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ORIGINAL ARTICLE

Fluoroscopy free flexible ureteroscopy with holmium: Yttrium-aluminium-garnet laser lithotripsy for removal of renal calculi

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KEYWORDS

Renal calculi;
Ureteroscopy;
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Lithotripsy

ABBREVIATIONS

KUB, plain abdominal radiograph of the kidneys ureters and bladder;
PCNL, percutaneous nephrolithotomy;
PCS, Pelvicalyceal system;
SFR, stone-free rate;
SWL, shockwave lithotripsy;

Abstract ***Objective:*** To evaluate the feasibility of access sheath insertion and ureteric stent placement without image guidance in flexible ureteroscopic lithotripsy with holmium:yttrium-aluminium-garnet laser for renal stones.

Patients and methods: Between March 2014 and October 2015, 80 patients with renal stones treated with flexible ureteroscopic laser lithotripsy were evaluated. Indications for surgery were renal obstruction, failed shockwave lithotripsy (SWL), stones in polycystic kidneys, and mal-rotated kidneys. A 6.5-F Cobra flexible ureteroscope was used in all cases with an access sheath of 12 F, 35/45 cm in length. Fluoroscopy was not intended for use in all cases and postoperative JJ stenting was optional. The perioperative complications were listed and the collected data were analysed.

Results: The study included 80 patients (66 male, 14 female), with a mean (SD; range) age of 48.2 (8; 28–54) years and a stone burden of 13 (3.5; range 6–23) mm. In all, 26 patients had a stone burden of >15 mm and 48 patients had lower calyceal stones. The mean (SD; range) operative time was 71.5 (20; 25–130) min. Overall, 76 (95%) access sheath insertions were performed successfully without the use of fluoroscopy. JJ stenting was used in 22 patients (27.5%). The mean (SD; range) hospital stay was 10 (8.5; 10–36) h. After one session, a stone-free rate (SFR) of 87.5% was achieved (93.3% for stones of <15 mm). A single session was

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URS, ureteroscopy;
URSL, ureteroscopic laser lithotripsy;
US, ultrasonography/ultrasound;
YAG, yttrium-aluminium-garnet

successful in 87.9% of cases with lower calyceal stones, with a SFR of 91.7% for post-SWL failure cases. The perioperative complication rate was 15%.

Conclusion: Access sheath insertion without fluoroscopic guidance is feasible. This technique reduces radiation exposure in patients requiring flexible ureteroscopy.

Introduction

In the last two decades, shockwave lithotripsy (SWL) has been the first-line treatment for upper ureteric calculi of <20 mm. However, these stones are increasingly being treated by flexible ureteroscopes with holmium:yttrium-aluminium-garnet (Ho:YAG) laser lithotripsy. Growing awareness of the radiation hazards associated with routine medical imaging and intraoperative exposure has prompted the search for methods to reduce patient, surgeon, and intraoperative team exposure [1]. The USA Food and Drug Administration recommend that physicians reduce radiation exposure during imaging studies and fluoroscopic-guided procedures [2]. During flexible ureteroscopic lithotripsy, the placement of a ureteric access sheath exposes the patient to significant amounts of radiation. Thus, the goal is to insert the access sheath without the use of fluoroscopy. In the present study, we evaluated the feasibility of access sheath insertion and ureteric stent placement without image guidance in flexible ureteroscopic lithotripsy with Ho:YAG laser for renal stones.

Patients and methods

Between March 2014 and October 2015, 80 patients with renal stones treated with flexible ureteroscopic laser lithotripsy (URSL) were evaluated. Indications for surgery were: renal obstruction, failed SWL, stones in polycystic kidneys, and mal-rotated kidneys, calculi in calyceal diverticula, calculi in inferior calyces with narrow, long infundibulum, calculus in a patient with severe kyphoscoliosis and presence of coagulopathy, including use of warfarin. A Cobra flexible ureteroscope (6.5 F Wolf) was used in all cases with an access sheath of 12 F, 35/45 cm in length (Fig. 1A–C), and Road runner guidewires. A fluoroscope was not intended to be used in any of the cases. Intraoperative stenting was optional and stents were inserted under direct vision using a rigid 8-F ureteroscope with a 5-F working channel. The perioperative complications were recorded.

Surgical procedure

All patients received prophylactic parenteral third generation cephalosporin antibiotics (Ceftriaxone) preoperatively. General anaesthesia and endotracheal intubation or laryngeal mask associated with neuromuscular blockage was used for all patients.

Briefly, after diagnostic ureteroscopy (URS), a 0.64-mm straight tip Terumo guidewire was smoothly positioned in the kidney and a 0.89-mm straight tip Road runner guidewire was inserted in the ureter up to the kidney. Ureteric dilatation was performed by the use of two semi-rigid ureteroscopes. The first ureteroscope 6–7.5 F was inserted and maintained *in situ* for 2 min, followed by the second larger ureteroscope 8.5–11 F under direct vision. The introduction of a 12-F access sheath after dilatation was feasible and convenient without any difficulties in most of the cases. Presence of a pre-existing stent obviated the need for dilatation. Using good lubrication, a cystoscopic sheath 18–22 F was inserted guided with the Road runner guidewire into the bladder. A technique was devised to allow placement of a ureteric access sheath without image guidance by replacing fluoroscopy with visual and tactile cues. The access sheath 12 F, 35/45 cm in length (Navigator, Boston Scientific Corp., USA) was used in all patients (Fig. 1A), as it yields direct access to the renal pelvis, better fluid irrigation, and permits removal of stone fragments. In female patients, we attempted to use the short access sheath (35 cm) without the cystoscopic sheath. We fixed an 8-F Foley catheter to maintain bladder drainage during the procedure instead the cystoscopic sheath in females.

The flexible ureteroscope (Richard Wolf Medical Instruments Corp., USA) has outer and tip diameters of 9.9 F and 6 F, respectively. This instrument has the same upwards and downwards deflection of 270°. It was introduced through the access sheath to the renal pelvis (Fig. 1C) [3]. Once the scope reaches the pelvicalyceal system, it is rotated gently on both sides with use of the deflecting mechanism, to visualise the pelvicalyceal system clearly. Continuous irrigation and/or intermittent manual pumping of normal saline ensured a clear ureteroscopic view. Once the particular calyx is identified and the calculus is seen, the Ho:YAG laser was inserted (200–272 μm fibre, Megapulse stone laser, Richard Wolf Medical Instruments Corp.) for fragmentation. The laser apparatus settings were adjusted to produce 200–4000 mJ with a pulse frequency of 3–25 Hz. After complete fragmentation, the process is stopped when only very small stone fragments (2 mm) are seen, avoiding the need for basket stone retrieval. The laser fibre was