STONE DISEASE

Biochemical and physicochemical presentations of patients with brushite stones

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Purpose: We determined whether the biochemical and physicochemical backgrounds of patients with brushite stones differ from those with hydroxyapatite and calcium oxalate stones.

Materials and Methods: From a computer data base of patients completing ambulatory evaluation 19 with brushite stones, 24 with hydroxyapatite stones and 762 with calcium oxalate stones were identified with the specified composition in greater than 70% of stones.

Results: Absorptive hypercalciuria type I was present in 63% of patients with brushite, 17% with hydroxyapatite and 30% with calcium oxalate stones. Distal renal tubular acidosis was noted in 32% of patients with brushite, 42% with hydroxyapatite and 3% with calcium oxalate stones. Mean urinary calcium in the brushite group was significantly higher than in the hydroxyapatite and calcium oxalate groups (265 +/- 125 vs 186 +/- 103 and 187 +/- 95 mg daily, respectively). Urinary pH in the brushite group was slightly but significantly higher than in the calcium oxalate group (6.15 +/- 0.30 vs 5.91 +/- 0.42). The brushite relative saturation ratio in the brushite group was marginally higher than in the hydroxyapatite group and significantly higher than in the calcium oxalate group (3.25 +/- 2.03 vs 2.34 +/- 1.51 and 1.83 +/- 1.66, respectively).

Conclusion: Patients with predominantly brushite stones could be distinguished from those with predominantly hydroxyapatite and calcium oxalate stones by higher urinary saturation with respect to brushite due mainly to hypercalciuria from absorptive hypercalciuria.

Editorial Comment

Brushite stone formers constitute a particularly aggressive and difficult-to-treat subset of calcium stone formers. The low fragility of brushite stones observed in vitro is consistent with the clinical finding that they are relatively SWL-resistant; consequently, these stones typically require endoscopic treatment. Moreover, brushite stone formers tend to be highly metabolically active, with high recurrence rates even when patients have been rendered stone free after surgery (1). Therefore, insight into the physicochemical causes of brushite stone formation may facilitate management of these patients, who in my practice constitute a most challenging group of patients to manage medically.

Pak and colleagues searched their stone registry to identify 19 patients with predominantly brushite stones and 24 with predominantly hydroxyapatite stones, then compared them with a control group of 762 calcium oxalate stone formers to discern differences in urinary physicochemisty. Brushite stone formers were found to have urine that is significantly more supersaturated with respect to brushite than the other 2 groups, primarily as a result of higher urinary calcium. Indeed, absorptive hypercalciuria was overrepresented in the brushite group (63%) and underrepresented in the hydroxyapatite group (17%) compared with the calcium oxalate group (30%). Not surprisingly, urinary pH was also higher in the brushite and hydroxyapaptite groups than the calcium oxalate group.

The authors raised the question as to why brushite, which represents a relatively unstable form of calcium phosphate that forms at lower urine pH than hydroxyapatite, fails to undergo conversion to hydroxyapatite during normal periods of urinary alkalinization. They speculate that perhaps urinary inhibitors prevent the transformation. Equally important in my mind, is why these patients are so difficult to treat medically. Anecdotally, correction of their hypercalciuria often fails to result in a corresponding reduced rate of stone recurrence as is

typically seen with calcium oxalate stone formers. Whether pH manipulation (i.e., lowering of urine pH) can prevent brushite stone formation requires further clinical investigation, but it is likely to be a difficult and potentially dangerous (risk of bone loss) maneuver. For now, clinical studies such as these, may help shed some light on this difficult group of patients.

Reference

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Ureteral access sheath provides protection against elevated renal pressures during routine flexible ureteroscopic stone manipulation

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Background and Purpose: New-generation flexible ureteroscopes allow the management of proximal ureteral and intrarenal pathology with high success rates, including complete removal of ureteral and renal calculi. One problem is that the irrigation pressures generated within the collecting system can be significantly elevated, as evidenced by pyelovenous and pyelolymphatic backflow seen during retrograde pyelography. We sought to determine if the ureteral access sheath (UAS) can offer protection from high intrarenal pressures attained during routine ureteroscopic stone surgery.

Patients and Methods: Five patients (average age 72.6 years) evaluated in the emergency department for obstructing calculi underwent percutaneous nephrostomy (PCN) tube placement to decompress their collecting systems. The indications for PCN tube placement were obstructive renal failure (N=1), urosepsis (N=2), and obstruction with uncontrolled pain and elevated white blood cell counts (N=2). Flexible ureteroscopy was subsequently performed with and without the aid of the UAS while pressures were measured via the nephrostomy tube connected to a pressure transducer. Pressures were recorded at baseline and in the distal, mid, and proximal ureter and renal pelvis, first without the UAS, and then with the UAS in place.

Results: The average baseline pressure within the collecting system was 13.6 mm Hg. The mean intrarenal pressure with the ureteroscope in the distal ureter without the UAS was 60 mm Hg and with the UAS was 15 mm Hg. With the ureteroscope in the midureter, the pressures were 65.6 and 17.5 mm Hg, respectively; with the ureteroscope in the proximal ureter 79.2 and 24 mm Hg, and with the ureteroscope in the renal pelvis 94.4 and 40.6 mm Hg, respectively. All differences at each location were statistically significant ($P<0.008$). Compared with baseline, all pressures measured without the UAS were significantly greater, but only pressures recorded in the proximal ureter and renal pelvis after UAS insertion were significantly higher ($P<0.03$).

Conclusions: The irrigation pressures transmitted to the renal pelvis and subsequently to the parenchyma are significantly greater during routine URS without the use of the UAS. The access sheath is potentially protective against pyelovenous and pyelolymphatic backflow, with clinical implications for the ureteroscopic management of upper-tract transitional cell carcinoma, struvite stones, or calculi associated with urinary tract infection.

Editorial Comment

With dramatic improvements in endoscope design and instrumentation have come expanded indications for endoscopic stone management such that large and complex renal calculi are increasing managed ureteroscopically. However, the treatment of larger stones is associated with longer operative times and a greater potential for fluid absorption and/or bacteremia. A recent cadaveric study assessed renal pelvic and ureteral flow characteristics during flexible ureteroscopy either with or without a ureteral access sheath and determined that use of a ureteral access sheath was associated with low intrarenal pelvic pressures regardless of irrigation pressure used, and significantly lower pressures with ureteroscopy at all locations in the ureter compared with ureteroscopy using a bare ureteroscope (1).

Auge and colleagues validated the findings of this cadaveric study in a clinical study of 5 patients with nephrostomy tubes who underwent flexible ureteroscopy for management of obstructing ureteral calculi. Measuring renal pelvic pressures via the nephrostomy tube during ureteroscopy either without or with a ureteral access sheath yielded differences of 45 mm Hg, 48.1 mm Hg, 55.2 mm Hg and 53.8 mm Hg with the ureteroscope in the distal ureter, middle ureter, proximal ureter and renal pelvis, respectively. As such, use of a ureteral access sheath is more than just a mere convenience, facilitating retrieval of stone fragments or passage of the ureteroscope. Instead it provides a safety mechanism, particularly during lengthy procedures or when the occurrence of pyelovenous or pyelolymphatic backflow poses the greatest risk, such as during the treatment of urothelial tumors or potentially infected stones.

Reference

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ENDOUROLOGY & LAPAROSCOPY

Ureteropelvic junction obstruction: determining durability of endourological intervention

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Purpose: We evaluated the durability of endourological intervention for ureteropelvic junction obstruction and established guidelines for postoperative surveillance.

Materials and Methods: Since 1989, 150 patients have undergone endourological intervention for ureteropelvic junction obstruction, of whom 127 (53 men and 74 women) 13 to 79 years old (mean age 40.4) underwent postoperative evaluation at our center. These 127 patients are the study group reported. Endourological management consisted of hot wire balloon endopyelotomy in 25 patients, percutaneous endopyelotomy in 67 and ureteroscopic laser endopyelotomy in 35. Success in this study was strictly defined as symptomatic relief plus radiographic resolution on excretory urogram and/or diuretic renogram. Statistical analysis was performed to assess mean time to failure and develop Kaplan-Meier re-stenosis-free survival estimates.