Information for Parents About

Urolithiasis: Kidney Stones

Kidney stones are made of salts and minerals in the urine that join together to form small crystals that can then coalesce into larger stones. They can be as small as grains of sand or as large as golf balls. Spontaneous passage of a kidney stone into the ureter and out through the urethra can be associated with only mild symptoms of urinary urgency or frequency, but most often passage of a kidney stone causes intermittent flank pain, nausea and vomiting (ureteral colic) with hematuria (either microscopic or visible blood in the urine). Stones that stay in the kidney can cause progressive dilatation and deterioration of the kidney, and they can also promote or perpetuate urinary infection (bacteria sequestered with the kidney stone). Severe pain may develop when a stone has become lodged in the ureter and has caused obstruction of urine flow. Occasionally, pain from an obstructing ureteral stone can be localized to the abdomen or perineum.

Relative dehydration and excessive salt intake (sodium chloride) are the most common causes of kidney stone formation in children. Some families tend to excrete more calcium in the urine and therefore have a greater tendency to form calcium oxalate stones. Other less common types of urinary stones include calcium phosphate, calcium ammonium phosphate (struvite), and uric acid and cystine stones. The risk of recurrent stone formation is approximately 50%, but this risk can be significantly lowered with an increased oral fluid intake (keep urine a light color or clear) and with dietary salt restriction (avoid adding salt to foods, avoid heavily salted or processed foods, avoid excessive ingestion of Sport beverages high in sodium chloride). Other helpful measures include ingestion of lemonade (high in citrate, which keeps calcium and oxalate from joining in the urine) and control of constipation (to prevent excessive absorption of calcium in the colon).

Avoid using dietary calcium supplements and excess ingestion of chocolate, soy or nut products (high in oxalates). Cola and tea beverages are also high in oxalate and should be limited. Diet colas are especially hazardous because they contain caffeine (causes dehydration), oxalate and high levels of sodium.

TREATMENT

Passage of an obstructing ureteral stone usually occurs spontaneously (> 50%). Increased fluid intake and medication for pain and nausea are helpful to control symptoms while the stone passes. The last symptom noticed before spontaneous passage of a urinary stone is called stranguria (an urge to void frequently with only minimal urine output), and this suggests that the stone is making its way through the bladder wall into the bladder lumen.

Surgical intervention may be required if the stone remains lodged in the ureter for a prolonged interval (> 2 weeks), or if it causes severe pain and nausea that cannot be relieved adequately with medication. A high fever (> 101 F) and urinary infection associated with an obstructing stone is a medical emergency that must be treated promptly (percutaneous nephrostomy or ureteral stent) to relieve obstruction and to allow resolution of pyelonephritis (kidney infection).
EVALUATION

Retrieval of the stone itself (either after spontaneous passage or surgical treatment) is important in order to allow stone analysis (identification of stone type). Fasting blood tests (to monitor electrolytes, renal function, calcium, oxalate and uric acid levels) and a 24-hour urine collection for stone risk profile are important parts of a metabolic evaluation to determine the cause of stone formation.

Monitoring 24-hour urine production alone is often useful in identifying low urine production volumes (greatly promotes stone formation when < 500-1000 ml per day).

SURGICAL OPTIONS

**Extracorporeal shock-wave lithotripsy (ESWL):** Small shock waves are produced outside the body and are focused on the stone fluoroscopically in order to fully fragment the stone into small pieces that can then be passed spontaneously in the urine.

**Ureterorenoscopy:** The stone can be directly visualized within the ureter or kidney and then fragmented with a tiny laser fiber (passed through the ureteroscope) and then removed from the urinary tract.

**Open surgical removal:** The kidney or ureter is opened directly and the stone is removed intact (reserved for only extremely large stones).

**Endoscopic placement of a ureteral stent** may be necessary to relieve high-grade obstruction, to allow access to a small ureter prior to ureterorenoscopy, or to facilitate passage of stone fragments after other treatments.