Original article

Non-Fluoroscopic Uretero-Lithotripsy for Distal and Mid Ureteric Stone: Is it Safe and Feasible? Single Center Experience

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Abstract:

Objective: To assess safety and feasibility of completely non-fluoroscopic ureteroscopy for treatment of mid and distal ureteric stone in term of stone free-rate and complications. ***Material and Methods***: Over study period between January 2014 and January 2015, ninety-one complete fluoroscopy-less semirigid ureteroscopies were performed for treatment of symptomatic ureteric stones. Age, sex, stone size, location, side, operative time, auxiliary procedures, stonefree rate and complications, all were assessed. A Stone-free rate was defined as the lack of radiographic evidence of residual stone at 4 weeks. Postoperative imaging, and complications were grading according to modified Clavien classification system, which used initially to grade complications of general surgery. ***Results***: The average age of our subjects was 32.9, with male and right side predominant, 68 % and 64.8% respectively. The average stone size and operative time were 10.07 and 32.08 respectively. Fifty six semirigid retrograde ureteroscopies were done for distal ureteric and 35 for mid ureteric stones, achieving 91.2% stone –free rate, with overall intraoperative complications of 18.6%. All cases were managed on day case basis, ureters were stenting preoperatively in 37 patients and all cases were stenting with an appropriate size of double J. ***Conclusion***: Zero fluoroscopic semirigid retrograde ureteroscopy is a safe and feasible treatment modality for management of distal and mid ureteric stones.

Key words: ureteric stone; ureteroscopy; fluoroscopy.

Introduction

Urolithiasis is a major clinical and economic burden for modern health care system, at an annual cost of more than two billion dollars.[1] International epidemiological data suggest that the prevalence of stone disease is steadily increasing with an estimated lifetime prevalence between 7-12%.[2] Meanwhile, the treatment for urinary calculi has continuously evolved in last decades from cut for stone to fish out the stone , with the number of ureteroscopies (URS) performed for stone disease increasing by 127% over last 10 period 2000-2010, as consequences of technological advances in medicine, particularly in endourology; in addition the current guidelines recommended URS, over other treatments modalities including open surgery and in situ extra corporeal shock wave lithotripsy (ESWL), for majority of ureteric stones, with low complication rates, high stone free rate , short hospital stay and minimal contra-indications for the procedure.[3,4]

However conventional ureteroscopy relies on intraoperative fluoroscopy for guidance and visualization, exposing operating room staff, surgeon and patient to non-ionizing radiation, although exposure from single, fluoroscopically ureteroscopy is relatively low compared with levels delivered by a computed tomography (CT) scan, the effects are cumulative and many patients with stone disease require more endourological procedures and CT scan.[5]

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Recently, the Food and Drug Administration and United States National Council on Radiation Protection and Measurements (NCRP), both have been released a public health advisory encouraging physician to limit the use of fluoroscopy and promotes the "as low as reasonable achievable" (ALARA) principle when using ionizing radiation for medical purposes.[6,7]

Moreover, the contemporary studies has been shown a trend toward radiation –free techniques of ureteroscopy to be applied for general population to manage ureteric stone in a safe and an effective manner without ionizing radiation. In this study, We are aim to evaluate stone-free rate and complications with completely non-fluoroscopic ureteroscopy for treatment of ureteric stone.

Material and methods

After obtaining approval from ethical committee of our institute, medical records of patients who underwent semirigid retrograde ureteroscopy procedure by experienced surgeon for treatment of ureteric stone were reviewed.

All patients were assessed by urinalysis, urine culture and sensitivity, complete blood count, blood urea, serum creatinine, kidney, ureter and bladder (KUB) X-ray and ultrasonography.

Non-contrasted KUB CT scan and/or intravenous urography (IVU) were requested for radiolucent stone, history of previous surgery or instrumentation of kidney, ureter bladder, and when KUB U/S showed moderated to sever hydronephrosis and hydroureter. Proximal ureteric stone, multiple ureteral lithiasis, stone more than 2 cm in length, history of treatment with more than one session of external shock wave lithotripsy, pyonephrosis and sepsis, all were our exclusion criteria Over period of the study between January 2014 and January 2015, and after exclusion criteria applied, 91 semirigid ureteroscopies were performed for symptomatic and in whom four weeks of medical therapy failed. The variables assessed were age, sex, stone size, location, side, operative time, auxiliary procedures, stone-free rate and complications.

Stone-free rate was defined as the lack of radiographic evidence of residual stone at four weeks postoperative imaging.

The complications were grading according to modified Clavien classification system, which used initially to grade complications of general surgery; Currently after modification and validated further, its use is prevailing in most aspect of urology.[8]

Surgical technique

Risk of conversion to open intervention, possibility of nephrostomy, residual stone and need for re-ureteroscopy, all were included in informed consent signed patients. Patients with positive urine culture were treated with antibiotics accordingly and intravenous antibiotics (Ceftriaxone 1 gram or 500 mg amikacin) were routinely perioperatively given to all patients.

Ureteroscopies were performed under general or spinal anesthesia in dorsal lithotomy position and a 20 mg of lasix was given intravenously at time of induction of anesthesia.

An appropriate rigid cystoscopy was used to inspect urethra, bladder and ureteric orifices, and to insert a 5 Fr/70cm calibrated open-end flexi tip ureteral catheter (Cook Medical Inc, Bloomington, IN, USA) over 0.035-inch hydrophilic guide wire, after entrance of 25 -30 cm of ureteric catheter inside ureter, hydrophilic guide wire exchange with 0.035 PTFE-coating guide wire using 110 feedback and tactile cues.

The irrigation liquids were used glycine, normal saline or sterile water at room temperature. Ureteral orifice and intramural ureter was not dilated in all cases and ureter was stenting before ureteroscopy in 35 cases, and an appropriate semi-rigid ureteroscopies were used.

We gained access to the ureter alongside the guide wire and under visual guidance. Any difficulties in negotiating the ureteric orifice were overcome either by inserting a second guide wire through the working channel of the ureteroscope and advancing the ureteroscope between the two guide wires under visual guidance, or by rotating the instrument gently by 180° during insertion.

Stone was extract intact using either grasping forcep or basket in 4 cases, while 87 cases imposed fragmentation.

This was done using pneumatic or Holmium: Yttrium–aluminum–garnet (YAG) laser lithotripters (KARL STORZ GmbH & Co. KG –Tuttlingen, Germany). After this, the guide wire was position in renal pelvis or upper calyx via ureteroscopy, and according to authors practice, a double J ureteral stent was temporarily inserted in all patients due to concern for ureteral inflammation and edema after instrumentation.

Following recovery from anesthesia, assessment of vital signs and KUB x-ray were done to ensure stone free status and double J stent position, patients discharged on a day case basis unless there is an indication for keeping them in hospital.

All patients scheduled to visit the clinic after 1 week unless there is uncontrolled pain, fever, hematuria, inability to pass urine or other complaints, where they should attend emergency department and were managed accordingly.

At 4 weeks postoperative, KUB U/S was performed to exclude residual stone and other complications. Clinically insignificant residual fragments (CIRFs) were defined as less than 2 mm, asymptomatic, noninfectious, and non-obstructive residual fragments. Indwelling double J stent was removed within 4-6 weeks postoperatively. Another KUB U/S was requested 6 weeks later after removal of DJ to exclude silent hydronephrosis.

Results

A total of 91 semi-rigid ureteroscopies were conducted to treat 56 distal and 35 mid ureteric stones, with average stone size of 10.07 (range 5-17) mm. The average age of our cohort was 32.9 (range 5-75) year, with dominate male gender (no.62) and right side ureteric stone (no.59).

Stone-free rate after a single ureteroscopy was 91.2% (83 cases), The stone was extracted intact by basket in 4 cases, Ho.:YAG laser lithotripsy was used in 38 cases and 49 ureteric stones were fragmented by pneumatic lithotripsy, with average operative time of 32.08 (range 15-45) minutes.

At the end of the procedure an appropriate size of double J ureteric stent was inserted in all patients. Ureteroscopy and lithotripsy was incomplete in 7 cases due to retropulsion of calculi (4 cases), and failure to negotiate ureteric orifice or to reach the stone due to luminal narrowing in another 3 cases.

The overall rate of intraoperative complications was 18.6% (17 cases), these were represented by mucosal lesion (9), bleeding (6) and perforation (2). According to their mechanism and depth, the lesion of ureteral mucosa were classified in: false passage (5) and mucosal abrasion (4). They occurred during guide wire placement, ureteroscopy ascending, lithotripsy or stone extraction, and in all cases, the procedure was completed.

The ureteral perforation noted in 2 cases, occurred during lithotripsy and procedure was carried out without problem. Bleeding during ureteroscopy was usually minor, mostly as consequence of lesions occurring during ureteroscopy ascending, calculi fragmentation or manipulation. According to modified Clavien classification most of intraoperative complications (15) were grade 1, and 2 cases were classified as grade 3 b, necessitated only prolonged double J stenting.

Discussion

Interestingly, Ionizing radiation has been used in unrestrained form in our practice in last 10 years after released from embargo where the endourology equipments, radiological machines (CT scan, x-ray), ESWL becoming available in most of our hospitals, increasing the incidence, prevalence of urolithiasis and appearance of new generation of endourologist also leading to this liberal using of ionizing radiation.

The contemporary studies, showing increasing awareness of the morbidity of ionizing radiation exposure to patients, operating room staffs and surgeons in term of cataracts, malignancy potential, and occupational hazards of wearing protective leads during the procedure, such as chronic neck and lower back pain.[9-11]

In addition, there are a number of published studies describing several methods and technical modifications to reduce or preclude radiation associated with ureteroscopy, including pre-fluoroscopy checklist, intraoperative ultrasound, low dose and pulse fluoroscopy, visual and tactile cue to guide ureteroscopy while limiting fluoroscopy to to confirm stent position, and up to our best knowledge, this is a first study reviewing the experience of conducting ureteroscopies without aid of radiological tools (ultrasound or fluoroscopy).[12-14]

According to the European urology association (EUA) guidelines, semirigid ureteroscopy achieves a stone-free rate (SFR) of 86% and 94% for mid and distal ureteric stones respectively. In our study, we achieved an overall SFR of 91.3%.[15] On the other side the complications of URS in general are minor and self-limiting, only few major complications require surgical management or result in mortality had been reported. Overall complication rate reported in literature varies between 3.5% to 30%. [16]

In our experience, the general rate of intraoperative complications was 18.6%. According to the Modified Clavien classification scale , we have five grades for complications, Grade 1 and 2 equivalents to minor complications while grades 3-5 are regarded as major, and most of our complications were classified

as minor 88.2% (n=15), while major complications represent about 11.7% (n=2) of our work, both of complications not impairing the success of procedure and necessitated prolonged DJ stenting, and in agreement with other studies using same structural, objective classification system to grade the complications, as Ibrahim et al and Mandal et al showed complication rates of 26.6 and 30% respectively.[17,18] However, studies from centers of excellence with long experience showed a lower rate of complications as Georgescu et al reported a general rate of intraoperative complications of 2.8%.[19]

The mean operative time for our procedure was 32.08 (range 15-45) minutes, in agreement with Georgescu et al whom reported a mean intraoperative time of 34.6 minutes for his classical ureteroscopy, on other side Tepeler et al reported a mean operative time of 34.51 minutes for his limited fluoroscopy-guide ureteroscopy.[19,20]

Extracorporeal shock wave lithotripsy was another non invasive treatment option for ureteric stone as recommend by European urology associated guidelines, recent studies comparing ESWL and URS regarding x-ray exposure of the patient, although radiation risk from fluoroscopy guided ESWL is low, ESWL cannot be considered a safe treatment procedure, because of cumulative effect due to repetition of procedure in addition to pre and post treatment exposure.[21]

Recently, the option of completely fluoroscopy-less guided ureteroscopy becoming a point of interesting especially for management of recurrent stone, pediatric, young age population and pregnant women, as exposure to ionizing radiation at age of 30 increase the incidence of cancers of parenchymal organs till the age of 70 by 35% per Gy for men and by 58% per Gy for women. [22]

The limitation of this study, firstly , the higher complication rate in comparison with oversea centers , as it is a medium size study and a single center experience , secondly it is not involved upper ureteric stone in its inclusion criteria as from our experience, lithotripsy for these stone showed high rate of retropulsion and necessitate further intervention as flexible ureteroscopy or ESWL .

Conclusion: completely fluoroscopy-less retrograde ureteroscopy is a safe, effective and feasible procedure for treatment of distal and mid ureteric stones, and no x-ray exposure is an important issue especially in management of pregnant women, pediatric and young age population and patients with recurrent stones.

Conflict of interest: There is no conflict of interest to disclosure

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