Review Article

Traditional Approach for the Management of Urolithiasis

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ABSTRACT

Kidney stone is a general problem with increased reoccurrence, spread all over the world. It is the third most common disorder after prostate disease and infection of urinary tract. It is considered as the systemic disorder associated with many health conditions. An imbalance of urinary inhibitors and urinary promoters involved in crystallization are considered as the governing factors of biomineralization or kidney stone formation. Urine mainly contains crystalloids such as ammonium, calcium carbonate, cysteine, magnesium, potassium, urea, uric acid etc and colloids such as mucin, chondrotin etc. The mechanism involved in the stone formation and the factors effecting were determined. The plants used in the treatment of Urolithiasis belonging to different families have been mentioned. The effect of hormones in the kidney stone was elaborated. Herbal therapies have found to be more effective with minimal associated after effects. Some of the plants with antiurolithiatic property and the part of the plant being used were complied.

Keywords: Urolithiasis, Kidney stone, Biomineralization, Calcium oxalate stone, Crystallization.

INTRODUCTION

Urolithiasis can be defined as the mechanism of development of stone (calculi) in urinary system. Stone can be formed in any part of the urinary system like kidney, bladder and ureter and the associated diseases are called as nephrolithiasis, Cystolithiasis and Uterolithiasis respectively.[1] Disorder of kidney stones leads to considerable health and financial burden. Kidney stone disease is linked with other disorders like fractures, hypertension, metabolic disease, chronic kidney disorder, high risk of coronary artery disease (CAD) and diabetes (Insulin dependent diabetes), so it is referred as systemic disorder.[2] Urolithiasis result in hematuria (blood in urine), dysuria (painful urination), pyuria (pus in urine), renal colic and oliguria (reduced urine excretion) which are caused due to blockade of urethra. The consequence of this blockade is condensation of phosphate and oxalate salts which are less soluble and insoluble salts.[3] India is the country where naturopathy has been considered as the potential therapy since Vedic times 1500-1000 B.C.[4] Kidney stone formation in such is a general problem with increased reoccurrence which is spread all over the world.[5]

PREVALENCE

Urolithiasis affects, 2% of population (both the genders) globally and it is the third most common disorder,[5] but its recurrence rate is being high in males about 70-80% and low in females about 47-60%.[1] The race and cultural differences also plays a great role in occurrence of Nephrolithiasis as Caucasian males are more prone to it.[6] Prevalence of Nephrolithiasis increase after the age of 20.[7]For the treatment, prevention and management of urinary stone various medicinal plants enlisted below have been used that belongs to different families.

Table 1: Plants belonging to following families are used in treatment of Urolithiasis[8]

S. NO	Family	No of plants used as antiurolithiatic in the specific families
1	Amaranthaceae	15
2	Anacardiaceae	10
3	Acanthaceae	15
4	Amaryllidaceae	9
5	Aspleniaceae	5
6	Arecaceae	7
7	Asparagaceae	9
8	Apocynaceae	9
9	Crassulaceae	5
10	Caesalpiniaceae	7
11	Cucurbitaceae	18
12	Capparidaceae	5
13	Chenopodiaceae	6
14	Cupressaceae	12
15	Caryopyllaceae	11
16	Euphorbiaceae	20
17	Ericaceae	8
18	Equisetaceae	8

PATHOPHYSIOLOGY

Pathogenesis of renal stone can also be termed as biomineralization. It is basically the biological process that engage the physiochemical shifts, alternation in the walls of collecting system and concentration of urine in kidney.[9] Urine mainly contains crystalloids such as ammonium, calcium carbonate, cysteine, magnesium, potassium, urea, uric acid etc and colloids such as mucin, chondrotin etc. Any change in the concentration of these constituents leads to precipitation and adhesion of the free ions. Urinary infection, altered muco-protein concentration and pH leads to physiochemical changes. Urinary stasis, theory of Randall's plaque and deficiency of vitamin A leads to the alternations in collecting systems walls.[10]

Crystallization is an important phenomenon of stone formation depending on the thermodynamics, nucleation and the rate of nucleation. An imbalance of urinary inhibitors and urinary promoters involved in crystallization are considered as the governing factors of biomineralization. This imbalance leads to oxidative stress followed by injury and rupture of cells leading to nucleation. Stone formation occurs in biological events such as the crystal nucleation, crystal growth, crystal aggregation and crystal retention.[9]

Depending upon the type of stones and urine constituents, the sequence of events varies. Biomineralization is also caused due to ulceration followed by pus formation and crystallization.[10]

PATHOLOGY

Urolithiasis i.e. formation of stones in urinary system generally result due to the following

- ❖ Infection of urinary tract by microbes
- ❖ Diet rich in calcium and oxalate
- ❖ Deficiency of vitamins A and D
- ❖ Decrease urinary outflow
- ❖ Metabolic disorders such as
    - Gout
    - Hyperthyroidism
    - Intestinal dysfunction
    - Cystinuria[11]
- ❖ Lack of balance between the promoters of stone formation and inhibitors may results in Nephrolithiasis.[12]
- ❖ Hormones for stone formation

Hormones play a vital role in enhancing and preventing the formation of stone.

Table 2: Effect of hormones on Urolithiasis[13]

Hormone	Location	Effect
Testosterone	Hormone present in males	Enhances the formation of stone
Estrogen	Hormone present in females	Prevents the formation of stone by elevating the level of citrate in urine and maintaining the basic nature of urine

Table 3: List of plants showing Antiurolithiatic activity

S.No	Botanical name	Family	Part used	Mechanism of action
1.	*Achyranthus aspera* L.	Amaranthaceae	Leaves[14]	Prevents damage of renal epithelial cells, diuretic, Dissolves or prevents the formation of stone [15]
2.	*Aerva lanata* L.	Amaranthaceae	Whole plant[16]	Litholytic[17] lithotriptic [18]
3.	*Achyranthus indica* Linn.	Amaranthaceae	Roots	Dissolves or prevents the formation of stone [19]
4.	*Amaranthus caudatus* L.	Amaranthaceae	Leaves[19]	Diuretic, litholytic and antioxidant property[17]
5.	*Amaranthus spinosus* L.	Amaranthaceae	Roots[19]	-
6.	*Aerva javanica* Burm.	Amaranthaceae	Roots	Diuretic[17], Lithotriptic [20]
7.	*Alternathera brasiliana* L.	Amaranthaceae	Leaves	Diuretic and litholytic [17]
8.	*Amaranthus blitum* L.	Amaranthaceae	Leaves[21]	-
9.	*Amaranthus viridis* L.	Amaranthaceae	Roots	Litholytic[17]
10.	*Beta vulgaris* L.	Amaranthaceae	Leaves and Rhizome	Dissolves or prevents the formation of stone[22]
11.	*Digera muricata* L.	Amaranthaceae	Leaves	Dissolves or prevents the formation of stone[23]
12.	*Gomphrena celosioides* Mart.	Amaranthaceae	Roots	Dissolves or prevents the formation of stone[24]
13.	*Nothosaerva brachiata* L.	Amaranthaceae	Roots	Diuretic, litholytic, lithotriptic[17] Dissolves or prevents the formation of stone [25]
14.	*Helianthus annuus* Linn.	Asteraceae	Leaves[26]	Used in treating kidney and urinary

				problems[27]
15.	*Helichrysum plicatum* DC.	Asteraceae	Flowers[28]	-
16.	*Ageratum conzoides* L.	Asteraceae	Whole plant[26]	-
17.	*Enhydra fluctuans* Lour.	Asteraceae	Ariel parts	Dissolves or prevents the formation of stone[30]
18.	*Eupatorium birmanicum* DC.	Asteraceae	Leaves	Dissolves or prevents the formation of stone [28]
19.	*Myriogyne minuta* Less.	Asteraceae	Ariel parts	Used in treating stone in urinary tract when given along with equal ratio of sugarcane juice[27]
20.	*Tagetes erecta* Linn.	Asteraceae	Leaves	Used in treatment of kidney related diseases
21.	*Wedelia chinensis*	Asteraceae	Whole plant	Used in treating Urolithiasis
22.	*Xanthium strumarium* Linn.	Asteraceae	Roots	Used in the treatment of kidney stones and cancer [27]
23.	*Acanthus ilicifolius* L.	Acanthaceae	Whole plant	Diuretic[30]
24.	*Barleria prionitis* L.	Acanthaceae	Roots	Diuretic
25.	*Ecbolium viride* Forsk.	Acanthaceae	Leaves and roots	Diuretic
26.	*Hygrophila auriculata* Schum.	Acanthaceae	Roots	Diuretic[17]
27.	*Lepidagathis prostrata* Dalzell.	Acanthaceae	Whole plant	Dissolves or prevents the formation of stone [31]
28.	*Thunbergia alata* Thnal.	Acanthaceae	Leaves	Lithotriptic[23]
29.	*Capsella bursapastoris* L.	Brassicaceae	Entire herb [32]	-
30.	*Barbarea vulgaris* R. Br.	Brassicaceae	Roots[32], leaves[33]	-
31.	*Cardamine hirsute* L.	Brassicaceae	Whole plant	Diuretic[34]
32.	*Ananas comosus* L.	Bromeliaceae	Ripe fruit	Used in the treatment of asthma, Urolithiasis and bronchitis[27]
33.	*Berberis aristata* DC.	Berberidaceae	Leaves	Used for treating kidney problems and infection of urinary tract[27]
34.	*Bauhinia acuminata* L.	Caesalpiniaceae	Bark/Leaves	Lithotriptic[35]
35.	*Cassia fistula* L.	Caesalpiniaceae	Fruit/stem	Litholytic
36.	*Hardwickia binata* Roxb.	Caesalpiniaceae	Balsam	Diuretic
37.	*Herniaria glabra* L.	Caryophyllaceae	Ariel parts	Lithotriptic [17]
38.	*Herniaria hirsuta* L.	Caryophyllaceae	Whole plant	Dissolves or prevents the formation of stone [23]
39.	*Paronychia argentea* Lam.	Caryophyllaceae	Whole plant	Litholytic
40.	*Spergularia rubra* L.	Caryophyllaceae	Leaves	Diuretic, Lithotriptic [17]
41.	*Benincasa hispida* Thumb.	Cucurbitaceae	Seeds[36]	Dissolves or prevents the formation of stone [37]
42.	*Cucumis sativus* L.	Cucurbitaceae	Leaves[32]	Lithotryptic and litholytic[17, 35]
43.	*Momordica charantia* Linn.	Cucurbitaceae	Fruits [38]	Antiurolithiatic [22] and lithotryptic[39]
44.	*Melothria purpusillsa* Blume.	Cucurbitaceae	Whole part of plant [40]	Lithotryptic[35]
45.	*Curcuma Angustifolia* Roxb.	Cucurbitaceae	Whole plant	Used for treating kidney stones infection and jaundice[41]
46.	*Citrullus colocynthis* L.	Cucurbitaceae	Fruits	Antiurolithiatic[22]
47.	*Homonoia riparia* Lour.	Euphorbiaceae	Root[42]	Diuretic, antioxidant [23]and lithotryptic[17]
49.	*Acalypha indica* Linn.	Euphorbiaceae	Whole plant[43]	Antiurolithiatic, anti-inflammatory, diuretic, analgesic and antioxidant[17]
50.	*Bridelia crenulata* Roxb.	Euphorbiaceae	Stem bark[44]	-
51.	*Emblica officinalis* Geartn.	Euphorbiaceae	Fruit [29]	Lithotriptic[35]
52.	*Euphorbia hirta* Linn.	Euphorbiaceae	Whole[45]	Antiurolithiatic, anti-inflammatorydiuretic, analgesic and antioxidant[17]
53.	*Mallotus philippensis*	Euphorbiaceae	Bark	Used to treat stone formed in urinary tract[27]

54.	*Phyllanthus urinaria* Linn.	Euphorbiaceae	Whole plant	Used in urinary diseases[46]
55.	*Mercurialis annus* L.	Euphorbiaceae	Leaves	Diuretic[47]
56.	*Sapium sebiferum* Linn.	Euphorbiaceae	Leaves	Diuretic[17]
57.	*Sesbania grandiflora* L.	Fabaceae	Leaf juice[48]	-
58.	*Tamarindus indicus* Linn.	Fabaceae	Fruit pulp[49]	Inhibits crystallization of stone
59.	*Macrotyloma uniflorum* Lam.	Fabaceae	Seed [50]	-
60.	*Copaifera langsdorffii*	Fabaceae	Leaves	Prevent growth of crystal and inhibits the formation of crystal[51]
61.	*Alhagi mannifera* Desv L.	Fabaceae	Roots[32]	-
62.	*Didymocarpus pedicellata* Roxb.	Gesneriaceae	Leaves[44]	-
63.	*Ammannia baccifera* Linn.	Lythraceae	Leaves[52]	-
64.	*Lawsonis inermis* Linn.	Lythraceae	Leaves[53]	-
65.	*Rotala baccifera* Linn.	Lythraceae	Whole plant	Used in treating urinary trouble
66.	*Abrus precatorius* Linn.	Malvaceae	Leaves	Aqueous extract of this plant is used as antiurolithiatic
67.	*Abutilon indicum* Linn.	Malvaceae	Whole plant	Used in treating urinary problems
68.	*Hibiscus sabdariffa* Linn.	Malvaceae	Leaves	Used in treating problems associated to kidney stone
69.	*Indigofera tinctoria* Linn.	Papillionaceae	Roots	Used in treating urinary problems [27]
70.	*Fragaria indica* F.	Rosaceae	vegetative part	Dissolves or prevents the formation of stone [40]
71.	*Docynia Indica* (Colebr) Decne.	Rosaceae	Fruit	Used for treating urinary troubles[45]
72.	*Bergenia Ciliata* Wall.	Saxifragaceae	Rhizomes[54]	-
73.	*Solanum nigrum* Linn.	Solanaceae	Seeds	Used in treating kidney stones[27]
74.	*Saccharum officinarum* Linn.	Poaceae	Stem	Used for treating kidney and liver infections and purifies blood[55]
75.	*Hedychium coronarium* koening.	Zingiberaceae	Rhizome	Used for problems related to kidney[27]

CONCLUSION

Kidney stones are prevalent in different communities in India which also forms an underlying cause for the development of many diseases. The rate of reoccurrence of Urolithiasis is high of the patients that have been treated with the synthetic drugs. These drugs provoke many side effects causing distress to the patients. Therefore, the herbal therapies of these drugs that have been studied showing anti-urolithiatic activity have been compiled, as the alternative method of treatment as far to mankind have been by far more useful, economic and providing lesser side effects.

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