Journal of Pediatric Urology (2018) xx, 1.e1—1.e6

Combined use of flexible ureteroscopic lithotripsy with micro-percutaneous nephrolithotomy in pediatric multiple kidney stones

Jun Li, Wenying Wang, Yuan Du, Ye Tian

Department of Urology, Beijing Friendship Hospital, Capital Medical University, Beijing, China

Correspondence to: W. Wang, Department of Urology, Beijing Friendship Hospital, Capital Medical University, Beijing, 100050, China, Tel.: +86 010 6313 9043; fax: +86 010 6313 9043

1517829478@qq.com, miniaowwy@aliyun.com (W. Wang)

Keywords
Pediatric; Flexible ureteroscopic lithotripsy; Micro-percutaneous nephrolithotomy; Kidney stone

Received 24 October 2017
Accepted 10 March 2018
Available online xxx

Summary

Background
We investigated the clinical value of treating pediatric multiple kidney stones with extensive distribution using flexible ureteroscopic lithotripsy (FUL) combined with micro-percutaneous nephrolithotomy (micro-PNL).

Patients and methods
In total, 21 pediatric patients with multiple renal calculi between May 2016 and June 2017 received FUL combined with micro-PNL. The group included 13 boys and eight girls; the patients' mean age was 3.8 years (range 1—8 years). The maximum stone diameter ranged from 1.0 to 1.5 cm. FUL was first performed in the lithotomy position to fragment stones that were located in the renal pelvis, and upper and mid-renal calyx. Patients were then moved to a prone position, and micro-PNL was performed to treat lower pole stones that could not be reached by the flexible ureteroscope during FUL. Percutaneous renal access to the lower calyx was achieved using a 4.8F "all-seeing needle" with ultrasound guidance, and stone fragmentation was performed with a 200-μm holmium laser at different settings to disintegrate 1- to 2-mm fragments.

Results
All 21 pediatric patients with multiple kidney stones underwent combined FUL and micro-PNL. The stone free rate (SFR) was 85.7% (18/21). The mean surgical time was 45 min (range 30—70 min). The mean volume of irrigation fluid used was 480 mL (range 300—1200 mL). The mean surgical time for FUL and micro-PNL was 31 min and 14 min, respectively, and the mean volume of fluid used for FUL and micro-PNL was 360 mL and 120 mL, respectively. According to the modified Clavien classification, grade 1 and 2 postoperative complications occurred in five and one patients, respectively. The mean decrease in the level of hemoglobin was 0.4 g/dL (0—0.7 g/dL), and no patients required a transfusion. The average hospital stay was 3 days (range 2—5 days).

Conclusion
Combined FUL and micro-PNL is a safe, effective, and minimally invasive operation to remove multiple renal calculi with extensive distribution in children in selected cases.

https://doi.org/10.1016/j.jpurol.2018.03.005

Introduction

Urolithiasis is less common in children than in adults, representing approximately 7% of total stones [1]. The management of pediatric nephrolithiasis has changed substantially with advances in technology and has become more minimally invasive over the past few decades. European Association of Urology (EAU) guidelines have expanded the indications for endourological interventions, which include percutaneous nephrolithotomy (PNL) and flexible ureteroscopic lithotripsy (FUL), for the management of kidney stones. Although the stone-free rate (SFR) of large channel PNL is high, it usually requires large or multiple channels for complex stones; these channels can damage the kidney and are associated with high complication rates [2,3]. Minimally invasive methods (e.g., mini-PNL, micro-PNL, and FUL), have been used to prevent these complications. However, in young pediatric patients with multiple kidney stones, the efficiency of a single method is low, the residual stone rate is high, and recurrence is common. This study investigated the efficacy and safety of combined FUL and micro-PNL for pediatric patients with multiple renal calculi with extensive distribution. To the best of our knowledge, this is the first report to use this combined method in children.

Patients and methods

Clinical data

A total of 21 pediatric patients with multiple kidney stones who were admitted and treated between May 2016 and June 2017 were included in this study. All patients had multiple renal stones with extensive distribution; the stones located in the lower calyx were smaller than 1.5 cm; and the pelvicaliceal anatomy did not allow the flexible ureteroscope to reach the stones that were located in the lower pole during FUL, including narrow infundibulopelvic angle, long infundibular length, and small calyceal neck. If a single stone was larger than 2 cm, or stones located in the lower calyx were larger than 1.5 cm, mini-PNL, or other methods instead of micro-PNL, was performed. A preoperative routine B mode or 2D mode (B) ultrasound, plain abdominal radiograph of the kidney, ureter, and bladder (KUB) (Fig. 1), and non-contrast urinary computed tomography (CT) scan were performed to confirm the diagnoses. Routine urine tests and cultures were performed, and the specimens were obtained using the mid-stream clean catch method.

Figure 1 Plain abdominal radiograph showing right multiple stones with extensive distribution.

Surgical methods

Ureteral indwelling stents (4.7F/12—18 cm, Cook, Bloomington, IN, USA) were placed in all pediatric patients for passive dilatation of the ureter under intravenous general anesthesia at least 14 days before surgery. Intravenous antibiotics were started 2 days before surgery if the urine culture was negative; if the urine culture was positive, appropriate antibiotics based on antibiotic sensitivity were used before surgery.

General anesthesia was provided through a laryngeal mask or tracheal intubation, and an infant thermal insulation blanket was used. The irrigation and disinfectant fluid was pre-heated to 36 °C. With the patient in a lithotomy position, an 8/9.8F ureteroscope (Richard Wolf GmbH, Knittlingen, Germany) was used to remove the double J stent, and the bladder was filled with irrigation fluid. Suprapubic cystostomy with a 14G vein detained needle was performed for drainage of irrigation fluid in boys; for the girls, the 14G vein detained needle was placed in the bladder through the urethra. A 4.5/6.5F or 8/9.8F ureteroscope was used to insert a 0.035-inch nickel—titanium alloy guidewire. An F12/14 ureteral access sheath (UAS) was used in three patients; an F9/11.5 UAS was used in eight patients; and no UAS was used in 10 patients. A flexible ureteroscope (8F/30—42 cm, Poly Diagnost, Pfaffenhofen, Germany; or Richard Wolf, Knittlingen, Germany) was used. The renal pelvis and middle and upper calyx were explored using the flexible ureteroscope to localize stones. A 200-μm holmium laser fiber was inserted to fragment stones layer by layer. Before the removal of the ureteroscope, the 0.035-inch nickel—titanium alloy guidewire was retained, and the 5F open-ended ureteral catheter or double J stent was maintained to drain the kidney. The cystostomy was removed after FUL. The patients were then adjusted to a prone position, and percutaneous renal access to the lower calyx was achieved using a 4.8F "all-seeing needle" (polyDiagnost, Pfaffenhofen, Germany) with ultrasound guidance (Fig. 2A and B); then, the inner puncture shaft was removed. A three-way connector was applied to the outer tip of the shaft, allowing the insertion of a flexible, micro-optic and laser fiber. Stone fragmentation was performed with a 200-μm holmium laser in different settings to disintegrate fragments of 1—2 mm (Fig. 2C).