Borneo Journal of Pharmacy
Vol 3 Issue 3 August 2020
Page 179 – 189

http://journal.umpalangkaraya.ac.id/index.php/bjop/article/view/1415
DOI: https://doi.org/10.33084/bjop.v3i3.1415
e-ISSN: 2621-4814

Mini Review

Advantages of Herbal Over Allopathic Medicine in the Management of Kidney and Urinary Stones Disease

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Keywords:
Allopurinol
Ayurveda
Hyperoxaluria
Uric acid
Xanthium strumarium

Abstract

Kidney and urinary stone disease (Nephrolithiasis and urolithiasis) are the condition where urinary stones or calculi are formed in the urinary tract. The problem of urinary stones is very ancient; these stones are found in all parts of the urinary tract, kidney, ureters, and the urinary bladder and may vary considerably in size. It is a common disease estimated to occur in approximately 12% of the population, with a recurrence rate of 70-81% in males and 47-60% in females. The treatment of kidney and urinary stone diseases such as a western (allopathy) medicine and surgery is now in trends. However, most people preferred plant-based (herbal) therapy because of the overuse of allopathic drugs, which results in a higher incidence rate of adverse or severe side effects. Therefore, people every year turn to herbal therapy because they believe plant-based medicine is free from undesirable side effects, although herbal medicines are generally considered to be safe and effective. In the present article, an attempt has been made to emphasize an herbal therapy is better than allopathic therapy for the management of the kidney and urinary stone disease.

Received: May 27th, 2020
Accepted: July 26th, 2020
Published: August 31st, 2020

INTRODUCTION

The urinary framework is comprised of two significant bean-molded kidneys, ureters, bladder, and urethra. These bean-formed kidneys are found only at the center of the back and beneath the sets of ribs. The kidney transports water and squanders from the flowing blood and converts it to form urine (Aune *et al*., 2018). These are likewise helpful for making an equilibrium balance of salts and different ions in the blood. The tubes of the urethras, which are restricted in size, convey urine creation from the kidneys, which transport it to a triangle-shaped chamber called the bladder (Fisang *et al*., 2015). Simultaneously, urine is put away in a versatile inflatable sort chamber called bladder, which gets straightened when urine is expelled through the urethra out the body. The term 'Urolithiasis' is a worldwide issue influencing human beings, called 'Nephrolithiasis' or kidney stones. Urolithiasis is a condition in which the crystals of uroliths/stones present in the urinary tract are summarized in **Figure 1** (Abdel-Daim *et al*., 2017). In the Conventional world, the yearly frequency of urolithiasis has been about 0.5% with a lifetime risk of creating is about 10-15%, yet its increment with 20-25% in the

Middle East. Urolithiasis is the arrangement of uneven calculi or the condition which has a place with urinary calculi (Ahmed *et al*., 2015). The condition of calculi is synonymous with the term uroliths, stones, or crystals. These calculi are made of polycrystalline totals made out of the crystalloid and organic matrix (Han *et al*., 2015). These calculi can fit as a fiddle and find any place in the urinary tract from the kidney to the bladder (Arya *et al*., 2017).

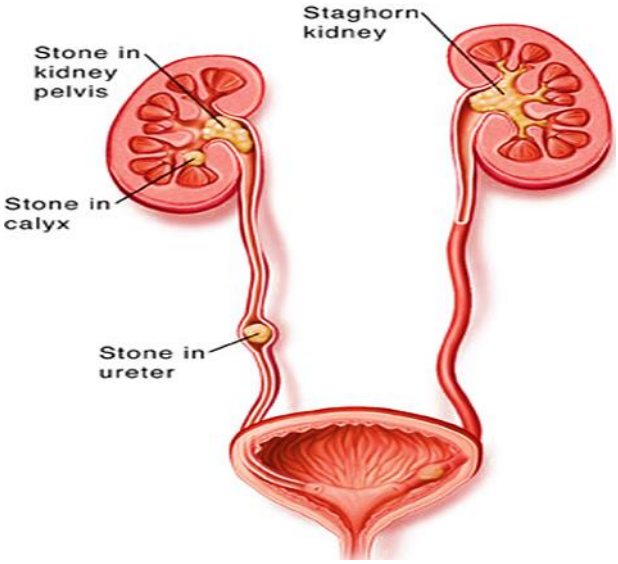

Figure 1. Locations of kidney and urinary stones in the urinary tract (Rodgers *et al*., 2016).

A kidney stone is a group of crystals formed together to make a hard lump in both kidneys. They can shift in size from a few millimeters to several centimeters. Most of the stones will drop off the urine body, with no assistance, yet some will require intervention to expel them (Jung & Osther, 2015). The urinary stones have been created with the crystals of phosphate, uric acid, magnesium ammonium phosphate with apatite, and struvite. Among the urinary stones, calcium-containing stones have been found about 75% of every single urinary calculi, which might be available as crystals of unadulterated Calcium oxalate (CaC_2O_4) 50%, calcium phosphate 5%, and a mixture of both compounds 45% (Ferraro *et al*., 2017). The diet can influence the concentration of specific substances in the urine and influence urine acidity. The 24 hours assortment of urine may find any given properties have expanded the risk of forming stones enlisted in **Table I** (Aziz & Hassan, 2020). Calcium oxalate, uric acid, and citrate are typical substances found in the blood (Khan, 2016). The acidity of any liquid is expressed as pH. The pH of < 7 is acidic, while pH > 7 is alkaline (Coe *et al*., 2016). The normal urine pH will change during the day, rely upon diet, and usually range between 5 and 8. Calcium oxalate stones can be found in any pH of urine. The development of uric acid stones is more in acidic urine, while calcium phosphate forms in more alkaline urine (Cakıroğlu *et al*., 2016).

Table I. Salt composition of the kidney (Chen *et al*., 2018)

Term	Descriptions
Hypocitraturia	Low levels of citrate
Hypercalciuria	High levels of calcium
Hyperuricemia	High levels of uric acid
Hyperoxaluria	High levels of oxalate

The chemical composition of kidney stones depends on the abnormalities in the urine composition of various chemicals. Human kidney stones are commonly classified into five types, as follows in **Table II** (Albert *et al*., 2017).

Table II. Five types of kidney and urinary stones and their descriptions (Kummer *et al*., 2015)

Stones	Descriptions
Urate or uric acid stone	Uric acid stones are formed due to low urine output, excessive intake of proteins, especially red meat. These form in acidic urine and are not visible in a plain X-Ray (Giardina *et al*., 2014).
Calcium stone	These are composed of calcium compounds, mostly CaC_2O_4. Sometimes other minerals such as calcium phosphate may also form stones. Calcium stones may be caused by Hypercalciuria, such as in Hyperparathyroidism (Holmes *et al*., 2016).
Struvite or Magnesium ammonium phosphate stone	These types of stones are usually associated with urinary infection. They can grow very rapidly forming cast in the urinary tract (Staghorn calculus). Left untreated, these may cause chronic infection and permanent kidney damage (Kanlaya *et al*., 2016).

Cystine stone	These occur due to an inherited defect in amino acid transport, manifests as recurrent stones in young patients
Drug-Induced stone	This accounts for about 1% of all stone types. Drugs such as guaifenesin, triamterene, atazanavir, and sulphas drugs induce these stones (Bultitude *et al.*, 2016).

In this mini-review, we will discuss the various advantages of herbal medicines, especially those used in ayurvedic therapy, compared to the use of various allopathic drugs to manage kidney and urinary stones disease. The advantages discussed are mainly from the side effects that occur from the use of these drugs. In addition, several things related to kidney and urinary stones disease will also be discussed, including epidemiology, pathophysiology, symptoms, diagnosis, and prevention.

EPIDEMIOLOGY

Globally, kidney and urinary stones disease pervasiveness and repeat rates are expanding, with limited choices of effective drugs (Evan *et al.*, 2015). Urolithiasis influences about 12% of the total population at some phase in their lifetime. It influences all ages, genders, and races. However, it happens more now and again than in women aged 20-49 years (Chauveau *et al.*, 2018). If patients do not make a difference metaphylaxis, the backsliding pace of secondary stone developments is assessed to be 10-23% every year, 50% in 5-10 years, and 75% in 20 years (Green & Ratan, 2013). In any case, the lifetime repeat rate is higher in males, even though nephrolithiasis is developing among females. Subsequently, prophylactic management is of great importance to manage kidney stones (Daudon *et al.*, 2018). Ongoing investigations have revealed that urolithiasis' predominance has been expanding in the previous decades in both developed and developing countries (Duan *et al.*, 2020). This development pattern is accepted to be related to changes in the way of lifestyle modifications, for example, the absence of physical action and dietary propensities and global warming. In the United States, kidney stones influence 1 of every 11 individuals, and it is assessed that 600,000 Americans experience the ill effects of urinary stones each year. In the Indian population, about 12% of them are relied upon to have urinary stones, and out of which, 50% may end up with the loss of kidney capacities (Cloutier *et al.*, 2015).

PATHOPHYSIOLOGY

The pathophysiology of kidney stones is not yet fully understood. Despite increasing study in the last decade, the mechanisms whereby CaC_2O_4 crystals are retained in the kidney and form renal stones remain (Gambaro *et al.*, 2017). The formation of stone required supersaturated ionic urine, summarized in **Figure 2**. The level of supersaturation is also dependent on urinary pH, ionic strength, solute concentration in the urine, and complications (Gambaro *et al.*, 2016). Three conditions must coexist for the formation of struvite calculi:

1. An alkaline pH of urine
2. The presence of urea or ammonia in the urine
3. A high amount of minerals in the urine.

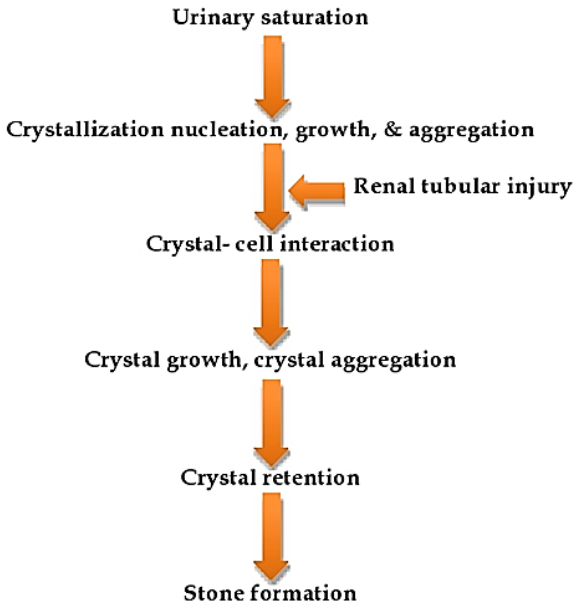

Figure 2. The formation process of stones in kidney and urinary tract (Ferraro *et al.*, 2019).

SYMPTOMS

Stones in the kidney frequently do not cause any signs and symptoms and can go undiagnosed. At the point when a stone leaves the kidney, it goes to the bladder through the ureter. Regularly the stone can become stopped in the ureter (Khan *et al*., 2016). When the stone obstructs urine progression out of the kidney, it can make the kidney swell (hydronephrosis), regularly causing much pain. Common symptoms of kidney stones are:

1. Sharp, squeezing torment in the back and side, regularly moving to the lower abdomen or groin (Smith-Bindman *et al*., 2014). Some female says the pain is worse than childbirth labor pains. The pain frequently begins all of a sudden and comes in waves. It can come and go as the body tries to get rid of the stone (Afsar *et al*., 2016)
2. A feeling of intense need to urinate
3. Urinating more often or a burning feeling during urination
4. Urine is dark or red due to blood. Sometimes urine has only small amounts of red blood cells that cannot be seen with the naked eye (Hollingsworth *et al*., 2016)
5. Men may feel pain at the tip of their penis (Das & Malipeddi, 2016).

DIAGNOSIS

Diagnosis of kidney and urinary stones requires a complete health history assessment, laboratory or imaging tests, and a physical exam. Other tests include in **Table III** (Courbebaisse *et al*., 2017).

Table III. Nephrologist uses diagnostic tests of kidney and urinary stones and their descriptions

Tests	Descriptions
Blood testing	Blood tests measure too much calcium or uric acid in the blood. Blood test results help monitor the kidney's health and may lead the nephrologist to check for other medical conditions (Zhu *et al*., 2014).
Urine testing	The 24-hours urine collection test may show that the kidney is excreting too many stones-forming minerals or too few stones preventing substances. For this test, the nephrologist may request to perform two urine collections over two consecutive days (Ragettli *et al*., 2017).
Imaging test	Imaging tests may show the availability of kidney stones in the urinary tract. Options range from simple abdominal X-rays, which can miss small kidney stones, to high-speed or dual energy computerized tomography (CT) that capture even tiny stones (Kapoor *et al*., 2017).
Other imaging options	An ultrasound, a non-invasive test, and intravenous urography, which involves injecting dye into an arm vein and taking X-rays (intravenous pyelogram) or obtaining CT images (CT urogram) as the dye travels through the kidneys and the bladder (Nirumand *et al*., 2018).

TREATMENT

Herbal medicine

According to the World health organization estimate, 80% population living in developing countries almost exclusively uses herbal medicines. This means that 3,330 million people use herbal medicines regularly (Sharifiyan *et al*., 2016). Ayurveda, an indigenous system of Indian medicine, offers immense extensions of the successful treatment of kidney stones disease described in **Table IV** (Tavasoli *et al*., 2020).

Table IV. List of herbal drugs used in the treatment of kidney and urinary stones

Scientific name (Family)	Common name	Mode of intake and use
Zea mays (Poaceae)	Corn, Makka	The decoction of the female inflorescence or immature cobs are orally administered to expel the kidney stones; Dose: two times a day for seven days (Pathan *et al*., 2018).
Aegle marmelose (Rutaceae)	Bael, Bilwa	Dried fruit pulp powder is given orally with coconut milk to dissolve kidney stones; Dose: a teaspoon powder with 100 ml of coconut milk taken two times a day for 14 days (Unno *et al*., 2020).
Cynodon dactylon (Poaceae)	Garika gaddi	The whole plant extract was given orally to dissolve kidney stones; Dose: 10-20 ml extract taken two times a day for ten days.
Strychnos potatorum (Loganiaceae)	Chilla ginjalu	The decoction of roots taken orally to dissolve and expel kidney stones; Dose: a teacup decoction taken two times a day for 20 days (Yiu *et al*., 2015).
Tribulus terrestis (Zygophyllaceae)	Gokharu, Devil's-thorn	Fruits and root decoction are given orally to be used to treat kidney stones; Dose: three

		times a day is taken regularly for 14 days.
Tinospora cordifolia (Menispermaceae)	Guduchi, Giloy	Crushed stem powder is given orally to expel the kidney stones; Dose: 5 g taken daily for 14 days (Spatola *et al*., 2018).
Celosia argentea (Amaranthaceae)	Gunugu	Dried seeds powder is orally administered to dissolve kidney stones; Dose: 1 g powder taken one time a day for five days.
Phyllanthus fraternus (Euphorbiaceae)	Gulf leaf-flower, Bhoi amli	Fresh plant extract pounded with pepper and turmeric extract is administered orally to dissolve the stones; Dose: 2 g taken daily for five days (Wang *et al*., 2016).
Bryophyllum pinnatum Oken. (Crassulaceae)	Patharchata, Ajjuba, Ghavpatta	Fresh leaf juice and kalimirch powder are given orally to dissolve and expel kidney stones; Dose: Taken two times a day for 15 days.
Boerhaavia diffusa (Nyctaginaceae)	Bishkapra, Punarnava	The root decoction is orally administered to expel kidney stones; Dose: Taken daily for a month (Türk *et al*., 2016).

Allopathic medicine

Patients with kidney and urinary stones, a nephrologist may also prescribe allopathic medicines to prevent future kidney stones (Wijarnpreecha *et al*., 2018). Depending on the 24-hour urine collection result, there are different treatment options for different kidney stones types (Vicedo-Cabrera *et al*., 2020). Now there is convincing evidence that by treating specific biochemical abnormalities, the recurrence rate can be reduced. Commonly three classes of allopathic medications used for kidney and urinary stones management are enlisted in **Table V** (Ross *et al*., 2018).

Table V. Treatment of kidney and urinary stones with conventional (allopathic) medicines

Classes	Drugs	Uses	Side effects
Sulphonamide derivatives	Zonisamide	Ailments of kidney and urinary stone	Lightheaded-ness, shortness of breath, rapid heart rate, trouble concentrating and fever (Pozdzik *et al*., 2019).
Bisphosphonate	Etidronate disodium	Kidney stones	Stomach upset or diarrhea, muscle pain, mood changes, and allergic reactions (rash, itching).
Cardiac glycoside	Digoxin	Ailments of kidney and urinary stones	Skin rash, itching, blurred vision, anxiety, depression, and severe stomach pain (Prabhu *et al*., 2016).
Bile acid sequestrates	Cholestyramine	Kidney diseases	Unusual bleeding/ bruising, rapid breathing, confusion, vomiting, and loss of appetite (Skolarikos *et al*., 2015).
Analogue of hypoxanthine	Allopurinol	Treatment of urinary infections and calculi	Persistent nausea/ vomiting, dark urine, unusual weight loss, vision changes, and severe dizziness (Prezioso *et al*., 2016).
Diuretics	Amiloride	Treatment of kidney-related problems	Abdominal pain, shortness of breath, weakness/ heaviness of the legs, vomiting, and wheezing (McTavish *et al*., 2018).
Nonsteroidal anti-inflammatory drug (NSAIDs)	Ibuprofen, acetaminophen, and naproxen	Acute renal colic and inhibit pain and inflammatory reactions	Peptic ulcers, renal failure, stroke and heart disease, allergic reactions (itching, rash, swelling), sensitivity to light (Ticinesi *et al*., 2018).
Opioid drugs	Morphine and meperidine	Management of renal colic pain and perioperative pain	Sedation, dizziness, nausea and vomiting, constipation, physical dependence, tolerance, and respiratory depression (Primarizky *et al*., 2016).

PREVENTION

Kidney stones disease is a silent killer. Patients at high risk of stone recurrence should receive preventive measures tailored to the metabolic assessment (Shang *et al.*, 2017). Generally, a simple and most important lifestyle change to prevent stones disease is to drink 4-6 L water/liquids/fluids per day, proper management of diet, and the use of medications is required (Ticinesi *et al.*, 2019). Enough liquid intake reduces urinary saturation and dilutes promoters of CaC_2O_4 crystallization. Thus, nutritional management is the best preventive strategy against Urolithiasis (Streeper, 2018). The five practical steps to prevent kidney stones disease described in **Table VI**.

Table VI. The five ways adopt in daily routine described may help to keep the kidney stones disease (Rodger *et al.*, 2018)

Steps	Descriptions
Healthy and balanced diet	Eat healthy food, plenty of fresh fruits and vegetables. Decrease intake of refined foods, sugars, fats, and red meats in the meals. For those above 40 years of age, consuming less salt in the diet may help prevent kidney stones (Shavit *et al.*, 2015).
Physical exercise/ activity	At least 30 minutes of regular aerobic exercise (swimming, running, cycling, or fast walking) maintains normal blood pressure, helps control blood sugar, and reduces the risk of developing kidney stones (Pickard *et al.*, 2015).
Maintain a bodyweight	Maintain a healthy or balanced body weight with a proper diet, burn calories, and regular physical activity plans to achieve and stay at a healthy weight (Roudakova & Monga, 2014).
Stop smoking or use tobacco products and manage alcohol intake	Smoking or use other tobacco products and excessive intake amounts of alcohol increase the risk of cardiovascular diseases (increase blood pressure, cholesterol levels, and heart attacks or strokes), which is associated with a reduction of higher risk of these severe conditions (Pearle *et al.*, 2014).
Stop the overuse of NSAIDs	Do not overuse NSAIDs (Ibuprofen, Aspirin, Naproxen, etc.) regularly. NSAIDs are known to cause kidney damage and subsequent failure, particularly if taken regularly. Consult a nephrologist to find the best way to control the pain without damaging the kidneys (Scales *et al.*, 2016).

CONCLUSION

Nephrolithiasis and Urolithiasis are among the most widely recognized problems which influence the urinary system in developing countries like the United States, India, Italy, Germany, Scotland, Spain, Sweden, Japan, and the remainder of the world. Herbal drugs are used for centuries due to its safety, efficacy, cultural acceptability, and lesser adverse or side effects as compared to Allopathic drugs. The present review article deals with measures to be adopted for the potential of plants in the management (stone dissolving and expel activity) of kidney and urinary stones disease.

ACKNOWLEDGMENT

The authors are thankful for our deepest core of heart to Dr. Md. Iftekhar Ahmad for his valuable guidance.

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