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Review Paper

POTENTIAL OF MEDICINAL PLANTS IN KIDNEY, GALL AND URINARY STONES

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Abstract: *Medicinal plants have been known for millennia and are highly esteemed all over the world as a rich source of therapeutic agents for the prevention of various ailments. Today large number of population suffers from kidney stone, gall stone and urinary calculi. Stone disease has gained increasing significance due to changes in living conditions i.e. industrialization and malnutrition. Changes in prevalence and incidence, the occurrence of stone types and stone location, and the manner of stone removal are explained. Medicinal plants are used from centuries due to its safety, efficacy, cultural acceptability and lesser side effects as compared to synthetic drugs. The present article deals with measures to be adopted for the potential of medicinal plants in stone dissolving activity.*

Keywords: *Medicinal plants, Kidney stone, Gall stone, Urinary calculi*

Introduction

Nature bestowed our country with an enormous wealth of medicinal plants. Plants have been used as traditional healthcare system from the centuries. The World Health Organization (WHO) has listed 20,000 medicinal plants in globally in which contribution of India is 15-20 %.[1] The WHO reported that 80 % of global countries depends on the medicinal plants.[2] A large body of evidence has collected to show potential of medicinal plants used in various traditional systems. In the last few years more than 13,000 plants have been studied for the various diseases and ailments in all over the world. [3]

Kidney stones are also major disorders prevailing all over the world. About 75% of kidney stones are composed of calcium oxalate crystals.[4] Gall stone problem is mainly affected in global countries. More than half a million people are affected annually in United States and more than 50,000 people in Canada. Canada endures surgical treatment to remove their gall bladder because of gall stone. About 80 % of the all gall stones be evidence for no symptoms and may continue for years. [5]

The report rate of stone disease in children is predictable to be 0.13 to 0.94 cases per 1000 hospital admissions in the western world [6], occurring twice as commonly in boys than girls [7]. Pediatrics nephrolithiasis can be generally seen. Practically 3.6-40% cases are reported to have a congenital abnormality, primarily ureteropelvic junction obstruction [8]. Other diseases include

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meningomyelocoele and Neutrogena bladder, especially after bladder augmentation with bowel. In such cases, a high rate of recurrence of urinary tract infection (75%) is noted. Infected urolithiasis also occurs more frequently in children younger than 4 years. [9]

Urinary calculi have been found in the tombs of Egyptian mummies dating back to 4000 BC and in the graves of North American Indians from 1500- 1000 BC. Reference to stone formation is made in the early Sanskrit documents in India between 3000 and 2000 BC The first documented urinary tract stones were found among the 7000-year-old remains of the pelvic bones of a teenage boy in El-Amara. [10-11]

A large number of people are suffering from urinary stone problem all over the globe. Not only the humans but animals and birds also suffer from the urinary stone problem. The occurrence in some areas is so alarming that they are known as 'Stone Belts' .Urinary stone disease is a common disorder estimated to occur in approximately 12% of the population, with a recurrence rate of 70–81% in males, and 47–60% in females Approximately 50% of patients with previous urinary calculi have a recurrence within 10 years. Stone disease is 2-3 times more common in males than in females. Most urinary calculi occur in patients aged 20–49 years. [12-13]

In India, 12% of the population is expected to have urinary stones, out of which 50% may end up with loss of kidneys or renal damage. Also, nearly 15% of the population of northern India suffers from kidney stones. Fewer occurrences of urinary calculi are found in southern India, which may be due to regular dietary intake of tamarind. [14]

From the above facts it is clear that there is a need to study medicinal plants for the treatment of stones. They can act as a potential source of curing the above disease. Moreover, it is also beneficial for mankind for its efficacy, safety and quality. With these objects we reviewed here the potential of herbal plants in ailments of kidney, gallbladder urinary stones.

Pathophysiology

Kidney stone

Kidney stone are called as renal calculi. They are crystal aggregations formed in the kidneys. Kidney stones normally leave the body by the route of urine stream, and many stones are produced and conceded without causing symptoms. If stones grow to plenty size before passage, on the order of at least 2-3 millimeters, they can cause barrier of the ureter. [15]

Etiology

Kidney stones caused due to basic metabolic conditions like renal tubular acidosis, medullary sponge kidney, Dent's disease and hyperparathyroidism. [16]

Types

- Calcium oxalate crystals- The most common type of kidney stone is composed of calcium oxalate crystals, occurring in about 80% of cases.
- Urate (uric acid) crystals - About 5–10% of all stones are formed from uric acid.
- Struvite crystals – It is composed of magnesium, ammonium and phosphate crystals.
- Calcium phosphate and cystine crystals.

Symptoms [17-19]

Colicky pain: "loin to groin". Often described as "the worst pain ever experienced". This can also occur in the lower back.

Hematuria: blood in the urine, due to minor damage to inside wall of kidney, ureter and/or urethra.

Pyuria: pus in the urine.

Dysuria: burning on urination when passing stones (rare). More typical of infection.

Oliguria: reduced urinary volume caused by obstruction of the bladder or urethra by stone or extremely rarely, simultaneous obstruction of both ureters by a stone.

Nausea/vomiting: embryological link with intestine–stimulates the vomiting center.

Hydronephrosis.

Post renal azotemia: when kidney stone blocks ureter.

Prevention [20-27]

Various strategies include dietary modifications and taking drugs with the goal of prevention of stone in kidney.

Drinking sufficient amount of water to make 2 to 2.5 liters of urine per day.

A diet low in protein, nitrogen and sodium intake.

control of oxalate-rich foods, such as chocolate, nuts, soybeans, rhubarb and spinach, plus preservation of an adequate intake of dietary calcium. There is equivocal evidence that calcium supplements increase the risk of stone formation, though calcium citrate appears to carry the lowest, if any, risk.

Taking drugs such as thiazides, potassium citrate, magnesium citrate and allopurinol, depending on the cause of stone formation.

Sometimes natural products such as, fruit juices which categorize into as orange, blackcurrant, and cranberry, may be useful for lowering the risk factors for specific types of stones. Orange juice may help to prevent formation of calcium oxalate stone, black currant may help prevent uric acid stones, and cranberry may help with UTI-caused stones.

Evasion of cola beverages.

Avoiding large doses of vitamin C.

Synthetic drug used in treatment of kidney stone

Diuretics

Mainly it is the alcohol drinker's associated behavior that sets it up. A class of drugs thiazides which is one of the recognized medical therapies for prevention of stones. [28]

Allopurinol

Allopurinol (Zyloprim) is another drug which proves many benefits in some calcium kidney stone formers. Allopurinol interferes with the liver's production of uric acid. Allopurinol reduces formation of calcium stone in such patients. The drug is also used in patients with gout or hyperuricemia. citrate in the form of Shohl's solution (sodium citrate), sodium bicarbonate, potassium citrate, potassium bicarbonate or acetazolamide, a carbonic anhydrase inhibitor) also prevent the formation of uric acid stones which relies relies on alkalinization of the urine . [29]

Tamsulosin (Flomax)

It is the category of Alpha adrenergic blockers which increase the spontaneous passage of the stone by 30%. [30]

NSAIDS

It is the category of Analgesia which used in an emergency room setting. Orally-administered medications such as opioids are often effective for less severe discomfort .Intravenous acetaminophen also appears to be effective. [31]

Gall stone

Gallstones are collections of cholesterol, bile pigment, which can form in the gallbladder or surrounded by the

bile ducts of the liver. In the United States, the most universal category of gallstones is made of cholesterol. Cholesterol stones are mainly causes due to difference in the production of cholesterol or the secretion of bile. Pigmented stones are mainly composed of bilirubin, which is a element formed due to the normal breakdown of red blood cells. Bilirubin gallstones are more common in Asia and Africa but they are seen in diseases that break red blood cells such a sickle cell anemia. [32]

Etiology

Gallstones may be caused by a combination of factors, including inherited body chemistry, body weight, gallbladder motility (movement), and perhaps diet. [33]

Symptoms

- Biliary Colic: In this condition a person will experience intense pain in the upper abdominal region that gradually increases for approximately thirty minutes to several hours. Patient may also feel pain in the back, ordinarily between the shoulder blades, or pain under the right shoulder.
- Murphy's sign: In this condition gallbladder is inflamed, the patient will hastily stop inhaling due to the pain.
- Low grade Fever: yellowing of the skin or eyes.
- Other symptoms include intolerance of fatty foods, belching, gas, abdominal bloating and indigestion. [34-37]

Treatment: Gall stone mainly treated by medical and surgical options

Medical options

Cholesterol gallstones can sometimes be dissolved by Oral Ursodeoxycholic acid, but it may be required that the patient should takes this medication for to two years. Gallstones may persist again however, once the drug is stopped. Gallstones can sometimes be relieved by endoscopic retrograde sphincterotomy (ERS) following endoscopic retrograde cholangiopancreatography (ERCP). [38]

Surgical options

The recurrence of cholelithiasis can be eliminated by Cholecystectomy (gallbladder removal). Only symptomatic patients must be indicated to surgery. The lack of a gall bladder does not seem to have any negative consequences in many people. However, there is a significant portion of the population between 5 and 40% who develop a condition called postcholecystectomy syndrome [39] which may cause gastrointestinal distress and persistent pain in the upper right abdomen. In addition, as many as 20% of patients develop chronic diarrhea. [40-42]

Urinary stone

Urinary calculi is composed of hard mineral masses lodged anywhere in the urinary tract. The urinary tract consists of organs which filter blood to eradicate liquid waste (urine) that is excreted from the body i.e. kidneys, ureter, bladder and urethra. The stones firstly form in the kidney and then it travel to other parts of the urinary tract where they may become trapped in smaller tubes e.g. bladder stones, ureteric stones and kidney stones. The condition may be extremely painful. [43]

Classification [44-45]

Based on the chemical composition of the stone and the severity of the disease different categories of stone formers can be identified.

1. **Calcium stones:** Calcium is the most common constituent of urinary tract calculi. Such stones are radio-opaque

    1. Calcium oxalate
    2. Calcium phosphate
    3. Calcium oxalate and phosphate

2. Non-calcium stones

    1. Magnesium ammonium phosphate (Struvite)
    2. Uric acid
    3. Cystine

- **Calcium oxalate**: Also called whewellite or 'mulberry' stones, these stones are characteristically dark brown/black in colour, with a dense, smooth appearance shows the crystals under electron microscopy. Calcium oxalate monohydrate crystals are dumbbell-shaped when viewed under light microscopy

- **Calcium phosphate:** Calcium hydroxyphosphate stones commonly comprise a significant proportion of carbonate to form apatite stones. These apatite stones are normally white in colour and are relatively poorly crystallized compared to hydrated acid calcium phosphate stones.

- **Magnesium ammonium phosphate (Struvite):** These are also called triple phosphate or struvite stones, named after Heinrich von Struve who first described them. They are usually formed in the presence of chronic urinary infection. Urea-splitting organisms within the urine (e.g. *Proteus* species) cause the urine to become more alkaline with its pH rising above 7.0, which causes precipitation and stone formation.

- **Uric acid:** Uric acid is the end product of purine metabolism. It is very insoluble in water and thus, as urine becomes more acidic, more uric acid becomes insoluble and this leads to stone formation.

- **Cystine:** Cystinuria occurs due to an inherited defect in the transport of amino acids cystine, lysine, arginine and ornithine. Cystine is insoluble, and hence excessive concentrations within urine lead to cystine stone formation.

General measures to prevent recurrent stone formation

- Increase fluid intake to maintain urine output of 2-3 l/day: Higher fluid intake is modestly effective in practice, and this effect is often offset by an increase in urine sodium as a result of increased sodium intake.
- Decrease intake of animal protein (≦ 52 g/day): Reduces production of metabolic acids, resulting in a lower level of acid induced calcium excretion; increases excretion of citrate that forms a soluble complex with calcium; and reduces supersaturation with

respect to calcium oxalate and limits the excretion of uric acid.

- Restrict salt intake (≤ 50 mmol/day of sodium chloride): Dietary and urinary sodium is directly correlated with urinary calcium excretion, and lower urinary excretion of sodium reduces urinary calcium excretion.
- Normal calcium intake (≥ 30 mmol/day): Low calcium diets increase urinary oxalate excretion, which may result in more stone formation and possibly a negative calcium balance.
- Decrease dietary oxalate: Reduce the intake of foods rich in oxalate—spinach, rhubarb, chocolate, and nuts.
- Cranberry juice: Decreases oxalate and phosphate excretion and increases citrate excretion. [46-48]

Pathophysiology of urinary stone [49-51]

The pathogenesis of urolithiasis is complex encompassing several physicochemical events occurring sequentially or concurrently. Despite increasing study in the last decade the mechanisms whereby calcium oxalate crystals are retained in the kidney and form renal stones remain incompletely understood .The stone formation requires supersaturated urine. Super-saturation also depends on urinary pH, ionic strength, solute concentration and complexations. Three conditions must coexist for the formation of Struvite calculi.

(1) Alkaline urine,
(2) The presence of urea or ammonia in the urine and,
(3) Higher concentration of minerals in the urine.

Urine from healthy humans consists of a large quantity of nitrogenous compounds, including 0.5 M urea, as well as inorganic ions. Urine is neutral to slightly acidic, and under these conditions, ammonia becomes protonated with the concomitant generation of hydroxide, which increases urine pH. The alkaline pH causes the precipitation of normally soluble polyvalent cations and anions in urine, leading to the formation of urinary stones .Kidney stones contain calcium, oxalate, phosphate, magnesium, uric acid and the formation of urinary calculi involves a crystallization process that includes

- Nucleation,
- Growth and
- Aggregation of crystals.

Stone formation may be either homogeneous (where the nucleus of the stone around which crystals aggregate is the same material as that of the crystal) or heterogeneous.

Nucleation

Nucleation is the establishment of the smallest unit lattice of a crystal species, the first step in crystal formation. There are two types of nucleation: homogeneous nucleation and heterogeneous nucleation. [52]

In human urine, homogeneous nucleation is unlikely to occur; rather, a heterogeneous nucleation process, by which crystal nuclei can form on structures such as cellular material, urinary crystals, and urinary casts occurs. In fact, most

urinary stones are a mixture of more than one crystal type suggesting that a process of heterogeneous nucleation is responsible for the formation of most stones. [52]

Growth

The urine must contain an excess of the crystalline material that can generate a stone. That is to say, the urinary environment must be supersaturated with these stone-forming crystals. The concentration at which urine becomes saturated with the dissolved salt and crystallization begins is known as the thermodynamic solubility product (*Ksp*). When the concentration of the salt in a solution is less than the solubility product, the solution is said to be undersaturated.

As the concentration of the salt increases above its solubility product, there will be a second point encountered where the solution becomes unstable with respect to the salt and crystallization will spontaneously begin; this point is termed the formation product. The region between the solubility product and the formation product is known as the metastable region. When a solution is metastable with respect to a salt, crystallization is unlikely to occur, although growth may occur on existing crystals. [52]

Aggregation

Crystal nuclei bind to one another to form larger particles, a process known as aggregation. In the urinary environment, chemically or electrically induced forces can promote crystal aggregation; once crystals have aggregated to one another, they are held in place by strong intermolecular forces, and cannot be easily separated. Crystal aggregation is likely an important mechanism in stone formation, as a single crystal will never be large enough to be retained in the urinary collecting system. [52]

Urinary stone caused by Bacterial infection [53]

Kidney stones form as a result of physicochemical or genetic derangements leading to supersaturation of the urine with stone-forming salts or, less commonly, from recurrent urinary tract infection with urease producing bacteria[(4)] like *Proteus vulgaris, Pseudomonas aeruginosa, Enterobacter* spp., *Serratia* spp., *Staphylococcus aureus, Staphylococcus epidermitis* etc.).

Urease enzyme is responsible for hydrolyzes urea into ammonia and carbamate. In pathological states urease-producing organisms may gain entry to the urogenital tract either from anal contamination or venereal transmission. In ascending the urinary tract these bacteria use urease-enzyme to their advantage .Bacterial urease alkalinizes urine, thereby causing:

(i) supersaturation with respect to struvite and calcium phosphate

(ii) formation of struvite and apatite crystals.

Urease-induced supersaturation appears to be the primary cause of infection-induced urinary stones.

Molecules in healthy human urine, including citrate, glycosaminoglycans and glycoproteins (for example osteopontin), can block crystal adhesion to renal cells.1 Of these substances citrate can be orally administered and it appears to be effective treatment against stone formation. The potential

mechanisms by which citrate prevents stone formation are many, including increased urinary pH, decreased crystal growth and aggregation, decreased Tamm- Horsfall protein aggregation and decreased crystal adhesion to tubular cells.

Mechanism of stone formation [54]

Age	Profession	Nutrition	Climate	Inheritance
Sex	Mentality	Constitutions	Race	----------

↓

Abnormal renal morphology	Disturbed urine flow	Urinary tract infection	Metabolic Abnormalities	Genetic Factors

↓

Increased excretion stone forming constituents	Decreased excretion of inhibitors of Crystallizations

↓

Physico-chemical change in the State of supersaturation

↓

Abnormal crystalluria Crystals aggregations Crystals growth	→	Formation of Stone

Treatment of Urolithiasis [55-57]

Allopathic medicines

Depending on the result of 24 hour urine collection, there are different treatment options for different stone types. Now there is convincing evidence that by treating specific biochemical abnormalities, the recurrence rate can be reduced. The three most commonly used classes of medications for stone prevention are enlisted here

1. **Thiazide diuretics** (e.g. Hydrochlorothiazide): are used to reduce urine calcium excretion, in patients with hypercalciuria.
2. **Alkali** (e.g. Potassium citrate): are used to increase the urinary citrate excretion in patients with hypocitriuria.
3. **Allopurinol:** is used to reduce uric acid synthesis and urinary excretion in patients whichc hyperuricaemia or hyperuricosuria.

4. **Sodium cellulose phosphate (SCP):** is used to restore normal calcium excretion by reducing intestinal calcium absorption. The SCP may induce hypermagnesiuria leading to increase saturation of CaOx due to reduced complexation of urinary oxalate by magnesium.
5. **Penicillamine** (Cuprimine)**:** are often recommended if drinking more fluids does not control cystine formations.
6. **Analgesic** (Diclophenac sodium): For patients with ureteral stones expected to pass spontaneously tablets of diclophenac sodium 50 mg administered twice daily during 3-10 days,might be useful in the risk of recurrent pain.
7. **Bisphosphonates:** Decrease fasting calciuria and less marked decrease in 24-hr calciuria.

8. **Potassium phosphate:** Increase serum phosphate, increase urine phosphate and possible increase in urine pyrophosphate.

9. ***Oxalobacter Formigenes*** **and other probiotics:** Decrease oxalate excretion

For Struvite stones, treatment of infection is mandatory and may be needed for long term

Ayurvedic medicines [58]

1. Cystone
2. Calcuri
3. Chandraprabha bati
4. Trinapanchamool
5. Rencare Capsul
6. Patherina tablet
7. Ber Patthar Bhasma
8. Chander Prabha vati

Drugs that may increase the risk of stone disease [59]

- Decongestants: ephedrine, guaifenesin.
- Diuretics: triamterene.
- Protease inhibitors: indinavir.
- Anticonvulsants: felbamate

S.no	Drugs	Category	Mechanism of action	Uses
1	Amiloride (Midamor)	Diuretics.	Na+ reabsorption in late distal tubule and collecting duct.	Kidney diseases.
2	Allopurinol (Lupurin, Zyloprim)	Analogue of hypoxanthine.	It inhibits xanthine oxidase and prevent the synthetic of urate from hypoxanthine and xanthine.	Urinary infections, calculi.
3	Cholestyramine. (Questran)	Bile acid sequestrates.	Increases in hepatic LDL receptors. Inhibition of reductase activity by a statin.	Kidney diseases.
4	Cholic acid.	Bile acid derivatives	It induces bile flow, feedback inhibits cholesterol synthesis, promote intestinal excretion of cholesterol.	Gall stone diseases.
5	Digoxin (Lanoxin).	Cardiac glycoside.	Inhibition of Na+, K+ ATPase.	Ailments of kidney diseases.
6	Etidronate disodium.	Bisphosphonate.	It prevent hydroxyl apatite dissolution.	Kidney stones.
7	Fluvastatin (Lescol).	Statin.	Reduction of LDL levels. It competitive inhibits HMG-COA reductase.	Gall stone diseases.
8	Gemfibrozil.	Fibric acid derivatives.	It reduces triglycerides through PPAR α – moderated stimulation of fatty acids oxidations.	Gall bladder diseases.
9	Indinavir.	Peptidomimetic hydroxyethylene HIV inhibitors.	It reversely binds to the active site of HIV protease, prevent polypeptides processing.	HIV diseases, kidney diseases.
10	Zonisamide.	Sulphonamide derivatives.	It inhibits the T- type ca2+ channel, repetitive firing of spinal cords neurons	Ailments of stone diseases.

Table.1 List of synthetic drug used in treatment of stone diseases. [60]

Table.2 Lists of Plant Drugs used in kidney stone, gall stone, urinary calculi [61]

BOTANICALS	COMMON NAME	PART USED	USES
1. *Alhagi mannifera*	Camels thorn	Roots	For kidney pebbles and sands
2. *Armoracia lopathifolia*	Horse radish	Seeds	Diuretic, Kidney Stones.
3.*Barbarea vulgaris*	Rocket	Roots Leaves	For kidney stone.
4. *Capsella bursapastori*	Mothers heart	Entire plant	Diuretic, For bladder & kidney spasm
5. *Cucumis sativus*	Cucu	Leaves	Kidney stones, Emollient
6. *Ficus carica*	Fig	Fruit, latex	Destroy urinary & gall stones
7. *Olea europeae*	Olive	Oil	Treatment of kidney stone,
8. *Rosmarinus officinalis*	Rosemary	Leaves	Relive menstrual cramps, increase, urine flow, and reduce kidney pain
9.*Theobroma cocao*	Cacoa	Seed	urinary tracts diseases
10.*Tamarind indica*	Tamarindus	Fruits	For kidney and gall stone
11. *Mentha piperita*	Peppermint	Entire herb	Treatment in stone disease
12. *Pimpinella anisum*	Anise	Fruit	Antispasmodic, Diuretic, Treatment of kidney stones
13. *Santalum album*	White sandal	Oil	For urinary bladder.
14. *Urgina maritime*	Squill bulb	Bulb leaves	White Squill: Cardio tonic, Emetic, Diuretic.
15. *Urtica dioica*	Stinging nettles	Roots	Diuretic.
16. *Zingiber officinale*			

17. *Lavendula officinalis*	Ginger	Rhizomes	Stop bleeding, Ant rheumatism.
18. *Apium graveolens*	Lavender	Flowers	Decrease cholesterol level, Condiment.
19.*Citrus japonica*	Celery	Whole plant	Antispasmodic, Eczema.
20.*Zea mays*	Orange	Leaves	Antispasmodic, Carminative, Diuretic, Urinary tract.
	Maize	Oil of the seeds	For bladder & kidney spasm.

Most of these remedies were taken from plant and proven to be useful. They are reported to be effective with no side effects. [62-63]

Researches reported for stone dissolving activity

1) Aqueous and alcohol extracts of *Jasminum auriculatum Vahl* (Oleaceae) flowers are reported for kidney stone. [64]

2) Aqueous of extracts of *Herniaria hirsuta L.* are reported for nephrolethiasic.[65]

3) Ethanolic extracts of leaves of *hibiscus sabdariffa linn* are used for kidney stone. [66]

4) The acute diuretic effect of the water extract of the aerial parts of *Retama raetam (RR)* are used for kidney ailments. [67]

5) The chronic diuretic effect of the water extract of the whole plant of *Spergularia purpurea (SP)* are used for kidney stone.[68]

6) Aqueous extracts *Rosmarinus officinalis* and *Centaurium erythraea* are used for kidney ailments .[69]

7) Ethanolic extract of *Ammannia baccifera (Bhatjambol)* was found to be effective in reducing the formation of urinary stones (prophylactic).[70]

8) *Crateva nurvala (Varun)* were found to possess significant anti-hyperoxaluric and anti-hypercalciuric activity.[71]

9) The Aqueous extracts *Sesbania grandiflora* are used for antiurolithiatic. [72]

10) The Aqueous extract of the bark of *Raphanus sativus* was tested for its antiurolithiatic and diuretic activity. [73]

Plants acting on Kidney stones

Various types of plants and its species are used in the treatment of kidney stones. The plants used for kidney problems are A*llium sativum, Apium graveolens, Armoracia lopathifolia, Barbarea vulgaris, Capsella bursapastori, Citrus japonica, Ficus carica, Olea europeae, Pimpinella anisum, Rosmarinus officinalis, Theobroma cacao, Chamaesyce hirta, Flemingia strobilifera, Peperomia rotundifolia, Petiveria alliacea, Nopalea cochinellifera, Apium graveolens, Cynodon dactylon, Eleusine indica, Gomphrena globosa, Pityrogramma calomelanos* and *Vetiveria zizanioides.* The genus *Phyllanthus* has a long history of use in the treatment of kidney stones. Some related species in this

region with medicinal significance are *P. epiphyllanthus, P. niruri P. urinaria, P acuminatus and P. emblica. P. amarus, P. nururi and P. urinaria* are used in the treatment for kidney and gallstones. [74]

Plants acting on Gall stones

Different types of plants used in the treatment of gall stones are A*pium graveolens*, *Bauhinia cumanensis, Bauhinia excise*, *Costus scaber*, *Chamaesyce hirta*, *Cissus verticillata*, *Capraria biflora*, *Cocos nucifera*, *Eleusine indica*, *Ficus carica*, *Gomphrena globosa*, *Kalanchoe pinnata*, *Portulaca oleraceae*, *Solanum melongena*. [74]

Plants acting on Genito-urinary system

Plants and its species that are used in treatment of urinary stone are *Asalhagi gaecorum, Anduritica dioceia, Allium sativum, Gamphora globra, Elaegens angustifolia, Fleminfia strobilifera, Gomprena globosa, Justicia pectoralis, Lepianthes pelata, Momordica charantia, Nopalea cochenillifera* .[74]

Current aspects of medicinal plants in India

India has been referred to as the medicinal garden of the world. India comes under the 12 mega biodiversity centres having 45,000 plants species. In India around 20,000 medicinal plants species have been recorded, but around 500 traditional communities use 800 plant species for curing the diseases. Today around 50% of world population is totally depends upon the plant derived products as a primary health care with no side effects.[75]

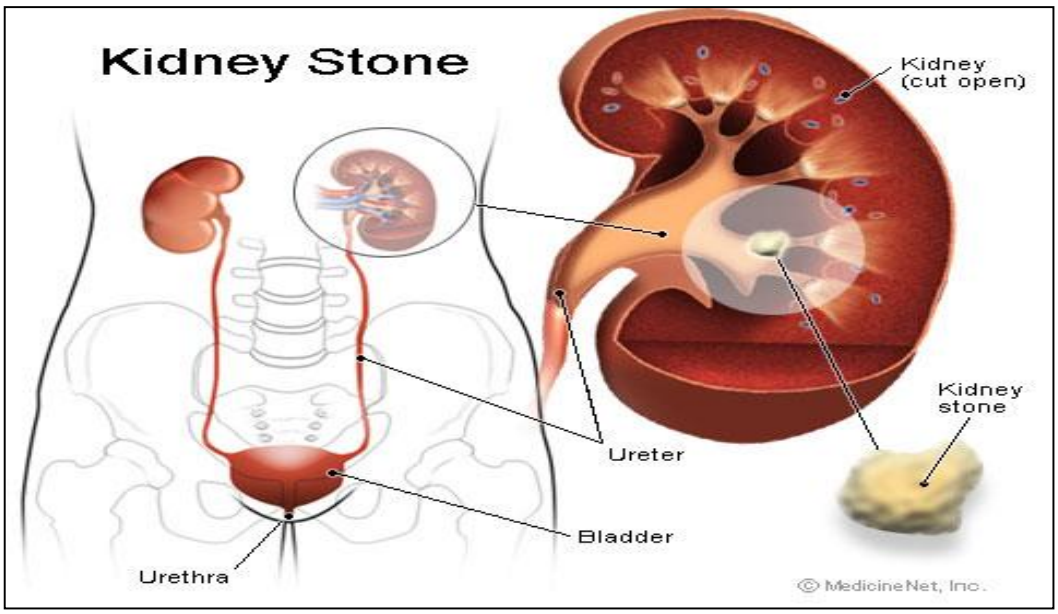
Challenges and future aspects of medicinal plants

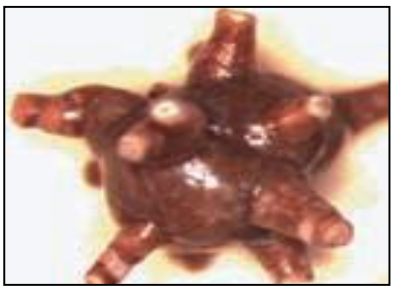
Today medicinal plants are very important for the growth of new drugs. People are using herbal drugs because of its safety, efficacy and lesser side effects. Plants and plant products have utilized with varying success to cure and prevent diseases. At present demand of natural plants derived products are increasing day by day in global countries. The significance of medicinal plants in national economy and its potential for the rapid growth of herbal products have been emphasizing frequently. [76]

Conclusion

As evident from the above discussion, nature is the best combinatorial chemistv and has possible answers to all diseases for mankind. Medicinal plants play a vital role in stone diseases. The undesirable effect of the modern medicine has already diverted the attention of the people towards herbal medicines. To increase the acceptability and awareness among the people, there is an urgent need to develop trust and faith towards the safer indigenous system by establishing its validity in treatment for various diseases. Health care systems are going to become more & more expensive, therefore we have to introduce herbal medicine systems in our health care. Lets us hope that in future natural products will be competing modern medicines with added advantages of more safety and lower costs.

Figure- 1 Kidney Stone





(A)

Figure -2 (A) Calcium oxalate stone (monohydrate), (B) Calcium phosphate apatite crystals

(B)

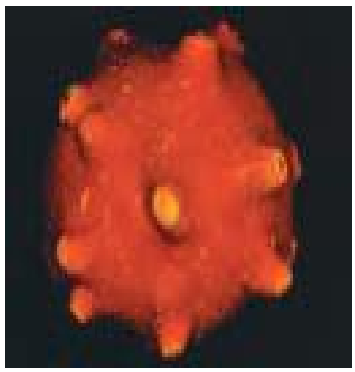


Figure – 3 (A) Magnesium ammonium phosphate stones, (B) Uric acid stones, (C) Cystine stones

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