CLINICAL VIGNETTE

Crohn's and Stones

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Case Report

A 40-year-old male with history of severe Crohn's disease status post a 60 cm distal small bowel resection 8 years prior presents with acute onset right lower quadrant, flank, and back pain. The right-sided pain was similar in quality to his previous Crohn's flares but more severe, more posterior, and with no associated bowel changes. He denies fever, nausea, vomiting, dysuria, hematuria, or urinary frequency/urgency. He had no recent medication or dietary changes.

On physical exam, he was afebrile with normal blood pressure and heart rate. He was a healthy appearing male in moderate distress due to pain. Abdominal exam revealed normal active bowel sounds, soft, non-distended, with moderate tenderness to palpation in the right lower quadrant and right flank. No costovertebral angle tenderness.

Urinalysis showed a pH<5.0, 3+ blood, calcium oxalate crystals. No leukocyte esterase, nitrites, or white blood cells. CBC revealed normal white blood cell count, hemoglobin, and hematocrit. Basic metabolic panel showed normal creatinine, potassium, magnesium, and calcium levels.

CT scan revealed a 5 mm kidney stone in the right mid ureter with mild hydroureter, no hydronephrosis. No evidence of intestinal inflammation, diverticulitis, or appendicitis.

This clinical vignette presents information on the link between Crohn's disease and kidney stones, how to clinically distinguish a Crohn's flare from a kidney stone, and how to prevent stone formation in these patients.

Background

Urolithiasis is the most common urinary complication associated with Crohn's disease. The incidence of calculi during the lifetime of Crohn's disease patients (25%) is believed to be higher than that of healthy people (approximately 10%).[1] Nephrolithiasis is more common after small bowel surgery – 4–5.5% (before) versus 15.0–30.5% (after), and it seems to be related to the location of the disease: 7–17% in ileocolic, 6–8% in ileal and 3–5% in colonic disease.[2]

Causes

The causes of kidney stone development in IBD Crohn's disease are believed to be dehydration associated with chronic diarrhea, decreased urine volume, aciduria, bowel resection, abnormal metabolism of oxalic acid, and altered intestinal bacterial flora.[2]

There is a higher risk with distal small bowel resection, especially if two or more resections and/or those who have > 100 cm of resection. The mechanism is speculated to be as follows: (i) oxalic acid, which usually binds to calcium and is excreted in feces, links to calcium and fat in the intestine due to abnormal fat absorption associated with bowel resection, and is converted into the more absorbable sodium oxalate; (ii) oxalic acid decomposition is inhibited due to changes in intestinal bacterial flora; and (iii) fatty acid and bile acids, which are not absorbed in the terminal ileum, promote oxalic acid absorption in the large bowel.[3]

The association of Crohn's disease and kidney stones is also related to diet and environmental factors including high dietary protein, low dietary calcium and magnesium, and altered intestinal bacterial flora. Excessive dietary protein intake can increase urinary oxalate, in combination with lower dietary calcium and magnesium that cause reduced binding with oxalate in the GI tract, making it more available. Patients with inflammatory bowel disease also have altered intestinal bacterial flora due to bowel resection and increased use of antibiotics. This altered gut flora has been shown to have decreased concentrations of oxalate decomposing bacteria (oxalobacter formigenes), resulting in higher oxalate absorption from the gut with an increased risk of oxalate stones.[4] Further research is needed to explore the role of probiotics containing oxalobacter formigenes in reducing oxalate stone formation in IBD. Patients with Crohn's have also been shown to have altered expression of tight junction proteins which can also promote an increase in gut permeability. As oxalate is absorbed in the intestine by both a paracellular and a transepithelial transport, it is suspected that altered tight junctions effect oxalate absorption via paracellular route.[2] Research is needed to explore the link between kidney stone formation and factors that improve intestinal permeability including probiotics, prebiotics, and decreased intake of processed foods.

The final main cause of kidney stone formation in Crohn's lies in the composition of the urine itself. Patients with Crohn's disease have significantly higher urinary oxalate and lower urinary magnesium and citrate concentrations. Lower urinary concentrations of magnesium and citrate (stone inhibitors), relative to calcium (stone promoter) in the setting of acidic urine

may predict likely stone-formers. Avoiding low urinary levels of magnesium and citrate may aid in preventing and treating calcium oxalate renal calculi.[5] Urine pH is an also an important factor in the production of kidney stones as uric acid and calcium oxalate stones tend to form in acidic urine (pH <5.5).[1]

Presentation

Because patients with Crohn's disease have multiple potential etiologies for abdominal pain, it is important to be aware of the correlation between Crohn's and kidney stones. On history, it is useful to understand the patient's usual symptoms with a Crohn's flare to compare to the current symptoms. On physical exam, look for pain that is localized more to the flank or costovertebral angle. This complication should also be considered in Crohn's patients with unexplained renal dysfunction, abdominal pain, or recurrent urinary tract infections. On data analysis, also look for clues that would point toward kidney stones such as acidic urine, microscopic hematuria, and decreased GFR.

Prevention

Prevention of future kidney stones in Crohn's patients can be achieved through screening tests, health education, diet, and medication. Prevention is also imperative to preserve kidney function and prevent morbidity. It is especially important in patients with a history of multiple bowel resections to be monitored closely for the development of kidney stones by means of regular urinalysis, ultrasound, and/or CT scans. In those IBD patients who have already had a bout of kidney stones, prevention of stone recurrence can be done via stone analysis along with blood and urine laboratory analysis to identify modifiable risk factors such as urinary calcium and magnesium levels and urine pH.

Patients should be encouraged to increase their fluid intake to ensure a high urine output with a goal of approximately 2 liters of daily urine volume. They can also be counseled to check their urine specific gravity at specific intervals using urine test strips, aiming to avoid excessively concentrated urines.

Given that acidic urine may be a contributor to increased stone formation, therapy with an alkalizing agent such as sodium bicarbonate has some advantages. Experts believe that it is essential to maintain urine pH around a level of 6.0.[5]

Calcium supplements may be useful for lowering urinary oxalate, especially in patients with lactose intolerance who have a low calcium intake due to the restriction of dairy products. Increasing dietary calcium could progressively lower urinary oxalate excretion by binding dietary oxalate in the gut.

Hypocitraturia and hypomagnesuria are often associated with magnesium deficiency in Crohn's patient and can be managed with magnesium citrate replacement.

Conclusion

The duration of Crohn's disease is believed to be positively correlated with the rate of concurrent calculi especially in patients with a history of resection. Prevention of calculi should begin at the early stages of Crohn's disease and patients with an ileostomy or history of multiple bowel resections should be monitored for the development of calculi by means of regular urinalysis, ultrasonography, and KUB. Increasing patient awareness of urinary complications in Crohn's disease is extremely important in the prevention and early identification of kidney stones, and close collaboration between specialists in gastrointestinal medicine and urology is necessary. In particular, it is essential to maintain urine pH around 6.0, avoid dehydration, limit dietary protein, and get adequate dietary calcium and magnesium.

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