Percutaneous Intrarenal Cyst Marsupialization and Simultaneous Nephrolithotomy in Selected Patients: Killing Two Birds With One Stone?

Hequn Chen, Lin Qi, Xiongbing Zu, Longfei Liu, Zhenzhen Cao, Feng Zeng, Jiping Niu, Yu Cui, and Long Wang

OBJECTIVE
To assess the safety, feasibility, and efficacy of percutaneous intrarenal cyst marsupialization and simultaneous nephrolithotomy in the management of a renal cyst with ipsilateral calculi in selected patients.

MATERIALS AND METHODS
Between July 2010 and August 2013, 16 patients (11 men and 5 women; mean age, 51 years) with a solitary posterior or parapelvic renal cyst and ipsilateral calculi underwent percutaneous intrarenal cyst marsupialization and simultaneous nephrolithotomy in our center. Mean cyst size was 6.3 cm (range, 4.2-11.8 cm). Mean stone surface area was 5.8 cm2 (range, 1.8-12.1 cm2). By preoperative computed tomography planning and interoperative ultrasound guidance, the optimal puncture route was selected carefully to marsupialize the cyst and approach the target calyx. The cyst was marsupialized into the collecting system at the dilation process. Subsequently, percutaneous nephrolithotomy was performed in a standard fashion.

RESULTS
The mean operative time was 68 minutes (range, 47-93 minutes), and the mean hospital stay was 4 days (range, 3-7 days). A nephrostomy tube and a double-J stent were placed for a prolonged period to ensure the channel remained opened. Nearly complete cyst regression and calculi clearance confirmed by postoperative imaging was achieved in all patients. No intraoperative or postoperative complications in Clavien grading score 2 were noted during a mean follow-up of 21 months (range, 8-25 months).

CONCLUSION
In selected patients with a posterior or parapelvic renal cyst and ipsilateral calculi, the percutaneous technique is a safe and effective option through intermediate follow-up.

The surgical approach for symptomatic renal cysts has evolved from open decortication to encompassing laparoscopic, antegrade percutaneous, and retrograde ureteroscopic techniques.1-3 Nevertheless, the coexistence of renal cysts and ipsilateral calculi remains a challenge to the urologist. Laparoscopic cyst decortication with concomitant pyelolithotomy or laparoscopically assisted percutaneous nephrolithotomy (PCNL) have been reported4,5 for treating renal cysts concomitant with calculi. However, there is still controversy regarding the ideal minimally invasive management.

Percutaneous intrarenal marsupialization has been performed to treat simple renal cysts since the 1980s.6 Many studies have confirmed the safety and efficacy of the procedure.1,7-10 This approach is more attractive if there are coexisting calculi that need treatment. In this study, we sought to determine the safety, feasibility, and efficacy of percutaneous intrarenal cyst marsupialization and simultaneous nephrolithotomy in the management of renal cyst with ipsilateral calculi in selected patients.

MATERIALS AND METHODS
This study was approved by the Central South University Ethic Committee.

Patient Characteristics
Between July 2010 and August 2013, 16 patients (11 men and 5 women) with a solitary renal cyst and ipsilateral calculi underwent percutaneous intrarenal cyst marsupialization and nephrolithotomy at our institution. All patients gave written consent before the procedure.
consent, and their information was recorded and saved in the hospital database.

The patients were admitted with complaints of flank pain, renal colic, or gross hematuria. Two patients had undergone a prior session of extracorporeal shockwave lithotripsy. One patient had undergone catheterization with a double-J stent because of persistent acute renal pain. The serum creatinine level in each patient was within normal reference ranges. Urinalysis revealed microscopic hematuria in 6 patients.

Plain abdominal radiography, ultrasonography, and computed tomography (CT) indicated that all patients had renal calculi and an ipsilateral solitary cyst (Fig. 1). Each cyst was located in different portions of the kidney, including the posterior middle in 11 (68.7%), the posterior upper in 1 (6.3%), the posterior lower in 2 (12.5%), and in the parapelvic region in 2 (12.5%). The mean cyst size on the preoperative CT scan was 6.3 cm (range, 4.2-11.8 cm). The mean stone surface area was 5.8 cm² (range, 1.8-12.1 cm²). Detailed demographic and clinical data are described in Table 1. Percutaneous intrarenal cyst marsupialization and concomitant nephrolithotomy was performed by an experienced urologic surgeon (H.C.) in all patients. All relevant data were collected retrospectively and evaluated.

**Surgical Procedure**

All procedures were performed under continuous epidural anesthesia or general anesthesia. The procedure began with the patients in the lithotomy position. A 5F ureteral catheter was inserted into the ureter under direct ureteroscopic vision. The patient was then placed prone for percutaneous access. Ultrasound imaging was used to find a proper puncture site to avoid injuries to the bowel and other organs surrounding the kidney. A puncture through the 11th intercostal space or the 12th subcostal space between the posterior axillary line and scapula line was preferred. Under ultrasound guidance, an 18-gauge needle was advanced well past the cyst into the target calyx (Fig. 2A).

Collecting system entry was confirmed by methylene blue instillation through the ureteral catheter. A flexible 0.035-inch Zebra guidewire (Boston Scientific Corp) was then inserted into the renal collecting system through the needle sheath. The tract was dilated to 18F by fascial dilators in a sequential fashion, and a matched peel-away sheath was then inserted. The cyst was marsupialized into the collecting system at the dilation process (Fig. 2B).

Next, an 8/9.8F rigid ureteroscope was placed inside the access sheath using normal saline irrigant (Fig. 2C), and a holmium laser combined with Swiss LithoClast (Electro Medical Systems) were used to fragment the renal stones. The petty

![Figure 1. (A) Plain abdominal x-ray image demonstrates left renal pelvic and lower calyceal calculi (arrows). (B and C) Nonenhanced CT scans show pelvic and lower calyceal calculi and a large exophytic cyst at posterior middle of the left kidney.](image-url)
fragments were flushed out by the forceful pulse flow. Then, the rigid ureteroscope was introduced into the interior of the cyst, and the entire wall of the cyst was inspected. At the end of the procedure, a 6F double-J stent was placed with the proximal end in the cyst in an antegrade fashion (Fig. 2D). A 16F Silastic (Dow Corning Corp) nephrostomy tube was placed in the renal pelvis to provide drainage.

RESULTS

The operations were performed successfully in all patients. No serious complications occurred intraoperatively. Operative times were obtained from the anesthesia record and were recorded as the time from cystoscopy to placement of the nephrostomy tube. The mean operative time was 68 minutes (range, 47-93 minutes). Cyst fluid cytology was negative for malignancy. The mean decrease in the hemoglobin level after procedures was 1.3 g/dL (range, 0.8-1.6 g/L). No patient required a transfusion. The mean hospital stay was 4 days (range, 3-7 days). The nephrostomy tube was removed after 20-30 postoperative days (Fig. 3A), and the double-J stents were withdrawn 2-3 months after the operation. Postoperative complications according to Clavien grading score 1 included fever in 1 patient (6.25%) and gross hematuria in 3 (18.75%). Stone analysis revealed mixed calcium oxalate and calcium phosphate in 8 patients (50%), calcium oxalate in 5 (31.25%), calcium phosphate in 2 (12.5%), and uric acid in 1 (6.25%).

The patients were followed up every 3 months for the first year and annually thereafter. Ultrasonography was performed for bilateral kidneys and CT if necessary. With a mean follow-up of 21 months (range, 8-25 months), all patients had complete resolution of symptoms and signs. Follow-up CT or ultrasound imaging revealed complete or nearly complete resolution of the renal cyst and calculi (Fig. 3B).

COMMENT

Symptomatic renal cysts can be treated endoscopically by antegrade percutaneous nephroscopy, retrograde ureterorenoscopy, or laparoscopy. The treatment used depends on patient symptoms, cyst location, cyst number, operator skill, and therapeutic intent. Percutaneous aspiration, with or without sclerotherapy (alcohol, glucose, quinacrine, iophendylate, bismuth phosphate, or

Figure 2. (A) An ultrasound-guided puncture of target calyx through the renal cyst performed by an 18-gauge needle (arrows). (B) Marsupialization resulted in a channel (arrow) between the renal cyst and the collecting system. (C) Endoscopic view of pelvic stone and ureteral catheter. (D) The proximal end of double-J stent (arrow) placed in the cyst. (Color version available online.)
phenol), was used as an important method for renal cysts but was limited by reports of significant complications, including ureteropelvic junction obstruction, cyst abscess, fever, pain, and recurrence. Retrograde ureteroscopic management may be the least invasive method, but the indications for such an approach are extremely limited. It has been suggested that parapelvic cysts with a thin and transparent wall are suitable for ureteroscopic treatment.

Laparoscopic cyst decortication was first reported in 1992 by Morgan and Rader, with several subsequent studies reporting the long-term success rates. Laparoscopic cyst decortication has gained popularity because of its inherent ability to depict all of the structures surrounding the cyst, no matter the location or number. It has been suggested that parapelvic cysts with a thin and transparent wall are suitable for ureteroscopic treatment.

Percutaneous intrarenal marsupialization, which was first reported in 1984, offers an excellent surgical alternative for renal cysts. Many follow-up studies have confirmed the safety and efficacy of the procedure. It is particularly attractive if coexisting renal calculi require treatment. In our center, percutaneous intrarenal marsupialization and concomitant nephrolithotomy is an optimal option for patients with a renal cyst and ipsilateral calculi. Patient selection is most important; the ideal patient is one with a solitary posterior or parapelvic medium to large sized renal cyst and ipsilateral calculi.

Several studies explored the possibility of simultaneous treatment of renal cysts and calculi. Theoretically, this would decrease the costs and the potential injury risks. Micali et al reported use of a digital flexible cystonephroscope or wire basket for extraction of renal calculi during laparoscopic cyst ablation with concomitant pyelolithotomy. Mean operative time was 173 minutes. CT after 6 months showed clearance of all cysts and stones, without recurrence. Qiu et al reported their experience of retroperitoneoscopic cyst excision plus retroperitoneoscopy-assisted PCNL for simultaneous treatment of renal cysts and stones. The total operative time averaged 83 minutes, and mean duration of PCNL was 45 minutes. No recurrence occurred with a mean follow-up of 22 months.

The mean operative time in our study was lower than those reported by Micali et al and Qiu et al (68 vs 173 and 83 minutes, respectively). Although a change is needed from the lithotomy position to the supine position during our procedure, several factors may contribute to the reduction of the mean operative time. First, the laparoscopic technique, compared with percutaneous technique, may increase operative time and technical complexity. Second, we appropriately integrate the marsupialization procedure into the PCNL, which could dramatically reduce the operative time. Third, our series only included patients with a solitary renal cyst, which was relatively easily managed.

It must be clear that stone clearance is our first priority goal. In a highly selective patient population, percutaneous intrarenal cyst marsupialization and nephrolithotomy can be achieved at the same time with our method. If the renal cyst was not on the optimal puncture route or the cyst diameter was less than 4 cm, we would not deal with the cyst in one session. The key point of our technique is the choice of puncture route, which is selected carefully to marsupialize the cyst and approach the target calyx. In our experience, CT, especially when performed with 3-dimensional reconstruction, offers precise anatomic delineation to help the surgeon to choose the optimal puncture route preoperatively. Under ultrasound real-time guidance, the channel between the renal cyst and the collecting system can be performed (Fig. 2A). A nephrostomy tube and a double-J stent were placed for a prolonged period to ensure the channel remained opened.

Figure 3. (A) Postoperative computed tomography (CT) at 2 months shows the double-J stent in the correct position after the nephrostomy tube has been removed. (B) Postoperative CT at 12 months demonstrates clearance of calculi and cyst without recurrence in left kidney.
PCNL is a well-recognized safe and minimally invasive management option for almost all kinds of renal calculi. A thorough evaluation of stone burden, stone location, and concomitant cyst location will help direct the surgeon in selecting the most appropriate target calyx. In most cases, we would like to choose the posterior middle calyx, because it enables favorable endoscopic maneuvering to get to the lower, upper calyx and proximal ureter with minimum torque and deformity on the endoscope and on the renal tissue. The posterior lower calyx and upper calyx were sometimes chosen as the target because of the concomitant cyst location.

Given the rarity of the condition, our study was limited by its relatively small patient sample and lack of a control group and long-term follow-up. In addition, the prolonged placement time of the nephrostomy tube and double-J stent may affect the patient’s quality of life and may also increase stent-related symptoms and costs. Thus, in further study, we will evaluate the efficacy of percutaneous intrarenal cyst marsupialization with concurrent nephrolithotomy with larger cohorts and longer follow-up and will also investigate the optimal time to remove the stents.

CONCLUSION
We have presented a series of selected patients who underwent successful percutaneous intrarenal cyst marsupialization with concurrent nephrolithotomy. This is a safe and effective alternative for the simultaneous treatment of a solitary posterior or parapelvic renal cyst and ipsilateral calculi through intermediate follow-up.

References