

**MODERN TREATMENT APPROACHES FOR URINARY STONE DISEASE  
(UROLITHIASIS)**

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**Abstract**

Urinary stone disease (urolithiasis) is a widespread urological disorder characterized by the formation of calculi within the urinary tract. It represents a significant clinical and economic burden due to its high prevalence, recurrence rate, and potential complications. Recent decades have witnessed remarkable progress in the management of urolithiasis, shifting from open surgical procedures toward minimally invasive and non-invasive techniques. This article provides a comprehensive review of modern treatment approaches for urinary stone disease, including conservative management, pharmacological therapy, extracorporeal shock wave lithotripsy, endourological interventions, and preventive strategies aimed at reducing recurrence.

**Keywords**

Urinary stone disease; Urolithiasis; Extracorporeal shock wave lithotripsy; Ureterscopy; Percutaneous nephrolithotomy; Minimally invasive treatment

**Introduction**

Urolithiasis is one of the most common diseases of the urinary system, affecting individuals of all ages and both sexes. The incidence of urinary stone disease has increased globally due to changes in lifestyle, dietary habits, and environmental factors. Stone formation is a multifactorial process involving metabolic abnormalities, urinary tract infections, genetic predisposition, and inadequate fluid intake.

**Conservative Management**

Conservative or expectant management is recommended for patients with small, uncomplicated stones. Stones measuring less than 5 mm in diameter often pass spontaneously. Conservative treatment includes adequate hydration, analgesia, and medical expulsive therapy.

**Pharmacological Therapy**

Pharmacological treatment plays an important role in both acute management and long-term prevention. Urine alkalinization with potassium citrate is effective in dissolving uric acid stones.

**Extracorporeal Shock Wave Lithotripsy**

ESWL is a non-invasive treatment modality that uses focused shock waves to fragment urinary stones. Extracorporeal shock wave lithotripsy: how are stones crushed using ultrasound? Extracorporeal shock wave lithotripsy (ESWL) is one of the basic methods of treating urolithiasis and recommended methods for removing small and medium-sized stones (<20mm) in most international manuals. Kidney stones up to 20mm in size, excluding the lower calyx. Concretions of the lower calyx of the kidney up to 10 mm in size. Concretions of the upper and lower parts of the ureter with a stone size of <10mm.

Bladder stones. The principle of operation of a remote lithotripter is based on the destruction of stones in the human urinary tract by focused acoustic shock waves created in water by an

underwater spark electric discharge or other energy source. Destruction occurs gradually and continues until the stone fragments into sand and small fragments, which are painlessly excreted along with urine. In this case, the shock wave passing through the patient's body outside the focal zone in which the calculus is located does not damage tissues and organs. When performing remote crushing, there is no need to make incisions, punctures, or introduce special endoscopic instruments into the lumen of the urinary tract, which makes this treatment method non-traumatic and highly effective.

**Remote shock -wave lithotripsy:** The SLK MODULIT features a revolutionary new design: a compact shock wave source mounted on a flexible, movable articulated arm provides a wide energy range for all shock wave readings. The device allows for remote crushing of kidney stones, upper, middle and lower parts of the ureter and bladder stones. The patient is placed on the operating table. The doctor places a soft pillow filled with water on the patient's body. Under ultrasound control, the shock wave penetrates the patient's body and is precisely focused on the stone.

#### Endourological Interventions

**Ureteroscopy and laser lithotripsy of ureteral stones.** Ureteroscopy is a procedure in which a thin tube (ureteroscope) is inserted into the bladder and then into the ureter (the "tube" that connects the kidney to the bladder) and is used to diagnose and treat various urinary tract diseases. For ureteral stones, ureteroscopy allows the urologist to examine the ureter, find the stone and remove it. The ureteroscope can be rigid or flexible and allows the urologist to pass up the ureter to the stone and see it on a video monitor through a fiber optic.

The reduction in the outer diameter of ureteroscopes and the emergence of modern semi-rigid, flexible miniscopes (fibroureteroscopes) made it possible to avoid, in most cases, the need to expand the cell and the lower part of the ureter, and to significantly reduce the frequency of cases when pathological formation of the upper urinary tract was unattainable for the ureteral trauma instrument. Ureteroscopic lithotripsy has become the treatment of choice for the treatment of ureteral stones due to its safety and effectiveness. Endoscopic lithotripsy involves visualizing the stone in the urinary tract and simultaneously applying energy to fragment the stone or stones into small pieces and sand. The holmium laser currently remains one of the most popular tools in urological procedures, including lithotripsy. One of the main advantages of the holmium laser is that it can effectively fragment urinary stones regardless of their size, hardness, chemical composition or physical consistency; accordingly, a high stone removal rate can be achieved. Therefore, ureteroscopic laser lithotripsy is recommended as the gold standard intracorporeal lithotripsy for the endoscopic treatment of urinary tract stones [Aboumarzouk, O.M., et al. J Endourol, 2012].

#### Conclusion

Modern treatment of urinary stone disease is based on minimally invasive and patient-specific approaches.

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