

Management of kidney stones

Urolithiasis affects 5-15% of the population worldwide and it has a recurrence rate of approximately 50%. It has a high cost to the society and the individuals it affects. The most common presentation in the general practice is acute renal colic. (1)

Presentation

A complete medical history and physical examination is necessary in patients presenting with urolithiasis. Intermittent colicky flank pain which may radiate to the lower abdomen and groin is the most typical symptom of acute renal colic this may also be associated with nausea and vomiting. Dysuria, frequency, urgency and haematuria may also occur once the stone enters the ureters.(2)

Family history and a past medical history of kidney stones are of huge importance in addition to previous treatments, anatomical abnormalities or previous surgeries of the urinary tract. Systemic illnesses including Primary hyperparathyroidism, cystinuria, gout, Diabetes Mellitus as well as certain drug treatments play a role in stone formation. A thorough drug history will help identifying some of the patients who are in the high risk category of forming kidney stone who are taking these certain medications including Topiramate, Ephedrine, Guaifenesin and calcium with vitamin D.(2)

Assessment

Monitoring the vital signs is important in the initial assessment as fever could be an indication of acute intervention. Physical examination usually reveals costovertebral angle or lower abdominal tenderness. Microscopic haematuria and renal colic combined together is highly suggestive of urolithiasis justifying the need for performing a urinalysis in all patients suggestive of stones, but stones could also occur in the absence of haematuria. If the urinalysis is positive for nitrites, bacteria or leucocytes this may be indicative of urinary tract infection. Microscopic urinalysis could identify crystals which may be seen in cystinuria. In an acute situation complete blood count, serum electrolytes and measurement of renal function are necessary.(3)

Diagnosis

The former gold standard in diagnosing ureteral calculi was intravenous urography but recent studies have shown that the best radiographical test for diagnosing urolithiasis is computed tomography, it is also the investigation of choice for patients presenting with acute flank pain. Most kidney stones are identifiable on computed tomography except the ones induced by drugs including

indinavir. One of the important qualities of CT is identifying the real cause in cases where the symptoms experienced are not caused by urolithiasis.(4)

Classification of kidney stones

Calcium oxalate, phosphate, or both (70-80%)

Uric acid (5-10%)

Cystine (1%)

Struvite (magnesium ammonium phosphate) (5-15%)

Others (such as xanthine, guaifenesin) (1%)

A plain abdominal x-ray is used to determine whether the stone is radio-opaque and it is also used to monitor the disease activity. CT is preferred to x ray for follow up of kidney stones especially when the stones are radiolucent. Ultrasound is not routinely used as it has low sensitivity though it is used for pregnant patients with flank pain.(4)

Urgent intervention

An acute obstruction is a sign of urgent intervention and needs to be dealt with promptly, reduced glomerular filtration rate and reduce renal blood flow could result once the stone is passed down into the ureters. Recent studies have shown that ureteral catheters, ureteral stents and percutaneous nephrostomy tubes are all effective in decompressing the urinary tract.(5)

Antibiotic sensitivity testing should be performed on bladder and renal pelvic urine, the urine should also be sent for culture. Based on the result of the culture antimicrobial drugs are prescribed but initially a broad spectrum antibiotic should be commenced.

Narcotics were traditionally given to help with the pain in acute renal colic, non-steroidal anti-inflammatory drugs such as ketorolac and diclofenac are effective in helping the patients with pain and also decreasing ureteral contractility although these drugs are avoided in patients with reduced renal function.(6)

Treatment

Open surgery was the main treatment for urolithiasis, but it has now been replaced by less invasive treatments such as:

Shock wave lithotripsy

The treatment of nephrolithiasis was revolutionised with the introduction of shock wave lithotripsy. A shock wave is produced from an external source to the body; these shock waves are passed through the body and focused on the stone. These shock waves produce mechanical stresses and result in the breakdown of the stone inside the body.(7)

Shock wave lithotripsy is the most common treatment for urolithiasis but it comes with its own side effects such as acute renal injury. CT and MRI scans of the patients who have received shock wave lithotripsy have shown that 63-85% of these patients have demonstrated renal injury. A retrospective study with 19 year follow up has demonstrated an association between patients who have received shock wave lithotripsy and development of hypertension and diabetes mellitus. (8)

Ureteroscopy

Ureteroscopy is done by using a rigid, semi-rigid or flexible endoscope to visualise the collecting systems. Developments in the field of fibreoptics and reduction in the size of ureteroscopes have increased the use of ureteroscopy for visualising the stones in the upper urinary tract. The ureteroscopes benefit from a working channel which enables the surgeon to pass through a variety of instruments to remove or fragment the stones.

A retrospective study showed that ureteroscopy is the treatment of choice when lithotripsy has failed or in instances where factors such as pregnancy, coagulopathy or morbid obesity preclude lithotripsy. It is also a useful procedure when complex or lower pole renal calculi are present. The main disadvantage with this procedure is the need for a urethral stent which is often necessary to prevent obstruction from oedema or stone fragments, this also causes discomfort for some patients.(9)

Percutaneous nephrolithotomy

Percutaneous nephrolithotomy is a surgical procedure where a small incision is put through the skin to remove stones from the kidney. It is usually used for stones bigger than 2 cm and positioned near the renal pelvic. Through this incision access is gained to the renal collecting system using a nephroscope. The nephroscope has a working channel where other instruments such as laser, graspers and basket extraction could be put through to break down and remove the stone. A main advantage of this technique is that all the stone fragments could be extracted so that the patient does not have to pass any fragments and also the stones could be sent for analysis. A large meta-analysis has shown the safety and efficacy of this procedure despite its invasiveness compared to ureteroscopy and lithotripsy specially for large, complex and multiple stones.(10)

Guidelines for treatment selection

The guiding treatment selection is to maximise stone clearance and reduce patient morbidity as much as possible. The decision making process is simplified by categorising the stones based on location and complexity of the stones.(11)

What's new?

Medical expulsive therapy

This treatment focuses on spontaneous passing of the stones through the use of medications such as calcium channel blockers (nifedipine), steroids and alpha adrenergic blockers. These blockers work by reducing ureteral tone and peristaltic frequency, they also the intensity of the ureteral contractions.(11)

summary

The best technique for diagnosing urolithiasis is computed tomography.

Open surgery has been replaced with lithotripsy, ureteroscopy and percutaneous nephrolithotomy in recent years.

Most ureteral calculi of less than 5 mm in diameter pass spontaneously during the first 4 weeks after the onset of symptoms.

80-85% of simple renal calculi could be treated with lithotripsy while the treatment of choice for the complex renal calculi is percutaneous nephrolithotomy, and the best form of treatment for pregnant, morbidly obese and patients with coagulopathy is ureteroscopy.

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