improve their quality of life.

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