

AN OVERVIEW ON DIAGNOSTIC & MANAGEMENT APPROACH OF KIDNEY STONES

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ABSTRACT

Renal colic is a severe pain that occurs in the flanks. The cause is often an obstructing renal or ureteric stone. This disease is commonly associated with chronic medical conditions such as hypertension, obesity, diabetes, and osteoporosis. While medical management is key to the treatment, often surgical intervention is needed. In this review, we discuss renal stones from pathophysiology, clinical features, medical and surgical management, and follow-up. PubMed database was used for articles selection, papers were obtained and reviewed. PubMed database was used for articles selection, and the following keys terms: renal stones, pathophysiology, clinical features, diagnosis, management. Renal stones are a clinical diagnosis, and certain clinical features should guide the surgeon to an accurate diagnosis. The mechanism of renal stone formation depends on the aetiological substances, which commonly is calcium, but could also contain oxalate, cystine, or uric acid. While medical therapy remains the standard for the management of renal stones, larger stones need surgical intervention and postoperative follow-up. During this remission period, the management should focus on preventing future stone formation.

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Introduction

Renal colic is one of the common surgical complaints, being one of the worst pains on the scale [1, 2]. The age demographic for affected people ranges anywhere from a young adult to early sixties of age. There is also a predisposition for stones to form in people living in hotter climates, probably due to dehydration [3]. Many other factors lead to renal stone formation, including environmental and medical conditions. Renal stones are a clinical diagnosis, and certain clinical features should guide the surgeon to an accurate diagnosis. In this review, we discuss renal stones from pathophysiology to surgical management and follow-up.

Materials and Methods

PubMed database was used for articles selection, papers were obtained and reviewed. PubMed database was used for articles selection, and the following keys terms: renal stones, pathophysiology, clinical features, diagnosis, management. Regarding

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the inclusion criteria, the articles were selected based on the inclusion of one of the following topics: renal stones, their diagnosis, medical and surgical management. Exclusion criteria were all other articles that did not have one of these topics as their primary endpoint.

Review

Pathophysiology

The mechanism of renal stone formation depends on the aetiological substances, which commonly is calcium, but could also contain oxalate, cystine, or uric acid. The most common types of renal stones are calcium oxalate or calcium phosphate. As urine becomes supersaturated, the likelihood of stone formation increases. However, the exact mechanism of nephrolithiasis formation is not well understood at the cellular level [4].

The risk factors are better studied, and the most common risk is that of dehydration and hot climate, as they lead to low urine flow rate and the chance for nidus formation. Genetic inheritance could play a role in renal stones, for example in patients with hypercalciuria, as they are predisposed to forming calcium oxalate stones [5]. Medical conditions could also be a risk for renal stone development, this could be primary hyperparathyroidism, enteric hyperoxaluria from short bowel syndrome, and primary hyperoxaluria [6].

Clinical Findings

The presence of renal stones would cause a great deal of agony to patients, in addition to associated micturition complaints. The mechanism of pain is that of stretching the urinary ducts known as ureters, this stretching and resistance to normal spasms are due to the obstructions caused by the stone. Many patients would describe the pain as one of the worst they have suffered. The pain is felt in the anterior abdomen and radiating downwards towards the genital area. Many patients report gastrointestinal symptoms due to this severe pain, mainly nausea and vomiting.

The follow-up of pain is important in cases of renal or ureteric stones as they help in estimating the location of the obstruction. For instance, stones leaving the kidney in the upper ureter may have radiating pain to the flanks or back. If the pain dissipates then the stone has probably passed through to the bladder. If the stone gets stuck on its way down at the ureteropelvic junction then the patient may complain of irritative urination and frequency of micturition. If the obstruction is not relieved urgently and correctly, the stagnant urine could cause backflow and injury to the renal parenchyma, or it could lead to a bacterial infection.

Diagnosis

Renal stone diagnosis is a clinical finding, and investigations are often done for confirmatory reasons. Checking the patient vitals could give an idea about the severity of pain as tachycardia and hypertension would be present. During the examination, the physician should aim to identify signs specific to nephrolithiasis. In many patients, an unremarkable examination could be the case, except for the presence of pain as described by the patient. In others, there could be tenderness under the costovertebral angle.

As aforementioned, tests are only supplementary to the clinically made diagnosis from the history and examination of the patient. Patients may or may not complain of a change in urine color, but any urinary complaint could warrant a simple urine dipstick test. Microscopic haematuria is often identified, and in infection cases, nitrites would be positive. Infectious cases could present with fever and a full blood count would be beneficial. As many patients present with nausea and vomiting, it would be best to check their electrolyte levels, it would also help in identifying the type of stone causing the problem.

Patients with chronic history or repeated infections may require a serum creatinine test to check on their kidney functionality. Females are especially at risk of having chronic kidney injury when they present with renal stones, and as mentioned later would need successive renal function monitoring [7]. In imaging of renal disease certain imaging modalities are used ranging from nuclear imaging tomography, ultrasonography, and pyelography. These imaging modalities are often more important in identifying complications of renal stones such as hydronephrosis, unrelenting obstruction, and recurrent stones.

Management

The management of renal stones is medical, with surgical intervention only used in unrelenting stones. The medical treatment focuses on reducing the severity of symptoms, prevention, and chemical degradation of stones. As many patients vomit due to the pain, it is vitally important that they are given necessary intravenous fluid replacement and appropriate analgesics, antiemetics would be useful in patients who continue to be nauseous. Medications can also facilitate stone relief and passage as alpha-blockers could be used. Patients with fever, or with irritative urinary symptoms, should be offered antibiotics.

As serum and urinary electrolytes help identify the stone type, passing of the stone and examining its structure could also help in future prevention. Options used in chemolysis of stones and prevention include uricosuric agents for gout patients, alkalizing agents for stones of uric acid or cysteine nature, and thiazides in high urinary calcium cases [8]. Recent evidence has shown favorable outcomes of extracorporeal lithotripsy when combined with supplements mainly containing hydroxy citric acid [9]. Of course, shock wave lithotripsy is the standard non-invasive procedure used for small stones, but new studies are investigating burst wave lithotripsy which shows promising results [10].

As mentioned previously, surgical options are reserved for certain cases where the stone does not pass naturally. In addition to unrelenting obstruction, cases requiring surgical intervention include increased stone diameter, complicated infection, or severe pain not relieved. The unretractable pain is an indication for hospital admission along with obstruction in post-renal transplant or solitary kidney, and superimposed infection on ureteral stone obstruction.

These stones are typically larger than the constrictions at ureter junctions and are larger than seven millimeters. The surgical options can be simple procedures such as stent placement, Procedures can also be done directly to the kidney by percutaneous nephrostomy or nephrostolithotomy. Complicated cases of staghorn stones require advanced procedures such as atrophic nephrolithotomy. Nephrolithotomy is the gold standard for the management of renal stones that are large or of the staghorn type. While the surgical positional approaches may differ, there is no evidence one positional method is better than the other in regards to postoperative outcomes [11].

In staghorn stones, a ureteroscopy-assisted puncture for percutaneous access for ultrasonographic guided endoscopic surgery has shown favorable outcomes concerning a lower need for further surgical intervention, lower infection rate, and procedure time. This ureteroscopy-assisted puncture is ideal in females with staghorn calculi with no hydronephrosis [12]. Upon successful treatment, necessary tests must be conducted depending on if the patient is having a recurrent ureterolithiasis or first occurrence.

Follow-up

In patients who underwent surgical treatment, the surgeon should be alert to infection, haemorrhage, and obstruction. Hence, the post-operative patient should be well educated before discharge. The safety net should include the return to the hospital if there is a recurrence of fever, pain, or vomiting preventing fluid intake. The patient should be advised on increasing fluid intake and performing specific dietary and lifestyle changes, while also adhering to medications [13]. In patients with the first-time occurrence of renal stones, they should preferably return for assessment of their parathyroid function, renal function tests, and urine culture in certain cases. In patients with recurrent stones, a metabolic evaluation should be conducted as they may require treatment to prevent future occurrences of renal stones. The preferred test is often a 24-hour urine metabolic and electrolyte investigation.

Every 6-12 months from the surgical intervention, the patient should return for further imaging and investigations. The important investigations at this stage include metabolic investigations and chemolytic agents as prevention if required. There are a few patients that require imaging, and these include unusual symptoms and undiagnosed stones, as well as patients who suffered complications of surgery. Furthermore, patients who underwent retrograde intraparenchymal surgery should be reassessed for residual fragments [14].

Conclusion

The presentation of renal colic helps the surgeon in diagnosing renal stones clinically. The investigations and imaging done thereafter are important for identifying complications and residual stones. While most renal stones remain with an unknown cause, it is always in the patient's best interest to avoid the common risk factors for the disease. While medical therapy remains the standard for the management of renal stones, larger stones need surgical intervention and postoperative follow-up. During this remission period, the management should focus on preventing future stone formation.

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