

A Novel Endoscope to Treat Bladder Stone

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Abstract

Purpose: To recommend a novel endoscope, Aihua (AH)-1 stone removal system (SRS), and introduce the structure and function to treat bladder stones.

Materials: SRS is composed by illuminant and imaging component, continuous-flow component, a jaw to grab and extract stone, lithotripsy tube, handle, and sheath. The entire device is usually attached to a video camera to provide vision for the surgeon. During surgical procedure, first 26F SRS was inserted into bladder to search stone. Then, stone was grabbed and fixed using jaw, and lithotripsy was performed with holmium laser or pneumatic lithotripter through lithotripsy tube. Fragments could be extracted using jaw through sheath synchronously. If there were more residual small fragments, Ellik evacuator could be connected with sheath to wash out them. Finally, resectoscope was inserted in urethra to perform transurethral resection of the prostate (TURP). Between January 2008 and July 2010, 37 cases of bladder stone with benign prostatic hyperplasia were treated by SRS combined with TURP. The device was designed by Aihua Li, M.D., and manufactured by Hangzhou Tonglu Shikonghou Medical Instrument Co., Ltd.

Results: In the experiment *in vitro*, sphere >60 mm in diameter can be fixed with jaw by occlusive force and downward pressure, sphere <15 mm can be grabbed directly, and sphere <8 mm can be extracted through sheath. Inner diameter of the sheath is 8.2 mm, and it can be connected with Ellik evacuator. The lithotripsy tube is 1.4 mm in inner diameter, by which, holmium laser fiber or pneumatic lithotripter probe can be transited to perform lithotripsy. In the clinical study, the designed multiple functions had been

showed in cystolithotripsy. The jaw, like a ring in longitudinal, is located at the front of objective lens and open downward, and the central part still is a circular cavity when it is closed. The lithotripsy tube is located at the lower edge of objective lens, which facilitates fragmentation in direct vision. Two jaw pieces are frame-shaped, which is favorable to grab and fix stone. Two little bars are installed at the far end of jaw so that it can be used to extract stone fragments through sheath as a trawler and more fragments can be extracted at one time. On other hand, Ellik evacuator can be connected with sheath to wash out small fragments. The principle of swing flow is applied in design that makes the device to collect fragments automatically. In stone fragmentation, holmium laser fiber or pneumatic lithotripter probe can be transited through lithotripsy tube to crush stones. Stones in 19 patients were <2 cm, the mean size was 1.36 ± 0.33 (0.7–1.8) cm, and stone removal time was 6.32 ± 4.44 min. Among these patients, those with multiple stones were five (35.71%), the stone number was 3.2 ± 1.30 , and mean size was 1.24 ± 0.25 cm. Stones in other 18 patients were >2 cm, the mean size was 3.49 ± 1.32 (2.0–6.4) cm, and stone removal time was 32.88 ± 24.21 min. Among these patients, those with multiple stones were six (37.50%), the stone number was 6.67 ± 6.67 , and mean size was 2.51 ± 0.93 cm. TURP was performed first in three patients for urethral stricture or larger median lobe of prostate. No significant complication was found in the surgical procedure. However, a patient with multiple stone who was 97 years old, with a largest stone in 5.8 cm, second lager stone in 2.2 cm, and other 15 stones <2 cm, undergone a second endoscopic procedure at 14 day postoperatively for surgical safety.

Conclusion: SRS is a novel endoscope with multiple functions to treat bladder stone. Our study shows that multiple functions such as fixing stone, crushing stone, automatically gathering stone, extracting stone, washing out stone, and continuous-flow can be expected when SRS is applied in cystolithotripsy. Especially, it can be used to automatically collect stone by swirling flow and extract more stones by jaw through sheath at one time, which can effectively reduce stone removal time and surgical damage to urethral mucosa. SRS combined with TURP is an effective and rapid modality to treat bladder stone with benign prostatic hyperplasia.^{1–6} This minimally invasive endoscopic procedure appears to be safe and efficient, and could expand the range of operating indications on cystolithotripsy. Additional randomized trials comparing other endoscopes are warranted to delineate the best device to manage bladder stone.^{7–11}

No competing financial interests exist.

Runtime of video: 9 mins 20 secs

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