

Kidney Stone: A Review

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ABSTRACT

Kidney stones are a significant issue in both India and emerging nations. In the average, 10-12% of people in industrialised countries suffered from kidney stones. Kidney stones usually appear in humans later in life. Males and females alike most frequently have kidney stones. One of the main risk factors for the development of stones is obesity. Kidney stones are frequently caused by calcium oxalate crystals, excessive uric acid levels, and low citrate levels in the body. Oxalate-rich foods like cucumber, green peppers, beets, spinach, soy beans, chocolate, rhubarb, popcorn, and sweet potatoes are advised to avoid because a slight decrease in urinary oxalate has been proven to be associated with a large reduction in the production of calcium oxalate stones. In the blood may have the tendency to develop kidneys stones as compared to normal. The combination of herbal medicines with allopathic treatment have a great idea to get rid all the complications related to kidney stones.

INTRODUCTION

The two main kidneys, which are bean-shaped, the ureters, bladder, and urethra make up the urinary system. These kidneys, which resemble beans, are situated directly below the ribcage in the centre of the back. In order to create urine, the kidneys convert the body wastes and water present in the blood as it circulates. [1] These are helpful for maintaining the blood's equilibrium between salts and other ions. The kidneys' composition of urine is transported to the bladder, a triangle-shaped chamber, through the urethras, which are little tubes. Urine is simultaneously stored in the bladder, an elastic balloon-like structure that flattens when urine is expelled from the body through the urethra. [2]. "Urolithiasis" is a worldwide issue.

Urolithiasis is a condition in which the crystals of uroliths/stones present in the urinary tract.[3]

Composition of kidney stone:

A cluster of crystals that coalesced to form a hard lump in one or both kidneys is called a kidney stone. From a few millimetres to many centimetres, they can range in size. The majority of stones will naturally exit the body through the urine, but some will need to be removed surgically. Crystals of phosphate, uric acid, magnesium ammonium phosphate, apatite, and struvite have been used to generate urinary stones. [5] Any of the following properties have a higher risk of producing a stone, according to the 24-hour urine collection of urine:

[1] Hypercalciuria, or high calcium levels, is one example.

[2] High oxalate levels, or hyperoxaluria

[3] Hyperuricaemia, or high uric acid levels

4) Hypocitraturia, low citrate levels [6].

Normal components of blood include calcium, oxalate, uric acid, and citrate. Less than 7 is considered acidic, whereas more than 7 is considered alkaline. Any pH of urine can contain calcium oxalate stones. While calcium phosphate stones form in more alkaline urine, uric acid stones are more likely to form in acidic urine.[7].

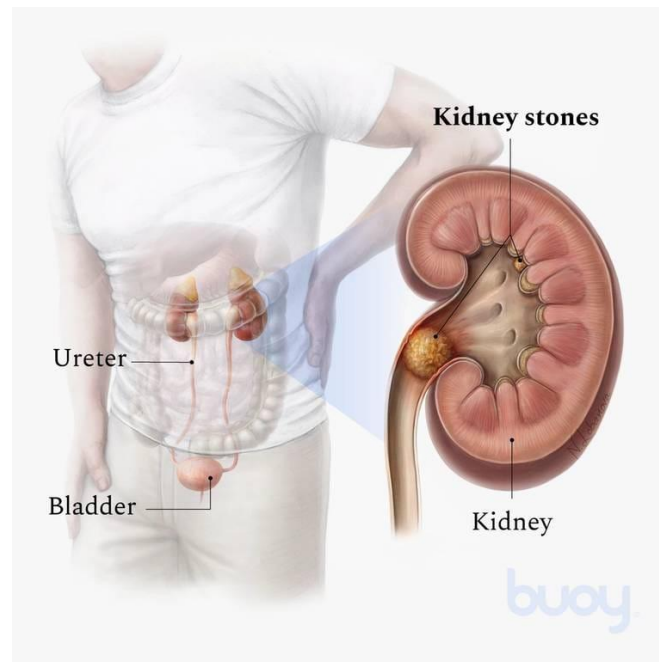


Fig.1: Location of Kidney Stone

TYPES OF KIDNEY STONES

There are four main forms of kidney stone deposits: calcium (75–85%), struvite (2–15%), uric acid (6–10%), and cystine stones (1–2%). The geographic location of the population being researched and the distribution and frequency of these stones vary. About 1% of the time, long-term drug use results in kidney stones.[8]

Calcium stones: Hypercalciuria, which is brought on by hyperparathyroidism, is linked to the development of calcium oxalate, calcium urate, and calcium phosphate stones. Increased calcium absorption from the intestine in patients with illness leads to renal calcium orphosphate leak, the development of hyperuricosuria, hyperoxaluria, hypocitraturia, and hypomagnesuria.[9].

Struvite stones: Stones made of magnesium ammonium phosphate, or struvite, grow to fill the collecting system (partial or complete staghorn calculi). This stage is brought on by recurrent UTIs brought on by *Proteus*, *Pseudomonas*, and *Klebsiella* species, which are Gram-negative urea-splitting rods. [10].

Uric acid stones: Patients with gout are more likely to develop uric acid stones due to high purine intake medicines or high cell turnover (such as malignancy). Most cases of uric acid stones occur in urine that is somewhat acidic (pH 5.5). In nature, they are visible, and on X-ray film, they are typically radiolucent.[11].

Cystine stones: Cystine stones are caused by cystinuria, an inherited metabolic disease that affects how well cystine is reabsorbed in the renal tubule. Given their high sulphur content, these stones might be challenging to detect on X-rays. There are a number of medicines that can contribute to the development of renal stones in drug-induced stones. [12].

Drug-induced stones: Some drugs that are used to treat other diseases are also contributing to the creation of renal stones. They are silicate (antacids), sulfa medicines, guaifenesin, triamterene, indinavir, atazanavir, and silicate. Rare and frequently visible on X-rays are these stones (radiolucent). [13]

Sign & Symptoms

The common signs of kidney stones are confirmed by.

- 1] A sudden urge to urinate. [15]
- 2] Burning when urinating.
- 3] Feeling of nausea and vomiting.
- 4] Colour of the urine will be dark or red due to blood particles of RBCs.
- 5] Male patients feel pain at the tip of their penis.
- 6] Sudden and acute pain in the back or lower abdomen.[16]

PATHOPHYSIOLOGY OF URINARY STONE

The pathogenesis of urolithiasis is difficult to understand since it involves a number of physicochemical processes that might happen one after another or simultaneously. The methods by which calcium oxalate crystals are stored in the kidney and develop renal stones are still not fully understood, despite increased research over the past ten years. [17]. Supersaturated, ionic urine was necessary for stone formation. The pH of the urine, the ionic strength of the urine, the quantity of solutes in the urine, and complications all affect the level of super-saturation. Struvite calculi can only occur under certain circumstances

- 1] Alkaline PH of urine,
 - 2] Urine's capacity to contain urea or ammonia
 - 3] Urine contains a lot of minerals.[18].
- Treatment of kidney/urinary stones

Small stones: By drinking a specific amount of water, small stones can be removed from the body with little therapy. Approximately 4-5 lit/day of daily water consumption helps the body eliminate stones through the urine. Stone movement causes discomfort, which can be alleviated by using certain analgesics. [19].

Medical kidney stone treatment:

Alpha blockers are typically prescribed by doctors; they aid to clear kidney stones more quickly by relaxing the muscles in the ureters. Diuretics can also help remove stones by increasing urine flow. [20]

Large stones: Despite drinking plenty of water, large stones are difficult to eliminate because they become caught in the renal tube and cannot leave the body. These stones may be detrimental to the body because they can injure the kidneys and result in internal bleeding, nephron loss, or make it simple to contract some uti infections. Because of their size and potential for breakdown, bigger stones cannot pass entirely from the kidneys. Additionally, they harm the kidneys and cause bleeding, UTIs, and other complications. [21]

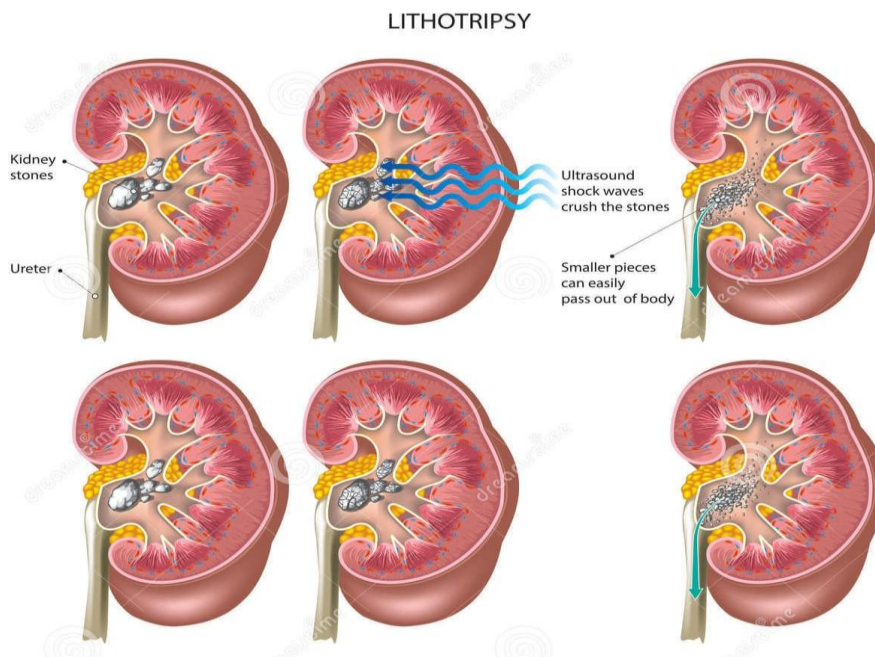


Fig 2: Using shock wave lithotripsy

During this procedure, intense vibrations caused by sound waves or shock waves break big kidney stones into smaller fragments. Urine can help drive the microscopic fragments of fractured stones out of the body. [22]

Ureteroscopy

The process used to remove stones that become lodged in the ureters or bladder is known as ureteroscopy. Upper urinary tract stones can be checked with ureteroscopy. This uncomfortable technique includes a short wire that links to a camera at the end. To remove stones, a cage is connected to a wire that is introduced into the urethra and then passed into the bladder.[23]

See fig.3

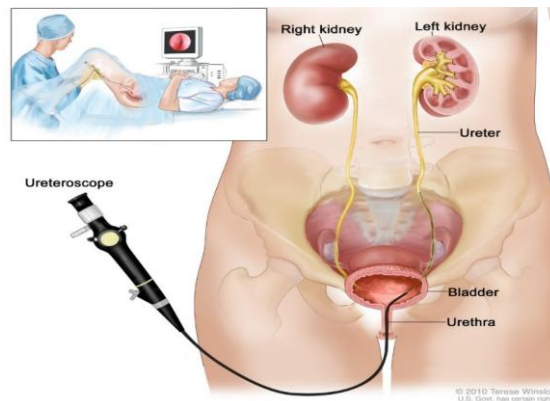


Fig.3: Ureteroscopy

Treatment through allopathic medicines:

It is not enough to change one's diet and drink more water to stop kidney stones from forming. To remove built-up stones from the body, doctors should recommend the medication. The most appropriate drug can be chosen based on the kind, size, and abnormalities of the urine. The following list of drugs includes those that are used to treat stones.

Thiazide diuretics:

Thiazide diuretics are helpful for people with excessive calcium urine levels as well as kidney stones caused by calcium. [25].

Potassium citrate:

Calcium, cystine, and uric acid patients who have low urinary citrate levels can benefit from potassium citrate, which is used to make urine less acidic. Urinary acidity is increased by potassium citrate. Stones made of cystine and uric acid are less likely to form as a result of this characteristic.

Acetohydroxamic acid:

Acetohydroxamic acid, also known as AHA, is used to treat struvite stone production in patients as well as infections in urinary tract infections. Repeated urinary tract infections might lead to the formation of these stones. The urine may become less favourable for the development of struvite stones if AHA is added, diluting it.

Herbal treatment of kidney stone:The treatment of kidney stones can benefit from using herbs and herbal medications. Due to their clinically validated effects, such as immunomodulation, adaptogenicity, and antimutagenicity, these medications have sparked interest among the public. Additionally, the overuse of synthetic medications, which increases the likelihood of bad drug reactions, has encouraged people to revert back to using natural therapies.[27]

Celosia argental (Viratarvadigana): The Indian medical system is thought to be particularly effective at treating kidney stones. For the dissolving and elimination of stones, its aqueous decoction is employed. *Didymocarpus pedicellata*, sometimes called *Shila pushp* or *Patharphodi*, is beneficial for kidney and bladder stones. [28]

Fenugreek seed (Trigonella foenum-graecum): In northern Africa, kidney stones are frequently prevented and treated using the seeds of this herb. Fenugreek seed greatly decreased kidney calcification and helped prevent kidney stones, according to an animal study. [29]

Shatavari root (also known as asparagus racehorses): This is a significant Ayurvedic *Ramayana* (rejuvenative cure) that has been shown to prevent calcium oxalate stone formation in test animals. [30]

The Chanca stonebreaker: Also known as *Chanca piedra* (*Phyllanthus niruri*), has a long history of use in the tropics for aiding in the prevention and passage of kidney stones. The daily consumption of this herb has been shown in numerous in vitro and animal experiments to help reduce kidney stone formation.[31]

Gokshura fruit/root (Tribulus terrestris): This herb is an Ayurvedic *rasayana* and nephroprotective agent that is frequently used to treat urinary tract disorders in China and India. In experiments on animals, it stopped kidney

stones from forming and may even have helped to reverse early stage urolithiasis. Animal studies are supported by in vitro study, which further hints that Tibullus also guards against calcium oxalate-induced kidney injury. [32]

Origanum vulgare: This herb's medicinal properties include lithotripter, diuretic, and antispasmodic effects. It is a commonly used spice. The in vitro inhibitory activity of the crude aqueous metabolic extract of the aerial component of *O. vulgare* was seen in the nucleation and aggregation of calcium oxalate crystals, as well as in the reduction of crystal production in calcium oxalate unpalatable solutions. [33]

Barberry root bark [*Berberis vulgaris*]:

The root bark of the barberry plant, *Berberis vulgaris*, has been shown to reduce the crystallisation of calcium oxalate and shield the kidneys from oxidative stress. The preparation that worked best was water extract. [34]

Chanca Piedra/Stonebreaker (*Phyllanthus niruri*): a tropical native plant with a long history of usage in kidney stone prevention and passage. The daily consumption of this herb has been shown in numerous in vitro and animal experiments to help reduce kidney stone formation. [35]

Black cumin seed (*Nigella sativa*): In experiments on animals, this plant greatly prevented test animals from developing calcium oxalate stones that were artificially generated.

Punarnava herb [*Boerhaavia diffusa*]: This common Indian plant, is used as a kidney tonic and to aid in the elimination of kidney stones as the punarnava herb (*Boerhaavia diffusa*). It was able to prevent the development of struvite stones in a research conducted in vitro, but it is unknown if it would have the same effect in humans. [37]

Varuna bark [*Crataeva nurvala*]: Consuming this Ayurvedic herb on a daily basis decreased kidney stone development and urine calcium excretion (*Crataeva nurvala*). This herbal remedy from Ayurveda is used to cure kidney stones and to help avoid kidney stones. It is also used in combination with banana stem. [38]

Evening primrose seed oil (EPO; *Oenothera biennis*): In a human study, daily consumption of EPO (1000 mg per day) markedly increased citraturia (urinary citrate levels) while lowering urinary oxalate, calcium, and the Tiselius risk index, which is a gauge of the likelihood of developing kidney stones. [39]

Risk of factors [40]

The following of the factors which can increase the risk of promoting kidney stones. [41]

- 1] Body dehydration
- 2] Genetic factors may contribute to kidney stones. A hereditary condition called cystinuria makes cystine stones more likely to form.
- 3] Increasing your intake of proteins, lipids, sodium, and sugar may make you more likely to develop kidney stones.
- 4] Compared to other disorders, people with kidney infections (particularly women) and urinary tract infections (UTIs) are more likely to develop struvite stones.
- 5] Kidney stones caused by metabolic syndrome occurred. [42]

CONCLUSION

One of the most frequent issues that affects the urinary system in developing nations and the rest of the world is kidney stones. Some medical conditions, such as a high-fat diet, poor nutrition, the addition of oxalate crystal-containing foods, a high-protein diet, and post-operative abnormalities, raise the likelihood of kidney stone difficulties. Common physiological processes, such as aberrant growth of the parathyroid glands, which regulate calcium metabolism, might lead to the development of the stones. Kidney stones are caused by this condition's excessive levels of calcium in the blood and urine. The prevalence of kidney stone illness is still on the rise. The development of kidney stones is influenced by a number of variables, including dietary, environmental, and metabolic factors. increased diagnostic accuracy. Some technique for the treatment of kidney stone such as allopathic and herbal medication or removal of stones through surgery is now in trends.

MYTHS VS FACTS

Myth 1: The risk of kidney stones increases with extended inactivity.

Fact: In part, yes; the likelihood of stone formation is higher if a person is bedridden and immobile. However, patients who engage in excessive physical activity and get dehydrated run a higher risk of developing stones. Therefore, exercising in moderation while keeping hydrated will have the lowest risk.

Myth 2: Kidney stones always manifest suddenly, causing colic, urinating blood, and fever.

Fact: Some kidney stones, whether small and not creating any obstruction or large and like stag horns, may not cause any symptoms. When there is an obstruction to the urinary tract, kidney stones typically cause pain. [43]

Myth 3: The third myth is that paediatric renal lithiasis is uncommon.

Fact: Kidney stones are diagnosed in children less frequently than in adults, although it is not impossible.

Myth 4: You must consume two litres of water each day to avoid Renal Lithiasis.

Although there is no one-size-fits-all method to avoid stone development, staying adequately hydrated greatly reduces the likelihood of a recurrence.

Myth 5: Diuretic herbs should not be used if you have renal lithiasis.

Fact: If the body is properly hydrated, several plant-based products or herbs that act as diuretics can help with the passing of small stones by increasing urine production.

Myth 6: Patients with only one kidney are more likely to develop kidney stones.

The incidence of stones is not higher, but treatment must be prioritised. Furthermore, removal may be necessary if a little stone is obstructing the kidney.

Myth 7: If you have kidney stones, you should stop drinking milk or other dairy products entirely.

Fact: If dietary calcium is totally halted or reduced, some types of stones, such as those with oxalates as their major component, can form more. Therefore, milk or a milk product should be consumed in moderation to balance out dietary oxalates.

Myth 8: Patients with kidney stones cannot eat tomatoes.[44]

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