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## Original Article

# Comparison of miniaturized percutaneous nephrolithotomy and flexible ureterorenoscopy for moderate size renal stones in elderly patients

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Received 29 June 2017; accepted 11 October 2017

**KEYWORDS**Aged;  
Ureteroscopy;  
Nephrolithiasis;  
Lithotripsy;  
Nephrostomy,  
percutaneous

**Abstract** Life expectancy has become longer, thus the number of elderly people who require treatment for nephrolithiasis has increased. We aimed to analyze the efficacy of flexible ureterorenoscopy (f-URS) and miniaturized percutaneous nephrolithotomy (mPNL) in the management of 10 and 30 mm renal stones in patients aged >60 years. In prospective non-randomized series, the data of patients who underwent f-URS or mPNL for kidney stones between July 2013 and July 2016 were analyzed. The procedure was accepted as successful if the patient was achieved complete stone clearance according to CT imaging between 1–3 months postoperatively. In total 60 patients and 58 patients were underwent f-URS and mPNL, respectively. The mean operation time, fluoroscopy time and hospitalization time were significantly shorter for the f-URS ( $p < 0.001$ ,  $p < 0.001$ ,  $p < 0.001$ , respectively). According to Clavien classification system, complication rates were not significantly different between the groups ( $p = 0.673$ ). The stone-free rate was 81.7% for the f-URS group and 77.6% for the mPNL group after a single-session procedure ( $p = 0.747$ ). Calcium oxalate monohydrate stones were the most common stone type in both groups. In multivariate analysis, multiple stones localization was only independent factor to predict complications. Our study had showed that both f-URS and mPNL are effective treatment modalities for 10–30-mm renal stones in elderly patients. Additionally, presence of stones in multiple location was the only predictive factor for complication development.

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Conflicts of interest: All authors declare no conflicts of interest.

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<https://doi.org/10.1016/j.kjms.2017.10.003>

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Please cite this article in press as: Ozgor F, et al., Comparison of miniaturized percutaneous nephrolithotomy and flexible ureterorenoscopy for moderate size renal stones in elderly patients, Kaohsiung Journal of Medical Sciences (2017), <https://doi.org/10.1016/j.kjms.2017.10.003>

## Introduction

Nephrolithiasis was a widespread disorder worldwide and affected nearly 5% of the population in industrialized countries. Despite it not having a life-threatening nature, nephrolithiasis is associated with deterioration of patients' life quality, an economic burden to the healthcare system, and a high recurrence rate up to 50% in a 5-year period [1]. On the other hand, life expectancy has become longer, especially for industrialized countries in the last decades, thus the number of elderly people who require treatment for nephrolithiasis has increased [2]. Although age *per se* is not a disorder, age-related impairment in body function is observed in the elderly population and treatment choices become complicated.

Recently, minimally invasive treatment modalities including miniaturized percutaneous nephrolithotomy (mPNL) and flexible ureterorenoscopy (f-URS) are widely performed with acceptable stone-free and complication rates. The combination of modern flexible ureterorenoscopes and holmium laser assure effective stone fragmentation while using natural orifices [3]. Other size, access through 14F–20F is called mPNL and mPNL provides less hemorrhagic complications and postoperative morbidity compared with conventional percutaneous nephrolithotomy (cPNL) [4].

Although several studies have compared the efficiency of mPNL and f-URS for the management of kidney stones in the literature, no prospective studies have investigated mPNL and f-URS in elderly patients. In this study, our purpose was to analyze the efficacy of mPNL and f-URS in the management of renal stones in patients aged >60 years and reveal predictive factors for success and complication.

## Methods

In this prospective non-randomized series, the data of patients who underwent f-URS or mPNL for kidney stones in a tertiary academic center between July 2013 and July 2016 were analyzed. Patients aged >60 years who had renal stones between 10 and 30 mm were enrolled in the study. Exclusion criteria were patients with renal abnormalities, bleeding diathesis, and presence of nephrostomy tube before mPNL. The selection of surgery type was primarily based on the patients' choice, kidney and stone characteristics, anesthesia risk, and previous failed treatments.

A detailed medical history was obtained and a physical examination was performed for each patient. Stone characteristics were assessed using preoperative intravenous pyelography and/or non-contrast abdominal computerized tomography (CT). A sterile urine culture was obtained prior to surgery in all patients. Lastly, all patients signed an informed consent form before surgery.

### f-URS technique

In all cases, a standardized f-URS procedure was performed. Semi-rigid ureteroscopy was performed under general anesthesia for visual assessment of the ureter and to facilitate placing the ureteral access sheath (9.5/11 Fr or 11/13 Fr). A 7.5-Fr fiber-optic flexible ureterorenoscope (Storz FLEX-X 2, Tuttlingen, Germany) with a 200 or 273  $\mu$ m

laser fiber were used for stone fragmentation with energy of 0.8–1.5 J and a rate of 5–10 Hz. Stone fragments <2 mm were left for spontaneous passage and basket retrieval was performed for stone fragments >2 mm. At the end of each procedure, a 4.8-Fr JJ stent was routinely placed. Operation time was calculated as the time passed from insertion of a cystoscope to the completion of JJ stent placement. The JJ catheter was removed through cystoscopy 2 weeks after the operation.

### mPNL technique

A 5-Fr ureteral catheter was placed in the renal pelvis under general anesthesia. In the prone position, contrast media was used to visualize the calyceal system configuration and access was obtained to the proper calyx using an 18-G needle under a C-arm unit. After a 0.035-inch hydrophilic guide-wire was placed into the pelvicaliceal system, Amplatz dilators were used for dilatation and an 18- or 20-Fr Amplatz sheath was inserted. A combination of a 17-Fr rigid nephroscope and laser/ultrasonic lithotripter was used for stone fragmentation. Stone removal was performed using stone extraction forceps. In the event of residual fragments or presence of pelvicaliceal perforation, a nephrostomy tube was placed under fluoroscopy at the end of procedure. Operation time was defined as from access to desired calyx to nephrostomy tube insertion.

Operation success was assessed with a kidney-ureter-bladder (KUB) radiogram and/or urinary ultrasound at hospital discharge. Afterwards, follow-up stone-free rates were reevaluated in an outpatient clinic setting between 1 and 3 months postoperatively with abdominal CT. The procedure was accepted as successful if the patient was achieved complete stone clearance. Complications were classified according to the Clavien classification system [5].

### Statistical analysis

During statistical analyses, values were evaluated as numbers, means, percentages and intervals. Numbers and percentages were compared using the Chi-square test. Before the comparison of means of values, the values were evaluated for homogeneity. Homogeneously distributed values were compared using Student's t-test and heterogeneously distributed values were compared using the Mann–Whitney *U* test.

## Results

In total, 60 patients and 58 patients with 10–30 mm renal stones who underwent f-URS and mPNL, respectively, were enrolled in the study. Sex, age, body mass index, and American Society of Anesthesiologists (ASA) scores were similar between the groups ( $p = 0.584$ ,  $p = 0.493$ ,  $p = 0.554$ ,  $p = 0.812$ , respectively). Also, renal stone characteristics were comparable in terms of stone size and location of stone(s) ( $p = 0.166$  and  $p = 0.327$ ). Preoperative parameters are summarized in Table 1.

The mean operation time for the f-URS and mPNL was  $53.6 \pm 23.1$  min (range, 42–91 min) and  $103.5 \pm 37.5$  min (range, 62–135 min), respectively ( $p < 0.001$ ). Furthermore,

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