Characteristics of the New Comprehensive Herbal Medicine for the Treatment and Prevention of Urolithiasis

Olga Alexandrovna Smyslova*, Artem Aleksandrovich Markaryan, Olga Vladimirovna Evdokimova, Irina Urievna Glazkova, Mikhail Anatolevich Yaroshenko

I.M. Sechenov First Moscow State Medical University of the Ministry of Health of the Russian Federation (I.M. Sechenov First MSMU), 8/2 Trubetskaya Street, 119991 Moscow, Russia

Abstract

Urolithiasis is the disease characterized by the formation and accumulation of stones in the urinary tract. Despite significant advances in the treatment of urolithiasis, the problem of the prevention and treatment of this disease remains relevant even now. One solution of this problem is to use a multplant remedies providing comprehensive pharmacotherapeutic effect on various links in the pathogenesis of the disease. We have proposed a multiplant collection for the treatment and prevention of urolithiasis based on leaves of Vaccinium vitis-idaea (L.), herb of Equisetum arvense (L.), roots of Arctium lappa (L.), fruits of Anethum graveolens (L.), and herb of Artemisia vulgaris (L.). This article provides an overview of the pharmacological properties of the components of the proposed remedy, due to different groups of biologically active substances.

Keywords
Urolithiasis; Medicinal plants; Medicinal plant species

Introduction

Urolithiasis is the disease, the most constant and essential feature of which is the formation and the presence of single or multiple stones in the urinary tract – renal calices, renal pelvis, ureter, bladder, and urethra [1].

According to the foreign literature, the incidence of urolithiasis in the world population is about 12%. The age structure of the incidence of urolithiasis is characterized by high rates among people of the working age, particularly in the age group of 25-50 yrs. Most often, the disease occurs among men from 70% to 81% of cases, in women: 47-60% [2].

By the number of patients, urolithiasis takes one of the first places in the world as compared with other urological diseases (34.2% in Russia). The incidence varies greatly in different countries and averages 1-5% in Asia, 5-9% in Europe, 13% in North America, and up to 20% in Saudi Arabia. In the developed countries of the world, 400 thousand people out of every 10 million suffer from urolithiasis. Its incidence in adults in Russia is 460 per 100,000 population [1,3].

Urolithiasis is a comprehensive syndrome comprising exogenous and/or endogenous etiological factors, and multivariate pathogenesis.

Exogenous factors of urolithiasis include the following ones: hot climate, dehydratation, hardness of drinking water, characteristics of nutrition, lack or an overdose of some vitamins (A, D, etc.), hypodynamia, urinary tract infection, and overdose and uncontrolled use of certain drug substances.

Endogenous factors include disturbance of calcium and phosphorus metabolism, metabolism of oxalic acid (oxalates), uric acid, cystine metabolism, some endocrinopathies (hyperparathyroidism, hyperthyroidism, Cushings disease, etc.), osteoporosis, a number of diseases of the gastrointestinal tract, and disturbance of lithogenic substances transport [1,4,5].

Urolithiasis leads to a long-term disability, and incapacity in the population. It is characterized by recurrences (their rate can reach 80%) and complications. Due to its wide prevalence, characteristics of the development and course, urolithiasis remains to be one of the most urgent problems in the modern medicine. Particularly over the past decade, there was a trend toward a higher incidence of the disease associated with the growing influence of adverse environmental factors on the human body [1,6].

The world practice has shown that drugs based on medicinal plants are widely used as an effective component of conservative treatment of urolithiasis after removal of the urinary stones, and as the monotherapy for the prevention of the primary urolithiasis in the presence of the risk factors and recurrent stone formation.

Medicinal vegetable raw material has the following mechanism of action: it selectively affects blood circulation of the kidneys and urinary tract, and causes spasmolytic, analgesic, diuretic effect, as well as affects pH of the urine. Often its effect is synchronously interconnected with the effect on the liver, pancreas, and intestines by metabolism and transport (removal) of lithogenic substances [4].

Thus, the study of multicomponent herbal medicines having a wide spectrum of pharmacological activity for the treatment and prophylaxis of urolithiasis seems to be a promising research area. High pharmacotherapeutic efficacy of these agents is caused by harmonious combination of biologically active substances contained in plants, and providing not only an adequate impact on the main elements of the pathological process but also contributing to the pharmacological regulation of many functional systems and increasing the adaptive capacities of the organism as a whole system.

*Corresponding author: Smyslova OA, I.M. Sechenov First Moscow State Medical University of the Ministry of Health of the Russian Federation (I.M. Sechenov First MSMU), 8/2 Trubetskaya Street, 119991 Moscow, Russia

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Methods

In order to determine the acute toxicity and pharmacological activity of the studied object, we used some well-known methods of analysis [7]:

- Acute toxicity was determined on white mice and rats according to the guidelines of the Pharmacological Committee [8]. Determination of acute toxicity was conducted according to the Kerber's method with the determination of LD50 [7].
- Diuretic activity was determined in white mice by the method of Berkhin [9].
- Anti-inflammatory activity was determined in albino rats. Determination of anti-inflammatory activity of multicomponent herbal medicine and the control drug was limited to the assessment of their impact on the exudative phase of inflammation by Strelnikov [10], on the proliferation phase – by Trinus [11] and the process of alteration – by Oyvin [12].
- Antibacterial activity in vitro was determined by serial dilutions on meat-peptone broth. Gram-positive and Gram-negative strains of bacteria were used as test organisms [7,13].
- Antioxidant activity was determined in albino rats. Serum MDA concentration was determined by the method of Temirbulatov and Seleznev [14].
- Spasmolytic activity was determined on isolated segment of small intestine of white rats [15].

Results and Discussion

During screening studies intended to select individual components of the herbal medicines, the main emphasis was made on comprehensive study of their pharmacological effects and assessing the contribution of each type of herbal raw materials in the formation of a stable comprehensive pharmacotherapeutic action of the herbal medicine in general.

Diuretic action is aimed at the increasing of urine volume and the frequency of urination. The urine is removed with excess of salts, products of metabolism, which is important in case of violation of the colloidal state and often leads to the development of urolithiasis. Diuretic effect is indicated in case of small peripheral edema, hypertension, after endoscopic interventions, and lithokinetik therapy of small stones of pyelocaliceal system and ureters [16]. Plant diuretics are called water diuretics since they excrete only water from the organism. Herbal diuretics stimulate the glomerular filtration rate as well as the formation of primary urine due to an increase in the renal blood flow and/or acceleration of osmotic processes. Water diuretics have a number of advantages over saluretics that implement their diuretic effect through acceleration of osmotic processes. Water diuretics stimulate the glomerular filtration rate as well as the formation of primary urine due to an increase in the renal blood flow and/or acceleration of osmotic processes. Water diuretics have a number of advantages over saluretics that implement their diuretic effect through acceleration of osmotic processes.

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Antioxidant activity was determined in albino rats. Serum MDA concentration was determined by the method of Temirbulatov and Seleznev [14].

Spasmolytic activity is determined on isolated segment of small intestine of white rats [15].

Immunomodulatory activity is able to provide a stimulating effect on the main elements of cellular and humoral immunity. When giving herbal medicine to patients with urolithiasis, it is essential to improve the body's resistance [16].

The initial composition of the comprehensive herbal medicine was selected and proposed taking into account the data on the pharmacological effects of each component on the body. The preliminary pharmacological test data have also shown the effectiveness and the prospects of the proposed multicomponent herbal medicine for the further study.
The list of pharmacological activities of medicinal plants being the component of herbal medicines:

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<th>Medicinal plants</th>
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<th>Pharmacological activities</th>
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<td>In vivo animals</td>
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<td>Anethum graveolens (L.)</td>
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<td>Vaccinium vitis-idaea (L.)</td>
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<td>Diuretic [33]</td>
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<td>Arctium lappa (L.)</td>
<td>In vitro</td>
<td>Antioxidant [37,38]</td>
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<td>In vivo animals</td>
<td>Preventing precipitation of crystals in kidneys [39]</td>
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References


