Simultaneous Treatment of Renal and Upper Ureteral Stone and Cysts With Percutaneous Nephrolithotomy and Cyst Laser Intrarenal Incision and Drainage

Xiaohui Hu†, Kehua Jiang†, Hongbo Chen*, Shenliang Zhu, Chunxiong Zhao

Purpose: To assess the feasibility and safety of percutaneous nephrolithotomy (PCNL) combined with cyst laser intrarenal incision and drainage in the management of renal and upper ureteral stones with ipsilateral renal cyst.

Materials and Methods: Between March 2011 and March 2016, 28 patients with ipsilateral renal cyst in renal and upper ureteral stones underwent PCNL combined with cyst laser intrarenal incision and drainage. The perioperative evaluated variables included operation time, cyst size after surgery, complications and stone-free rate(SFR).

Results: All patients successfully underwent the operation without conversion to open surgery. The mean operative time was 64.4±30.1 minutes; the mean hemoglobin reduction was 7.9±1.6 g/dL; the mean time to removal of nephrostomy tube and double J ureteral stent was 3.0±1.0 days, and 30.3±7.0 days; the mean hospital stay was 8.5±2.0 days. The SFR of all the patients was 89.3%(25/28), and no serious perioperative complications occurred.

Conclusion: PCNL combined with cyst laser intrarenal incision and drainage is a feasible and safe approach for treatment of renal and upper ureteral stones with ipsilateral renal cyst.

Keywords: percutaneous nephrolithotomy; laser intrarenal incision and drainage; renal stone; upper ureteral stone; renal cyst

INTRODUCTION

Kidney stone and renal cyst both are one of the most common diseases in urinary surgery, with high incidence and recurrence rates. At present, the therapies of kidney stone include extracorporeal shock wave lithotripsy (SWL), percutaneous nephrolithotomy (PCNL) and flexible ureteroscopy and Holium laser lithotripsy, among which PCNL is the main method in the treatment of the larger calculi[1-3]. For renal cyst, the treatments mainly consist of ultrasound-guided puncture drainage and laparoscopic unroofing decompression, but puncture drainage easily causes relapse. With regard to a patients with both kidney stone and renal cysts which both need surgery, staging surgery is the general treatment but patients are faced with increased numbers and risks of surgeries[4]. In recent years, some reports showed that flexible ureteroscopy with laser incision and drainage treatment of renal cyst unraveled a good curative effect, as well as percutaneous nephrolithotomy combined with unroofing decompression. But both their curative effect and safety need further evaluation. Based on this situation, for patients in the urology department in whom the kidney stone was associated with renal cyst, the authors performed PCNL combined with cyst laser intrarenal incision and drainage at the same time, which achieved the goal of curing two diseases at the same time and relieving the suffering of the patients with multiple surgeries, and evaluated its efficacy and safety.

PATIENTS AND METHODS

Study population

From March 2011 to March 2016, a total of 28 patients-16 men and 12 women- with renal and upper ureteral stones and ipsilateral renal cyst were identified for this study. This approach was approved by ethic committee of the central hospital of Enshi Tujia and Miao autonomous prefecture.

Patients' information included gender, age, body mass index (BMI), operative time and length of hospital stay(LOS) were recorded. preoperative ultrasound of urinary tract system, plain films of kidney, ureteral, bladder, intravenous urography(IVU), and contrast-enhanced CT scans of renal and ureter were perfomred to evaluate the cyst and stone size and location. CT scan disclosed renal or upper ureter stones combined with ipsilateral renal cyst (**Figures 1,2**). Renal cyst size, stone size, and renal cyst Bosniak classification was measured by CT scan. The SFR after surgery was also measured by CT scan and plain films of kidney, ureteral, bladder. Follow up duration was 6-24 months.

Surgical Technique

All procedures were performed under continuous epidural anesthesia or general anesthesia with the patients in the lithotomy position. A 5F ureteral catheter was inserted under direct cystoscopic vision. Then we placed the patient in the oblique supine position.

Then three steps were processed as followed. The first one was to determine the relationship of stones and cyst by ultrasound imaging and CT scans, which made per-

† These authors contributed equally to this work.

Department of Urology, The central hospital of Enshi Tujia and Miao Autonomous prefecture, Enshi, HuBei Province, China.

*Correspondence: Department of Urology, The central hospital of Enshi Tujia and Miao Autonomous prefecture, Enshi, HuBei Province, China.

Tel: 86-718-8263186. Fax:86-718-8263186. E-mail: jkh_urol@163.com.

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Table 1. Demographic characteristics and surgical statistics.

Patient number	Gender	Age (Year)	BMI kg/m^2	Side	Stone Size(cm)	Preoperative Cyst size(cm)	Bosniak classification	Surgical Time(min)	Stone residual	Complication	LOS (days)	Remove Dj	Cyst size 3m after Surgery (cm)	Follow up (month)
1	Male	33	18.4	Right	2.1	3.6	I	84	No	-	10	20	0.5	24
2	Male	56	30.9	Left	1.1	2.3	II	35	No	-	9	30	0	24
3	Male	54	25.4	Left	2.6	1.9	I	79	No	-	8	27	0	11
4	Male	19	22.3	Right	3.1	2.2	I	80	Yes	Fever	12	30	0	24
5	Male	50	25.1	Left	1.7	1.6	I	75	No	-	8	30	0	24
6	Male	34	20.6	Left	3.4	4.1	II	103	Yes	Transfusion	10	40	1.0	10
7	Male	59	22.7	Right	1.1	3.6	I	29	No	-	8	20	0.8	24
8	Male	30	26.7	Left	2.5	4.0	I	62	No	-	7	30	1.0	24
9	Male	22	25.8	Right	1.8	3.0	I	36	No	-	7	26	0	8
10	Male	53	25.7	Left	2.0	2.7	I	38	No	-	7	18	0	24
11	Male	27	23.6	Left	1.8	2.8	I	29	No	-	7	40	0	24
12	Male	56	18.9	Right	1.5	2.7	II	34	No	-	8	30	0	24
13	Male	72	21.3	Right	3.1	2.2	I	73	No	-	7	34	0	24
14	Male	52	25.4	Left	2.0	1.8	I	64	No	-	6	30	0	24
15	Male	63	23.4	Left	2.4	3.0	I	74	No	-	7	20	1.0	24
16	Male	51	27.3	Left	2.7	1.7	I	62	No	-	7	30	0	24
17	Female	26	22.5	Left	3.2	3.5	I	126	Yes	Fever	14	45	0	12
18	Female	59	29	Right	1.9	3.6	I	71	No	-	9	30	0	24
19	Female	55	20.3	Left	1.8	1.6	I	41	No	-	7	35	0	24
20	Female	18	19	Left	1.6	2.9	II	34	No	-	12	35	0	12
21	Female	34	23	Left	1.8	3.4	I	78	No	-	6	43	0	24
22	Female	64	25.9	Left	2.3	2.0	I	104	No	-	11	30	0	6
23	Female	32	27.7	Right	4.0	4.1	I	132	No	-	10	26	1.0	24
24	Female	62	21	Left	1.9	2.8	I	45	No	-	7	30	0	24
25	Female	55	24.2	Left	1.0	1.9	I	28	No	-	9	30	0	24
26	Female	35	20.7	Left	1.5	2.6	I	36	No	-	7	30	0	24
27	Female	26	18.5	Right	1.8	3.4	I	44	No	-	8	30	0.5	18
28	Female	20	23.5	Left	2.2	1.8	I	108	No	-	10	30	0	24

cutaneous access possible to simultaneously process calculi and cyst, then an 18-gauge access needle was successfully punctured into the desired target calyx with the guidance of ultrasound imaging. Collecting system entry was confirmed by methylene blue instillation through the ureteral catheter, a flexible 0.035-inch Zebra guidewire (Boston Scientific Corporation) was passed into the renal collecting system through the needle sheath, then needle was removed and the nephrostomy tract was dilated to 18F by fascial dilators and a matched peel-away sheath passed. Holmium laser lithotripsy was initiated after passing an 8/9.8 rigid nephroscope placed inside the access sheath with normal saline irrigation (**Figure 3a**). The stone fragments were flushed out by the forceful pulse flow. Third step: we found out the renal cystic wall which was convex in the inner of kidney, the wall of cyst fluctuating with water current could be seen (**Figure 3b**), and the cystic wall was cauterized from the bottom of cyst at the avascular area by holmium laser in order to decompress, then the inner cyst fluid outflowed (**Figure 3c**). We resected and removed the wall of cyst, the nephroscope was introduced into the interior of the cyst and the entire wall of the cyst was inspected (Figure 3d), then a double-J stent was placed into the cyst and a nephrostomy tube was placed routinely.

RESULTS

CT scans and IVUs were performed in all patients and

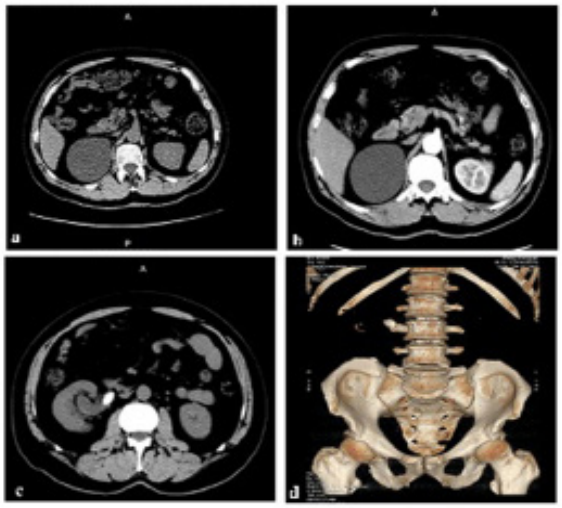

Figure 1. Computed tomography in a ureteropelvic joint stone with ipsilateral renal cyst.

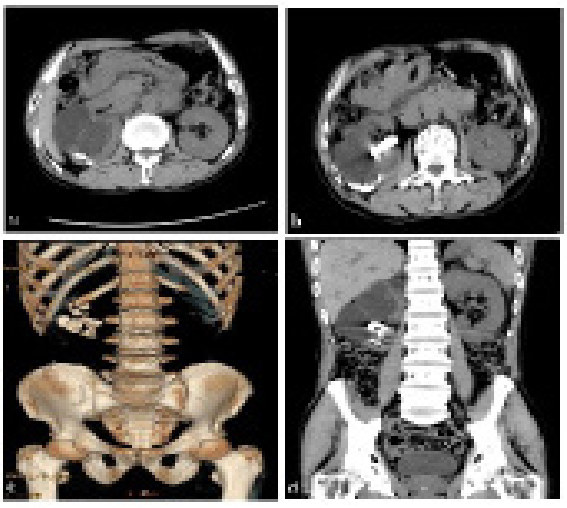

Figure 2. Computed tomography in multiple renal and upper ureteral stones with ipsilateral renal cyst.

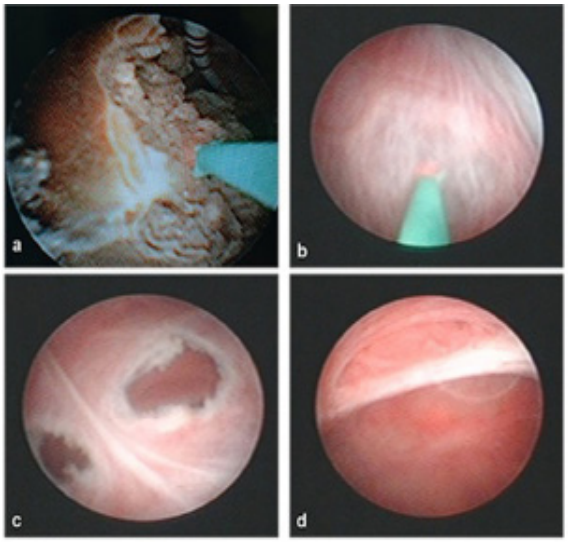

Figure 3. PCNL combined with percutaneous nephroscopic laser intrerenal incision for treatment of renal stones and cyst. (a) Percutaneous nephroscopic Holmium laser lithotripsy. (b) (c) The cyst wall was incised by Holmium laser from intrarenal. (d) The nephroscope was introduced into the interior of the cyst and the entire wall of the cyst was inspected.

Figure 4. Postoperative plain abdominal X-ray image and computed tomography (CT) show the double-J stent in the correct position, and demonstrate clearance of stones and disappearance of renal cyst in right kidney.

the presence of renal and upper ureteral stones with ipsilateral renal cyst were confirmed (**Figures 1, 2**). All the patients underwent successful PCNL combined with percutaneous nephroscopic cyst holmium laser intrarenal incision and drainage.

Their mean age was 43.5 ± 16.4 years and their body mass index was 23.8 ± 4.7 kg/m2. All of the patients complained of varying degrees of flank pain. Two patients had hematuria, three patients had renal colic. The mean stone size was 21 ± 16mm**,** the mean cyst size was 27 ± 13mm, 24 patients belong to grade I of Bosniak classification and 4 patients belong to grade II of Bosniak classification. In all patients, urine culture was negative, and no patient had pyuria; three patients had a history of previous stone surgery. Demographic parameters of patients' data were collected from medical charts and were listed in **Table 1**.

The KUB and CT scans performed 1 month after surgery assessed the SFR (**Figure 4**). Double J ureteral stent was removed after 3 months. Patients were discharged after removal of the nephrostomy tubes. They were followed up every 3 months in the first year and annually thereafter. Stone-free status or the presence of asymptomatic fragments < 4mm and renal cyst disappearance on postoperative CT and KUB were both recorded as successful outcomes. Postoperative follow-up lasted for 6-24 months; renal ultrasound showed no hydronephrosis in all patients. We found that both the stones and cyst did not relapse.

Operative characteristics are also listed in Table 1. All operations were performed successfully. No major complications occurred. One patient needed blood transfusion; two patients had fever after operation and the fever subside with antibiotics. All the patients had a single tract for PCNL. The mean operative time was 64.4 ± 30.1 minutes; the mean time to double J ureteral stent removal was 30.3 ± 7.0 days. The mean hospital stay was 8.5 ± 2.0 days. The SFR of all the patients was 89.3%(25/28). Three patients had residual stones in kidneys after operation; one patient had to undergo a second phase PCNL, and two patients had to undergo SWL.

DISCUSSION

Nowadays, Symptomatic renal calculus is generally treated by PCNL, flexible ureteroscopy, SWL or open surgery. The treatment applied depends on stone location, stone size and the degree of hydronephrosis. Renal cyst is mainly treated by percutaneous aspiration, laparoscopic renal cyst unroofing decompression, flexible ureteroscopic intrarenal incision and percutaneous nephroscopic renal cyst unroofing decompression[5-7]. The decision of therapeutic strategy depends on cyst size, patient symptoms and cyst location. Ultrasonic guiding percutaneous aspiration is applied as an effective approach for renal cysts but is limited by high rate of relapse and significant complications. Laparoscopic approach is recognized as the gold standard approach due to its good surgical field and curative effect. However, when compared with flexible ureteroscopy and percutaneous approach, it has some weaknesses, such as more port sites, extensive dissection and longer operative time[8,9]. Retrograde ureteroscopic management is the least invasive approach and has a low complication rate[10-12]. However, percutaneous technique has also been applied for treatment of renal cysts[7]. Many studies reported percutaneous marsupialization as a safe and efficient approach for treatment of renal cyst[13,14].

With regard to a patient with both kidney stone and renal cyst, Qiu et al.[15] reported single-session retroperitoneoscopic renal cyst decortication and retroperitoneoscopy-assisted PCNL for simultaneous treatment of renal cyst and stones. Chen et al.[16] reported percutaneous intrarenal cyst marsupialization and simultaneous nephrolithotomy for patients with renal cyst and ipsilateral calculi. The results showed that this method could decrease the costs and the potential injury risks. In our center, we also applied PCNL combined with percutane-

ous nephroscopic laser intrarenal incision and drainage for these patients. The main difference between Chen and our approach is whether 18-gauge needle puncture is passed through the cyst into the target calyx. If the cyst wall is thin, a needle is passed through the cyst into the target calyx which may cause urine leakage. However, we applied 18-gauge access needle which was punctured into the desired target calyx without injuring renal cyst with the guidance of ultrasound imaging, and the tract was dilated to 18F by fascial dilators, then the cystic wall was cauterized and cut open from the bottom of cyst at the avascular area by holmium laser in order to decompress. Then the incision was enlarged 2-4cm by holmium laser to achieve internal marsupialization, and at last the cyst was interconnected with collecting system. A 5F double-J stent was placed within the proximal end of the cyst.

Our results showed the mean operative time was lower than those reported by Chen (64.4 ± 30.1 minutes vs 68 minutes). The mean time to removal of double-J ureteral stent was 30.3 ± 7.0 days. The mean hospital stay was 8.5 ± 2.0 days. The mean SFR was 89.3%(25/28). The key point of our creation is that we choose a suitable puncture route without injuring external wall of renal cyst, which is selected carefully with important and precise information from preoperative CT and IVU to remove calculi and process intrarenal incision and drainage to decompress the cyst. It demonstrates that PCNL combined with percutaneous nephroscopic laser intrarenal incision and drainage is a safe and efficient approach in the management of renal and upper ureteral stones with ipsilateral renal cysts.

Also, our method has some deficiencies. Firstly, when faced with multiple renal cysts and excessive haemorrhage, it is difficult to deal with the cysts and calculi in one session because of risk of potential damage. Secondly, the prolonged placement time of double-J stent may affect the patient's quality of life and increase stent-related symptoms. Common symptoms include abdominal pain, frequent micturition, urinary urgency, hematuria, infection and so on. In addition, our approach is limited by its relatively small sample size and lack of a control group and limited follow-up. Thus, in subsequent study, we will assess the curative effect of PCNL combined with percutaneous nephroscopic laser intrarenal incision and drainage with larger sample and longer-term follow-up for treatment of renal and upper ureteral stones with ipsilateral renal cyst.

CONCLUSIONS

PCNL combined with cyst laser intrarenal incision and drainage is proved to be a safe, feasible and helpful procedure in management of renal and upper ureteral stoned with ipsilateral renal cyst.

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CONFLICT OF INTEREST

The authors report no conflict of interest.

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