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Review Article

Evaluation And Management Of Urolithiasis

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ABSTRACT

Urolithiasis is a condition that occurs when these stones exit the renal pelvis and move into the urinary collecting system, which includes the urethra, bladder, and urethra. It accounts for a large number of hospital visits and is frequently preventable by modification of risk factors and has a numerous treatment options. Many patients with urolithiasis can be managed with expectant management, analgesic, and anti-emetic medications; however, stones that are associated with obstruction, renal failure, and infection require further increasingly critical interventions. This review mainly focused on activity outlines the etiology, diagnosis, management, and treatment of urolithiasis and highlights the role of the interprofessional team in evaluating and treating patients with this condition.

INTRODUCTION

The formation of stony concentration in the bladder is defined as the urolithiasis. Stones which are originating anywhere in the bladder and also include the kidney. Urolithiasis's overall probability of forming stones varied from places around the world. In the year 2010, the European association has stated that the calcium that contains calculi is higher in males compared with females. The incidence of childhood urolithiasis is almost 10% of that in adults[1]. The risk of forming stones for an individual depends on their lifestyle[2].

The individual who is basically overweight or obese was reported to be more affected or have a higher risk of developing idiopathic calcium oxalate resides in the kidney which generally results in the formation of kidney stones this was reported by the study by seine et al in 2004.

Also, the individual who has poor dietary habits such as high salts diet, high protein diet, or extreme fasting (staying without eating the food) may increase the formation of kidney stones. It is said that it has occurred in inherited metabolic changes like hyperoxaluria and hypercalciuria. It may also

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occur due to the functional or the anatomical obstruction of the urinary system[3]. The long-term dates of nephron calcinosis in pre tern neonates have not been clear. The terms urolithiasis and nephron calcinosis are in 2 types of calcification in the urinary collecting system is urolithiasis. The stones are composed of lithogenic crystal agglomeration they are formed in the renal papillae to damage the renal epithelium. The microscopic calcification in the tubules or the interstitial tissue of the kidney is nephrocalcinosis [4,5]. Both nephrocalcinosis and urolithiasis can either occur separately or together. These were defined theoretically that the type and composition are very effective blood tests by pathologists.

EPIDEMIOLOGY

Approximately 50% of patients with previous urinary calculi have a recurrence within 10 years. It is more 2-3 times common in then more in adults than in the elderly pause than in children [6]. Occur more in whites than compared with that of Asians. The formation of stones is due to many factors, which causes an increase in an element in urine leads to the formation of stones in patients. The etiology of the disorder (disease) is due to many factors related to nephrolithiasis, which also leads to the formation of stones in the kidney, which leads to crystallization, nucleation, stone growth, and aggregation. 25% (or) about 25% of patients due to polygenic defect result in urolithiasis. Disorders related to renal stones are hereditary such as tubular renal acidosis, cystinuria, xanthinuria, and dihydroxy Deninuria which is of rare hereditary disease (or) disorder [7,8].

A higher rate of renal stone formation is in males than the females. Men are affected 4 times more than females and it is mostly diagnosed in the 5th decade. Increased water intake and urinary (urine) output and the presence or absence of certain elements (or) substances in water have been implicated in the urinary /renal calculi formation. Example of inhibitors of calcium crystallization in zinc [9]. Dietary intake, lifestyles, habits, and fluids intake may decrease the incidence of renal/urinary calculi. Excess amounts of purines, calcium, phosphate, oxalates, etc ingestion of these substances cause in excretion of excess of these compounds/components in urine. The risk of the formation of the urinary calculi/renal calculi was more in certain regions, societies, and in individuals, more disposable income to spend on the animals' proteins by inhabitants causes high concentrations in urinary related substances such as calcium, uric acid, oxalate, etc. It is said that urolithiasis occurs in a high-temperature condition in a high-temperature condition such as in hot conditions, acid areas [10,11].

Decreased fluid intake in the daily died is specified as the most influencing factor of stone formation. A proper dietary and good intake of fluids, a good exercise to the body might help an individual suffering from urolithiasis also medications such as triamterene, indinavir (Crixivan), and acetazolamide (Diamox) are also associated with urolithiasis[12].

Nephrolithiasis is a highly prevalent disease worldwide with rates ranging from 7%–13% in North America, 5%–9% in Europe, and 1%–5% in Asia. In the United States, there has been a linear increase in stone prevalence over the last 4 decades, with the prevalence in women rising disproportionately compared with men[13]. While traditionally men have demonstrated a higher prevalence of stone disease than women, the gender gap is narrowing. However, the difference in prevalence between men and women is not consistent worldwide, with male to female ratios varying from 2.7 to 4 among populations in Germany, Saudi Arabia, and China (Taiwan)[14].

The most common stone composition is calcium-based (70%–85%), followed by uric acid (5%–10%), struvite (1% –5%), and cysteine (1%), although one community found calcium stones present in 93.5% of kidney stone formers. In a

retrospective review of 1516 patients at a single institution from 1980 to 2015, the proportion of uric acid stones increased from 7% to 14%, with uric acid stone formers consistently older and with a higher body mass index (BMI) than calcium stone formers [15,16]. While calcium stones remain common, analyzing stone composition remains beneficial to identify non-calcium stone formers, who tend to have higher rates of recurrence and require specific preventive strategies accordance with recent guidelines[17].

Kidney stones that occur during pregnancy required special diagnostic and management algorithms upon presentation. The diagnostic imaging for kidney stones during pregnancy is ultrasonography (ultrasonography is the only gold standard line). By first line management of kidney stones during pregnancy is conservative. But clinically offers the ureterscopy when spontaneous passage fails to occur.

Features	Urolithiasis	Nephro calciosics
Aspect	Macroscopic calcification	Microscopic calcification
Position	Urinary collecting system	Tabules or tubular epithelium
Etiology	Stone formation inhibitor factor	Low glomerular filteration, kidney immature.
Identification	>2 mm on a low a enhanced CT	<2 mm on a low enhanced CT

Table: 1 Features of Urolithiasis

Types of Kidney stones

The size, shape, and chemical composition of stones are varied. Kidney stones are typically classified into the following five types according to differences in mineral composition and pathogenesis:

CaOx

Calcium stones, which account for roughly 80% of all urinary stones, consist of pure CaOx (50%), calcium phosphate (5%), or a combination of these (45%). The chief component of calcium stones is calcium hydrogen phosphate or hydroxyapatite. Found in the majority of kidney stones, CaOx occurs as CaOx monohydrate (COM), CaOx dihydrate (COD), or a mixture of both (the mixed form accounts for more than 60% of occurrences). COM is found more often than COD in clinical stones, and it is the most thermodynamically stable type of stone. CaOx stone formation involves many elements, such as hyperuricosuria, hyperoxaluria, and hypercalciuria. CaOx stone formation is promoted by a urinary pH between 5.0 and 6.5, and calcium phosphate stones develop when the pH exceeds 7.5. Calcium stones have a higher recurrence rate than other kinds of kidney stones.

Phosphate

These stones, accounting for 10% to 15% of all urinary stones, develop in patients with chronic, urease-producing urinary tract infections. Urease is required to split urea into ammonia and carbon dioxide; this renders urine more alkaline, which elevates the pH. Phosphate is less soluble with alkaline pH than with acidic pH; therefore, phosphate precipitates onto insoluble ammonium products, leading to a large stone formation. Women are more likely than men to develop this kind of stone.

Uric acid

Uric acid stones, which occur more often in men, represent approximately 3% to 10% of all stones. A diet high in purines, particularly a diet high in meat and fish, can lead to hyperuricosuria, low urine volume, and low urinary pH (< 5.05) and these conditions may result in the formation of uric acid stones. These stones may form in the kidneys of persons with gouty arthritis. Usually, the cause of uric acid nephrolithiasis is idiopathic.

Cystine

Constituting less than 2% of all stones, this type of calculus is caused by cystinuria, a genetic disorder in which the amino acid cystine builds up in the urine, resulting in stone formation. Each day, persons who are homozygous for cystinuria excrete more than 600 mmol of insoluble cystine. The presence of urinary cystine is the only clinical manifestation of cystine stones.

Drug-Induced

Approximately 1% of all stones are induced by medications such as triamterene, guaifenesin, atazanavir, and sulfa drugs. These agents may induce the formation of calculi through their metabolic actions of interfering with the metabolism of CaOx or purine [18].

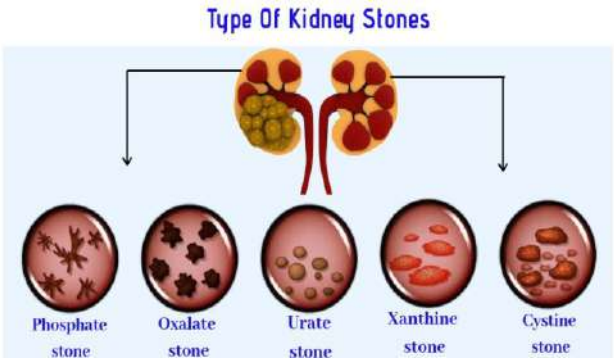

Fig: 1 Types of Kidney stones

Risk factors

The risk of urolithiasis increases as a result of any factor that leads to urinary stasis due to a reduction or obstruction of urinary flow. Certain risk factors contribute to a higher incidence of stone formation. For example, men excrete less citrate and more calcium than women, which is thought to be linked to the higher incidence of urolithiasis in men. In addition to sex, an individual's ethnic background can be considered a risk factor, as individuals with a Native American, African, or Israeli background are more likely to be affected by the condition [19].

A family history of the condition may also promote stone formation in offspring, as some families appear to have a tendency to produce excess mucoprotein in the urinary system. Additional aspects of the patient's medical history, such as the presence of certain intestinal diseases, recurrent urinary tract infections, and cystinuria, can all increase an individual's risk of stone formation[20].

Dehydration or reduced fluid intake may increase the risk of stone formation, in addition to a diet that is high in sodium, oxalate, fat, protein, sugar, unrefined carbohydrates, and vitamin C. In addition to diet, certain regions of the world are associated with an increased risk of urolithiasis, such as tropical climates, mountainous or desert terrain. Certain medications like ephedrine, guaifenesin, thiazide, indinavir, and allopurinol may lead to the development of stones.

SYMPTOMS

The exact symptoms of urolithiasis depend on the location and size of the calculi in the urinary system. General signs and symptoms mainly include:

- ✓ Abdominal pain
- ✓ Blood in the urine (hematuria)
- ✓ Renal or ureteral colic
- ✓ Urinary tract infection

Stones in the kidneys can obstruct the urinary flow in the kidneys or the ureters, which can lead to severe flank pain and possibly blood in the urine. Stones in the bladder can lead to symptoms such as pain, as well as an increased urge and frequency of urination [21].

DIAGNOSIS

The diagnosis of urolithiasis involves a medical history and a physical examination, in addition to appropriate testing methods to identify the calculi and make the appropriate treatment decisions [22].

Additional diagnostic tests may include:

- ✓ Urine culture and urinalysis to reveal signs of hematuria, pyuria, infection and acidity.
- ✓ Complete blood count tests to detect elevated white blood cells indicative of infection.

- ✓ Intravenous pyelography (IVP) to identify the size and location of the stone and its effect on the urinary flow.
- ✓ Computed tomography (CT) scan to visualize urinary tract and any obstructions such as in acute renal colic.
- ✓ X-ray imaging to identify the size and location of the stone.
- ✓ Renal ultrasound to screen for stones and detect obstruction in the urinary system.

PATHOGENSIS

The stone forming crystalloids which are present in urine are the requirements for renal stone formation. All the renal stones in kidney about 75% are based upon the calcium oxalate, calcium phosphate and mixture of both oxalate and phosphate. More than one component such as uric acid, aggregation with calcium is known as mixed stones. And remaining 10% and 1% of renal stones are based upon uric acid and cysteine. The renal stone formation in susceptible patients are formed, when urine is supersaturated with the cysteine, oxalate, struvite, uric acid .The renal stones such as calcium stone formation involves different stages which causes accumulation of the calcium oxalate and phosphate. This will notes formation of renal stones in kidney [23].

TREATMENT

Depending on the type of stone formed in the kidney, the treatment varies such as-

Large Stones

Large stones require invasive action to be taken, these cause many symptoms externally such as bleeding, pain, kidney damage this sometimes if not treated soon may lead to extensive treatment [24]. The extensive treatment include the following –

Surgery

Surgery is mainly done on patients whose kidney stones grow very large.Using small telescopes and instruments through the incision, kidneys stones are removed surgically. This procedure is called percutaneous nephrolithotomy. During this surgery anesthesia is been received for the patient and stays for 2 days in the hospital. This is only recommended when ESWL (extracorporeal shock wave lithotripsy) is unsuccessful.

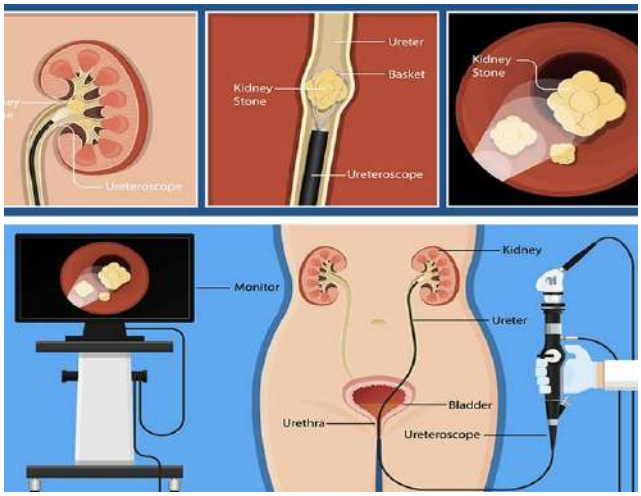

Fig: 2 ESWL (extracorporeal shock wave lithotripsy)

Sound waves

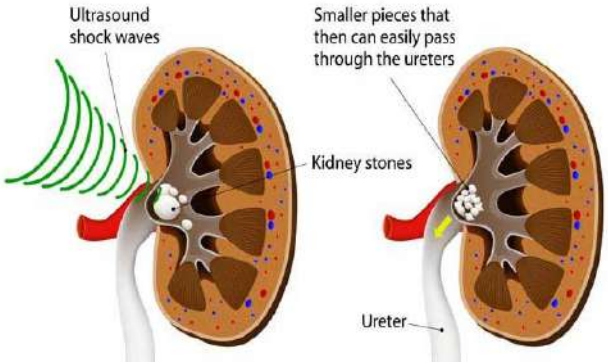

Fig: 3 Treatment using Sound waves

Sound waves are been used to generally break up the stones. This is recommended based upon the size and location of the kidney stone. This procedure is called extracorporeal shock wave lithotripsy (ESWL). Patients are kept under sedation or light anesthesia conditions. In this, sound wave procedure the strong vibrations (shock waves) are given which makes the stones break into small pieces. These small pieces of stones are passed out through urine. This is a process of 45 to 60 minutes and may cause moderate pain.

Using scope

To remove the stones which are present in the ureter of the kidney, the doctor inserts a light thin

tube ureteroscope with a camera through the urethra and bladder to the ureter, Once the stone is located then using the special tool it can snare the stones and the doctor gives a stent in the ureter to relieve swelling, healing. Anesthesia is given to the patient while this process.

SMALL STONES

Small stones don't require medical or surgical treatment. Few stones which are generally small in size can be able to pass by –

Medical therapy

Medications such as alpha-blockers are given by the doctors which help in the relaxation of muscles in the ureter to make the stone pass from the kidney more quickly with less pain. Examples can be drugs such as alpha-blockers which include tamsulosin and dutasteride and tamsulosin is the combination drug.

Pain relievers

Pain relievers help in not causing discomfort while passing. Doctors prescribe various types of relievers such as cystone Forte, Motrin IB and Advil.

Drinking water

Drinking water is considered the most useful method, drinking water about 1.8 to 3.6 liters a day may be helpful to prevent forming stones and diluting easily. Intake of fluids such as juices or soda but water is been considered as the best. This helps in the production of nearly clear or clear urine.

PREVENTION[25]

- ✓ Prevention of kidney stone include medication and lifestyle –
- ✓ Drinking a good amount of water every day may reduce the risk of kidney stones even for people who have a history of kidney stones
- ✓ If lived in hot or dry climatic areas more amount of water consumption is important as clear urine should be produced
- ✓ Eating less oxalate-rich food may reduce risk.
- ✓ These food include soy products, sweets, nuts, and chocolates.
- ✓ Physical exercise is also important [25, 26].

MEDICATION

- ✓ To prevent calcium stones from forming thiazide diuretic or a phosphate-containing preparation is prescribed.
- ✓ To prevent struvite stones, strategies to keep urine-free bacteria.
- ✓ To prevent cystine stones, suggest a diet lower in salt and protein [27].

CONCLUSION

Urolithiasis is a common conditiion that has been recognized and documented in medical literature since the Greek and Roman physicians. Urolithiasis encompasses both renal and ureteric stones. The stone varies with age, gender, ethnicity, and season. 50% of patients will have recurrent stone disease. The medical management of urolithiasis is a rational approach based on the abnormal parameters detected on a full investigation. However, in clinical practice, it is urinary parameters or multiple deranged parameters. In patients with all normal urinary parameters (idiopathic) the patient is advised dietary restriction and kept on periodic surveillance. In patients with multiple deranged parameters the drug the approach in a permutation combination the rationale is applied with periodic surveillance of the parameters at repeated intervals for dose modification or temporary discontinuation of the drug therapy. Both surgical and medical treatment is necessary for the complete management of patients of urolithiasis.

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