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RESEARCH ARTICLE

Principles of the Urolithiasis Phytotherapy

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ABSTRACT:
A wide range of plants and plant-derived products are used in folk medicine for the treatment of urolithiasis as a prophylactic agent or as curative agent. Most of them found to be effective, but still the complete mechanism of action of these herbal drugs remains to be unclear. In present review we are discussing the various mechanism of action through which phytotheraeupatic agents exert their antiurolithiatic effect. Unlike allopathic medicines which targets only one aspect of urolithiatic pathophysiology, most of plant based therapy have been shown to be effective at different stages of stone pathophysiology. The present review therefore critically evaluates the potential usefulness of herbal medicines in the management of urolithiasis.

KEYWORDS: urolithiasis, phytotherapy, herbal medicines.

INTRODUCTION:
Urolithiasis (UR) is one of the most common diseases in urological practice: in developed countries around the world, 400 thousand out of 10 million people suffer from urolithiasis, and according to the Ministry of Health of Ukraine, the share of urolithiasis in the structure of urological diseases makes from 27.4% to 32.7%. The world statistics of urolithiasis reveals 12% of the most socially active working age population (20-50 years old).[1,2,6]

For many years, the issues of etiology, pathogenesis, and also the prevention of urolithiasis have been topical. In many geographic regions, urolithiasis has assumed an endemic character, due to exo and endogenous factors which unfavourably affect a human body. The causes are divided into climatic, geological, socioeconomic, and hereditary, also, physicochemical and hydrogeochemical properties of drinking water and especially the diet of a local population are important. The forecasts for the future are also disappointing: the frequency of urolithiasis will continue growing.[3-5]

The complications of urolithiasis - infectious inflammatory diseases of the kidneys, hydronephrosis, renal insufficiency - are often life-threatening and can cause disability of the patients. High incidence of relapses is characteristic for urolithiasis: 35% of patients have it within 5 years, 52% have a probability of recurrence within the next 10 years from the calculus being removed.

Under the condition of urolithiasis, even if it has not been diagnosed yet, there is a disruption of the excretory function and mineral metabolism of the body that is immediately reflected in the oral cavity in a form of symptomatic gingivitis, and in more severe cases, it can be transformed into periodontitis. In its turn, advanced periodontitis, especially in the stage of abscess formation, is a factor that aggravates the course of urolithiasis.[1,4,7]

Typical symptoms in this case are: bleeding gums when brushing teeth, taste of blood when eating, bad breath, in more severe cases, discomfort when eating due to hyperesthesia and teeth mobility. Upon the examination of the oral cavity the observed conditions are: swelling, hyperemia, cyanotic marginal part of the gums and oral mucosa, a large amount of soft plaque, which quickly mineralizes (hardens) and turns into a supragingal and subgingival dental calculus.[8-12]

Timely treatment of urolithiasis is one of the important steps in the prevention of periodontal tissues and oral mucosa diseases.

Principles of the urolithiasis pharmacotherapy:

The choice of the scheme and rational way of treating urolithiasis depends on a number of factors: location, shape and size of a stone, its chemical composition, functional state of the kidneys, degree of dysfunction of the urinary tract urodynamic, presence of complications and concomitant diseases. The following possible treatment methods for urolithiasis are defined: 1) surgical removal of a stone or removal of the kidney with a stone; 2) symptomatic treatment; 3) application of conservative methods of treatment; 4) medical litholysis; 5) local litholysis; 6) percutaneous nephrostomy; 7) instrumental removal of stones; 8) percutaneous removal of kidney stones by extracting or litholopaxy; 9) contact ureteroscopic destruction of stones; 10) distant shock-wave lithotripsy.[3,15]

Surgical removal of urinary stones does not guarantee the elimination or at least weakening of the body's propensity to urolithiasis. After surgery, if the appropriate treatment routine is not followed, stones can be formed soon enough, because the original cause of salt precipitation is not eliminated. On the other hand, there is a quite large number of patients, for whom, due to various reasons, surgical treatment is simply impossible. All of these suggest for the medicine the task of combating urolithiasis with so-called conservative methods. And although there are no therapeutic medications that completely dissolve urinary stones in the kidneys and ureter, the effect of certain substances providing the mineral balance in a body is of unquestionable interest.[13,15]

It is considered that herbal remedies can be an independent alternative method of treatment and prevention of uncomplicated urolithiasis with concrements <10 mm.[6,9] The advantages of phytotherapy over synthetic drugs are undeniable: virtually no complications and undesirable side effects, and what is most important - there is a synergistic effect, namely possible selection of such herbal combinations, which, on the one hand, mutually potentiate individual properties, and, on the other hand, provide all biologically active substances a patient requires: flavonoids, essential oils, polyphenols, glycosides, alkaloids, tannins, vitamins, bitter, mucus, organic acids, coumarins, phytoncides, mineral salts, resins, oils, gum. [7,10]

Phytotherapy of Urolithiasis:

Modern medicine uses a lot of effective medications, made exclusively from herbs. After all, herbal extracts as potential medicines in many cases have fundamental advantages over the artificially created in chemical laboratories substances.

Phytotherapy of the urinary tract diseases has a very wide range of effects, since herbal preparations have an extremely diverse effect on a body: they stimulate the excretory function of the organs, activating the protective colloids of the urinary tract, suppress inflammatory processes, bind phenols, and neutralize the products of decomposition of microorganisms. Thus, they disinfect the urinary tract, increase the allocation of sodium ions, enhance blood circulation, and compact cell walls, which is of great importance in treatment of the kidneys. [7, 13]

The choice of herbs for treating the kidneys and urinary tract diseases is primarily determined by their properties. Characteristics of phytotherapeutic medications effects for treating and preventing the urinary system diseases are shown in Table. 1

Table 1. Characteristics of herbal substances effects applied for preventing and treating the urinary system diseases.

Effect	Medicinal herb
Antibacterial, antimicrobial, antiviral and disinfectant	Preparations of birch, cowberries, mulberry, juniper, fir, St. John's wort, peppermint, cranberry, oregano, hops, linden, etc.
Antiallergic	Preparations of great nettle, common burdock, common plantain, licorice, field horsetail, hops, bur beggar-ticks, etc.
Antihypoxant	Preparations of birch, plaster clover, pot marigold, great nettle, corn, linden, garden balm, Indian kidney tea, restharrow, violet, bur beggar-ticks, etc.
Immunotropic	Preparations of great nettle, garden balm, bur beggar-ticks, violet, birch, common burdock, milfoil, echinacea purpurea, etc.
Antihypertensive	Preparations of marsh immortelle, hawthorn, Baikal skullcap, etc.
Anti-inflammatory and reparative	Preparations of garden sage, hops, marsh immortelle, milfoil, fir, peppermint, pot marigold, wild carrots, horse gowan, oregano, great nettle, etc.
Diuretics	Preparations of birch, cowberries, bluebottle, knotgrass, St. John's wort, juniper, Indian kidney tea, wild carrots, restharrow, oregano, bearberry, strawberry, etc. Preparations of common horsetail, knotgrass, that contain compounds of silicon, and enhance the removal of uric acid from the body.
Spasmolytic and anesthetic	Preparations of peppermint, cumin, fennel, dill, common hops, milfoil, wild carrots, oregano, pot marigold, horse gowan, etc.
Litholytic	Preparations of cowberries, strawberries, golden rod, wild carrots, great nettle, Indian kidney tea, restharrow, bearberry, bur beggar-ticks, etc. The oxalatolytic effect is possessed by preparations of common elder, birch, cowberries, common persicaria, cranberries, garden balm, peppermint, Indian kidney tea, parsley, bearberry, sage, hips, etc .; the phosphatolytic effect is possessed by

	preparations of elecampane, snakeweed, common burdock, European madder, juniper, etc.
Nephroprotective	Preparations of black currant, strawberries, whortleberries, raspberries, great nettle, primrose, etc.

Burnet Saxifrage:
(large and small), (Pimpinella saxifraga. Apiaceae).
Chemical composition: A root contains about 0.5% essential oil, pimpinelin, isobergapten, isopimpinelin, umbelliferone, saponins, bergapten, organic acids, sugar, resins and tannins.

Pharmacological activity: Furocoumarin (similar to furochromones) that are a part of this plant's composition have a strong antispasmodic effect, relieve spasms of smooth muscles, blood vessels, bile duct, ureter, and therefore it is used for gallstone and urolithiasis.

It is most often used for salt diathesis, kidney and bladder stones, liver disease; stimulates the secretion of bile at heartburn, stomach catarrh.

Common Cowberries, (Vaccinium vitis idaea L.).
Chemical composition: vaccinine, sugar, carotene, vitamin C, organic acids, glycosides, arbutin and hyperoside, free hydroquinone, tannins, salidroside, rhodioloside, quercetin.

Pharmacological activity: due to the large amount of arbutin glycoside in cowberries leaves, the plant has diuretic and uroseptic effect, which allows to use it in the complex treatment of urological diseases, namely urolithiasis. In hydrolysis, arbutin is split into hydroquinone, which demonstrates a pronounced bactericidal and diuretic effect. Similarly, the antiseptic effect of cowberries is enhanced by tannins, which also have bactericidal and anti-inflammatory properties.

Restharrow, (Onion spinosa Fabaceae (Leguminosae)
In therapy, restharrow roots are used.
Chemical composition: Essential oil, isoflavones, tannins, starch, resins and sitosterol.

Pharmacological activity: diuretic, detoxification effect.

Application: Acute and chronic inflammations of the bladder and renal pelvis, gallstones and urolithiasis, urine sand, renal colic, swelling, jaundice, and arthritis of metabolic character.

Mountain Ash, (Sorbus aucuraía).

In therapy, fruit and leaves are used.
The mountain ash grows in woods, groves, among shrubs in gardens and parks, as well as in the mountains. Picking the fruit of the mountain ash is best after the first frosts, leaves are better to collect immediately after flowering. Berries of the mountain ash are multivitamin raw materials.

Activity:
Demineralizing, diuretic, hemostatic.

Kidney Beans, (Phaseolus vulgaris).
In therapy, pods (husk) are used. It is a quite energetic diuretic factor in various mixtures. Therefore, bean husk is used in folk medicine for reduced urine excretion or accumulation of metabolic products harmful to a body.

Corn, maize, (Zea mays Poaceae)
In therapy, stigmata or silks are used.
Chemical composition: Corn stigmata (Latin S*tigmata Maydis*) contain oil (up to 2.5%), other oils (up to 0.12%), gum (up to 3.8%), tarry matter (up to 2.7%), bitter glycosides (up to 1.15%), saponins (up to 3.18%), cryptoxanthin, ascorbic and pantothenic acids, vitamin K, inositol, sytoaetherin, sigmasterol and unstudied alkaloids (0.05%).

Pharmacological activity: diuretic, hemostatic, analgesic, anti-inflammatory and cholagogic effects; corn stigmata "destroy" stones in the bladder as well as gallstones.

Pot Marigold, (Calendula officinalis).
Flowers have therapeutic properties. Preparations from flowers of marigolds are consumed internally as a diuretic. In addition, they are used for diseases of the liver, spleen, stomach (especially peptic ulcer), female genital organs, and even as a preparation for delaying (slowing down) the pathological process in malignant tumors.

Couch-grass, (Agropyrum repens. Poaceae).
A root of this plant possesses therapeutic properties. It is widespread throughout the temperate zone of Europe, Asia and other continents.

Chemical composition: a rhizome of the plant contains polysaccharide triticin (up to 10%), fatty oil (up to 1.5%) and essential oils, carotene (up to 8.7 mg), ascorbic acid (up to 156 mg), saponin, starch, gum, sugar , mannitol (up to 3%), silicic acid, iron, amino acids, microelements (sodium, calcium), mucus, vanillin, pectin.

Pharmacological activity: regulates mineral metabolism in the body, has a diuretic and coating effect.

Common Horsetail, (Equisetum arvense L. Equisetaceae).
In therapy, the whole overground part of the horsetail is used.

Chemical composition. Common horsetail herb contains a wide range of saponins, alkaloids, flavonoids, carotene (up to 4.7 mg /%), organic acids and fatty oils, mineral salts, tannins, bitterness. In addition, the plant contains up to 190 mg /% of vitamin C, sitosterol, a large amount of silicic acid and other bioactive substances [48]. Currently, due to the large amount of silicates, the extracts normalize the proliferation of connective tissue of the kidneys; contribute to maintaining balance between colloids and crystalloids in the urine, which prevents the formation of stones [13].

Pharmacological activity: it is used as diuretic, hemostatic, anti-inflammatory, antimicrobial and antihypertensive. It is prescribed mainly for infectious-inflammatory diseases of the urinary tract.

European Berbine, (Verbena officinalis).
In therapy, leaves are used.
Activity. Antispasmodic, diuretic, astringent, tonic.
Application. For inflammation of the bladder and renal pelvis, salt diathesis, pelvic diseases, catarrhal inflammation of the gastrointestinal tract, digestive disorders, diarrhea, decreased gastric juice excretion and internal bleeding.

Golden Rod, (Solidago virga aurea).
In therapy, a flower is used.
Activity. Diuretic, diaphoretic, enhances secretion of the gastrointestinal tract.

Application. For kidney disease, renal colic, uremia, water metabolism imbalance. In addition, it is good for inflammatory processes of the gastrointestinal tract, for internal bleeding.

Great Nettle, (Urtica diodica).
Leaves, roots and seeds have medicinal properties. This well-known herbaceous plant from the Urticeae family grows in debris, in towns, in the gardens as weeds. It blossoms from June to late autumn.

Activity. Diuretic, hemostatic, antipyretic, antidiabetic, enhances the secretion of digestive juices.

Strawberries, (Fragaria vesca).
In therapy, berries and herbage are used.
Activity. Diuretic, depurative. Its fruits are used for stones in the kidneys and liver, for gout and many other diseases. As the experience of the folk medicine demonstrates, strawberries are a good and commonly used plant, which has astringent, diuretic, blood-purifying, strengthening, cholagogue, anti-inflammatory, depurative, and sedative properties; they improve the metabolism and regulate the activity of the gastrointestinal tract.

Whortleberries, (Vaccinium myrtillis).
The dried berries have about 25-30% of sugar (invert) - a mixture of glucose and fructose, sucrose, 2-3% of organic acids (citric, apple, amber, molybdenum, oxalic acid), etc.

Activity. Antiseptic, diuretic, antidiabetic, astringent. Berries are antipyretic, antiseptic, vermifuge and antipyretic.

Dog Rose, (Rosa canina).
In therapy, fruits, flowers, leaves and roots are used.
Rosehip is a good vitamin remedy. Rosehip tea is widely used for infectious diseases, inflammation of the kidneys, for diseases of the intestines, liver, stomach, for the lungs tuberculosis.

Milfoil, (Achillea millefolium).
In therapy, stems, leaves, flower heads are used.
Activity. Diuretic, anti-inflammatory, hemostatic, analgesic and anti-allergic.

Melilot or sweet clover, (Melilotus officinalis).
In therapy, flowers and leaves are used.
Activity. Anesthetic, antispasmodic, anti-inflammatory.
Application. Flowers and leaves of melilot in combination with other herbs are used for large (coral) stones in the kidneys, causing aching pain. It has been established that coumarin in melilot contributes to suppression of the central nervous system, which in its turn has antispasmodic and narcotic effect.

Oregano, (Origanum vulgare).
In therapy, the overground part is used.
Activity. Antispasmodic, diuretic, cholagogue, anesthetic, antiseptic and anti-inflammatory.
Application. Oregano preparations have a calming effect for renal colic, persistent pain in the lower back, reduce inflammation in the urinary tract, contribute to the removal of sand and pathological impurities in the urine.

Lovage, (Levisticum Officinal).
In therapy, a root, herbage and seeds are used.
Activity. Diuretic and cardiac, expectorant, cleansing, pain-relieving and soothing. Improves the activity of the gastrointestinal tract and reduces flatulence.

Application. For chronic inflammations of the kidneys, kidney bowls and bladder; for urolithiasis, diseases of the liver, jaundices, renal and hepatic colic.

Fragrant Bedstraw, (Asperula odorata).
In therapy, herbage is used.
The decoction of the herb has slightly laxative and, mainly, diuretic properties, as well as contributes to the dissolution and removal of sand and stones – both bile and uric. Although the herb itself is rarely used in folk medicine, in the composition of diuretics, it is very convenient as an aromatic substance that improves the medicinal drink.

In addition to diuretic properties, the herb of fragrant bedstraw demonstrates a mild analgesic effect for severe colic while urination; lowers the local temperature. Due to this fact, it reduces paroxysmal pain in renal and billious colic.

Hop, (Humulus lupulus).
In therapy, fruits - hops – are used.
Activity. Analgesic, antispasmodic, diuretic, anti-inflammatory. Hops are used for a which is applied for chronic and acute calculous pyelonephritis as a painkiller for renal stone diseases, inflammations of the bladder and pelvis.

Elecampane, (Inula helenium).
In therapy, rhizomes and roots are used.
Application. The pronounced diuretic, astringent, antiseptic, anti-inflammatory and soothing effect.

Iceland Moss, (Cetraria islandica).
In therapy, a whole plant is used.
Activity. Antiseptic, coating, general health-improving. Effective for chronic calculous pyelonephritis, complicated by purulent infection and even by tuberculosis.

Orthosiphon, (Orthosiphon stamineus, s. Ocimum basilicum).
In therapy, herbage is used.
Activity: The plant has diuretic, antispasmodic, cholagogue effect, increases the secretion of gastric juice, increases the secretion of hydrochloric acid. Its diuretic effect is supported by the excretion of the urea, uric acid and chlorides from the body. It is applied for acute and chronic kidney diseases, for edema, caused by renal function violations and impaired cardial function [29].

Black Currants, (Ribes nigrum).
In therapy, berries, leaves and buds are used.
Activity. Diuretic, tonic, diaphoretic, astringent.
Application. Leaves, fruits and buds are used as a diuretic (for the bladder diseases and kidney stones). In addition, they have diaphoretic (for colds and acute rheumatism), and light laxative properties (buds with white wine), are applied for scrotum, gastritis, heart disease, migraine and to improve metabolism.

Knot Grass, (Polygonum avicularae).
In therapy, herbage is used.
Knot grass herbage contains flavonoids (quercetin, campherols, myricetin, isomrenetene, luteolin), coumarins, 0.19% tannins, saponins, vitamin C, carotene, pectin, silicic acid compounds, organic acids, traces of essential oils, sufficient amount of zinc and manganese.

Application. In folk medicine, knot grass preparations are used primarily as a strengthening, anti-inflammatory and diuretic factor. Its biologically active substances prevent the formation of urinary stones (the effect of soluble compounds of the silicic acid!), increase diuresis and saluresis, increase filtration in the glomeruli and reduce resorption in the renal tubules, contribute to anti-toxic effect [16].

European Ash, (Fraxinus excelsior).
In therapy of urolithiasis, bark of young shoots is used.
In addition to bark, folk medicine also uses leaves of ash as an antifebrile remedy for chronic bronchitis, cystitis, and juice wash for treating festering wounds.

In folk medicine, the bark decoction is used for treating all types of arthritis, especially rheumatic, it has diuretic and diaphoretic properties

European Madder, (Rubia tinctorum. Rubiaceae).
In medicine, roots and rhizomes are used; they are harvested in early spring.
Chemical composition: madder-trahira acid, asperuloside, antraglycosides, copper, iron, oxymethylanthraquinons, citric acid, malic acid and tartaric acid, sugars, proteins, pectin substances.

European madder preparations have the following effect: dilute urates, oxalates and phosphates; eliminate pain in the process of urination; eliminate aching kidney pain; improve water-salt metabolism in the body; reduce tone and increase peristaltic contraction of muscles of renal pelvis, as well as ureters, which contributes not only to forward stones, but also makes them go out.

Base Broom, (Genista tinctoria, syn. Sarothamnus Fabaceae).
In therapy, herbage is used. The plant blossoms in June - July. It is harvested during flowering or late in autumn.
Chemical composition: the herbage contains alkaloids - cytisine, methyl cytisine and others, flavone glycosides, luteolin in particular, organic acids, essential oils (up to 0,03%), saponins, bitter, macro- and micronutrients.

Pharmacological activity: Demineralizing, diuretic, soothing, toning, vasoconstrictive effect. They are applied for salt diathesis, insufficient removal of chlorides in the urine, urinary retention, as well as for various cardiac disorders, circulation disorders, internal and external bleeding.

SUMMARY:

Thus, medicinal herbs, possessing a variety of pharmacological effects, are used for a wide range of indications; they can be used, alternating, for a long period of time, especially for chronic diseases, and can be combined with each other and with chemotherapeutic agents. The unique properties of medicinal herbs allow them to be recommended for treating acute conditions, for preventing relapses and complications in patients with infectious-inflammatory diseases of the urinary tract and urolithiasis, with edema syndrome of different origins. Despite significant advances, the search for new plant protections for nephropathy of various etiologies continues up to now, remaining an important and promising area in the work of domestic pharmacologists.

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