Practice Pointers

Kidney Stones: New and Not So New Issues

This month, Alex Constantinescu, MD, of the American Society of Nephrology Practicing Nephrologists Advisory Group speaks about the latest on kidney stones. Dr. Constantinescu is associated with the Joe DiMaggio Children's Hospital, pediatric nephrology, in Hollywood, FL.

KN: Are we facing a higher incidence of nephrolithiasis?

Recent evidence suggests that over the past 4 decades, the incidence of kidney stones has increased in adults from 3.8 percent to 8.8 percent (1). In children, over the past 25 years, it has increased at a rate of 6 percent to 10 percent annually, reaching 50 cases per 100,000 adolescents (2).

KN: What may be the reason(s) for this increase, and is it reflected in stone composition?

Over the past 50 years, a few notable changes have taken place: a rise in body mass index, a higher rate of obesity, and a higher purine intake. Several studies have found significant correlations between these factors and the higher incidence of kidney stones but could not conclude that they were the only responsible culprits. An analysis of 11,099 kidney and ureteral stones between 1990 and 2010 revealed gender differences in the biochemical composition of calculi (3). Although calcium-containing stones remained the most common, females had an increase in total kidney stones from ~30 percent to ~40 percent and a significant increase in the incidence of uric acid stones. By contrast, males had a stable rate of uric acid stones (~11 percent) and showed an increase in the incidence of cystine and struvite stones, along with a higher percentage of apatite per stone.

KN: Who is at high risk for the development of renal calculi (i.e., ethnicity, race, disease states, diet, medications)?

Although known genetic factors contribute to ~50 percent of all kidney stones (i.e., in hyperoxaluria, cystinuria, Dent's disease, medullary sponge kidney, polycystic kidney disease, in total, 30 known kidney stone genes), not all genes have been identified, which suggests that epigenetic factors play a significant role. Surprisingly, 14 monogenic genes account for only 15 percent of cases of nephrolithiasis and nephrocalcinosis (4).

In the United States, an analysis of data from the National Health and Nutrition Examination Survey from 1974 to 2010 found a correlation between stone prevalence and increased caloric intake, as well as with diets rich in dark green vegetables, flour or cereal products, fish or shellfish, corn products, and added sugars, and an inverse correlation with a high intake of citrus fruits, as expected (1).

In Europe, the Oxford cohort of the European Prospective Investigation into Cancer and Nutrition consisted of 51,336 participants and identified vegetarians as the subgroup with a lower risk for kidney stones, in particular those with high intakes of fresh fruits, wholegrain cereals, and magnesium-rich foods. The higher-risk group was characterized by a diet high in meat, meat products, and zinc-rich foods, such as seafood, dairy products, nuts, and beans, consistent with the role of zinc in mineralization and calcification processes (5).

A kidney stone risk of 5.5 percent was found after chemotherapy in patients with lymphoproliferative disorders, and the stone formers had higher serum uric acid, calcium, and potassium concentrations. Also, diabetes mellitus, hypertension, and hyperlipidemia were common in patients with de novo kidney stones (6). The known risk factors for urolithiasis also include medications such as topiramate (causing calcium phosphate stones), protease inhibitors (leading to various stone compositions, including drug-containing crystals), with excess calcium supplementation (some is good; too much is bad), loop diuretics, steroids, and ketogenic diet being among the most common causative agents (7).

KN: Are there new studies to identify the presence of, and complications from, kidney stones?

Most patients with renal colic undergo radiologic studies in the emergency department. Although a radiologic study of the kidneys, ureters, and bladder can identify calcium-containing radiopaque stones but not radiolucent ones, such as those composed of uric acid, ultrasonography and non–contrast medium computed tomography cannot differentiate between the various types of calculi, even though they can detect smaller stones. The Image Gently campaign was the origin of the quest for safer and more accurate imaging studies that can identify, and even attempt to differentiate, the composition of the stones. The use of a reduced dose of radiation appears not to diminish the ability to diagnose a ureteral stone larger than 5 mm (8). In addition, dual-energy computed tomography (9) appears to be able to differentiate between calcium oxalate and hydroxyapatite stones as well as the supersaturation values do. If the imaging study cannot only identify the stone but also give information about the stone composition with acceptable certainty, a specific therapy plan can be established much sooner, preventing complications from the long-standing calculus. In children, the stones are smaller, and such imaging studies may expose them to higher radiation doses. Therefore, the quest for the ideal diagnostic imaging test continues. In women, a history of urolithiasis has been associated with a higher risk of chronic kidney disease, even the need for dialysis (10).

KN: What are the benefits and limitations, if any, of minimally invasive techniques for the treatment of urolithiasis?

Some calculi smaller than 5 to 10 mm in both children and adults can pass spontaneously, or with help of hydration, diuretics, β-blockers, or a combination thereof. Unfortunately, some other calculi require surgical intervention. The discomfort caused by renal stones and their possible complications (e.g., infections, decrease in kidney function) have made early therapy a necessity. In addition, the need for faster recovery with the least tissue damage created an impetus for using endoscopic procedures, with less frequent extracorporeal shock wave lithotripsy and open surgical procedures for nephrolithiasis being very rarely needed. An analysis of this shift in surgical management confirmed this observation, with more than double the use of ureteroscopy and a decline in the use of extracorporeal shock wave lithotripsy over the past 20 years (11). Because this approach contributed to a decline in readmission rates, this trend may continue.

KN: What can be done to prevent the recurrence of renal calculi?

There is no doubt that patients who have experienced one kidney stone want to avoid a recurrence. This requires an accurate identification of the factors that led to the formation of the calculus and represent significant risk factors for its formation again. Stone composition is helpful, although it may not be available in all cases. Supersaturation values in 24-hour urine collection are helpful in adults, whereas in children, either ratios with urine creatinine as the common denominator, or values based on body weight and surface area are more frequently used. The American Urological Association published evidence-based guidelines for medical management of kidney stones in 2014. Increasing fluid intake, limiting sodium intake, and maintaining a normal calcium diet are recommended, independently of the stone composition. Specific dietary restrictions are based on stone composition or the biochemical abnormality noted. Lifestyle changes should be monitored closely, and drug therapy (i.e., thiazide diuretics, allopurinol, alkali) may be needed in carefully selected cases (12). Rule et al. (13) and colleagues identified younger white men with a family history of kidney stones, and uric acid composition of either symptomatic or asymptomatic calculi, to have the highest risk for recurrence, and they suggested a nomogram that can be the start of prevention trials.

References

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