

Ureteroscopic lithotripsy as a first line treatment for distal ureteral calculi in patients with a solitary kidney

Soliter böbrekli olgularda üreter alt uç taşı tedavisinde ilk seçenek tedavi olarak üreteroskopi eşliğinde taş kırma

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Summary

Aim: To evaluate the efficacy and safety of ureteroscopic lithotripsy as a first line treatment for distal ureteral calculi in patients with a solitary kidney.

Material and Methods: 21 patients who had a solitary kidney with distal ureteral calculi were enrolled in this study. A 8/9.8 Fr Wolf semi-rigid ureteroscope and pneumatic lithotripter were used for the procedures in all patients.

Results: Twenty-two procedures were performed on the patients. Successful fragmentation was achieved in 21 (95.4%) procedures. The mean serum creatinine level was 1.8 mg/dl (range 1.0-4.8). The mean stone size was 8.7 mm (range 7-13). The mean operative time was 36.2 minutes (range 26-48). The mean hospitalization time was 3.1 days (range 1-7). The mean time for DJ stent removal was 10.1 days (range 7-21). Severe complications were not observed during the procedures. However, mucosal injury was observed in one patient, migration of stone fragments into the renal pelvis in one, and fever ($>38^{\circ}$) in two. No long-term complications were determined in any patient.

Conclusion: It appears that ureteroscopic lithotripsy may be considered as a first line treatment for distal ureteral calculi in patients with a solitary kidney.

Key Words: Ureteroscopy, lithotripsy, solitary kidney, ureteral calculi.

Özet

Amaç: Soliter böbrekli olgularda üreter alt uç taşı tedavisinde ilk seçenek tedavi olarak üreteroskopi eşliğinde taş kırmanın etkinlik ve güvenilirliğini araştırmak.

Yöntem ve Gereç: Soliter böbrekli üreter alt uç taşı olan 21 hasta çalışmaya alındı. Tüm hastalar da 8/9.8 Fr Wolf semi-rigid üreteroskop ve pnömatik taş kırma uygulandı.

Bulgular: Hastalara 22 işlem uygulandı. Başarılı taş kırma 21(% 95.4) işlemde sağlandı. Ortalama serum kreatinin düzeyi 1.8 mg/dl (1.0-4.8) idi. Ortalama taş boyutu 8.7 mm (7-13), ortalama operasyon süresi 36.2 (26-48) dakika idi. Ortalama hastanede kalış süresi 3.1 (1-7), DJ stentlerin ortalama alınma süresi 10.1(7-21) gün idi. İşlemler sırasında ciddi komplikasyon olmadı. Bununla birlikte, bir hastada taş parçaları böbrek pelvisine kaçtı, bir olguda mukozal hasar ve iki olguda ise ateş ($>38^{\circ}$) gözlemlendi. Hastaların hiçbirinde uzun dönem komplikasyonu görülmüdü.

Sonuç: Üreteroskopi eşliğinde taş kırma soliter böbrekli üreter alt uç taşı olan olgularda ilk seçenek tedavi olabilir.

Anahtar Kelimeler: Üreteroskopi, taş kırma, soliter böbrek, üreter taşı.

Introduction

Ureteroscopic lithotripsy (URSL) is nowadays one of the procedures most widely used for treating ureteral calculi. It provides a high and immediate success rate with minimal morbidity for the treatment of ureteral calculi (1- 4).

However, there is little known in the English literature about the efficacy and safety of URSL for the treatment of ureteral calculi in patients with a solitary kidney. This is probably because of the rarity of this condition or the fear of impairment of renal function due to some complications of URSL. Patients with a solitary kidney need to become stone-free as soon as possible due to risk of acute obstructive renal insufficiency. Since URSL offers both immediate relief from symptoms and stone fragmentation with minimal complications, it may be

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Makalenin Geliş Tarihi: 21.11.2010 Kabul Tarihi: 16.02.2011

successfully used for the management of ureteral calculi in patients with a solitary kidney.

In the present study, we assessed the efficacy and safety of URSL as a first line treatment for distal ureteral calculi in patients with a solitary kidney.

Materials and Method

Twenty-one patients who had a solitary kidney with distal ureteral calculi were diagnosed at our institution between April 2005 and December 2009. The solitary kidney was secondary to nephrectomy due to urinary stones in 20 patients and renal cell cancer in 1 patient. Thirteen patients had a right solitary kidney and 8 patients had a left solitary kidney. The presenting symptoms were colicky abdominal pain in 16, anuria in 8, nausea-vomiting in 7, LUTS in 14, haematuria in 10 and urine leakage from nephrostomy tract in 1 patient. The patient who had urinary leakage from the nephrostomy tract had undergone percutaneous nephrostomy and SWL in another center one month previously. All patients were assessed by whole blood count, BUN, serum creatinine, plain abdominal X-ray (KUB) and renal ultrasonography, or non-contrast abdomino-pelvic CT if needed. In patients with normal serum creatinine level, urinalysis, urine culture and intravenous urography (IVU) were performed as additional tests. In 20 patients, diagnosis of distal ureteral calculi was made when the stone was localized below the inferior part of sacroiliac joint. The stone size was determined by the sum of the maximum diameters of the calculi on KUB. In one patient, the diagnosis was made by non-contrast abdomino-pelvic CT because of non-opaque distal ureteral calculi and renal calculi. Informed consent was obtained from all patients. Cystoscopy was initially performed to evaluate the lower urinary tract and ureteral orifice. Ureteroscopy was carried out with video guidance, using a 8/9.8 Fr Wolf semi-rigid ureteroscope in all patients. The procedure was performed under spinal anesthesia or general anaesthesia. Ureteral orifice dilation was necessary in one patient. Pneumatic lithotripter (Karl Storz, Calculusplit 276300 20, Germany) and a 1.0 mm probe were used for stone fragmentation. Stone forceps were used to remove stone fragments ≥ 4 mm. The operative time was calculated from the time cystoscope was introduced to the final removal of all endoscopes. A DJ stent was placed by using a cystoscope in all patients. All patients received third generation cephalosporin preoperatively and it was maintained until discharge. Patients who were discharged received an oral quinolone for one week. Patients with normal serum creatinine levels and without complications were discharged from the hospital at the first postoperative day, however, the others stayed

in the hospital until a normal serum creatinine level was obtained and some complications improved. Stone fragments were sent for biochemical analysis whenever possible. All patients were evaluated by KUB and ultrasonography, or non-contrast abdomino-pelvic CT if needed at postoperative one week. The stent was removed by using a rigid cystoscope under local anesthesia. All the patients were evaluated with IVU for long-term complications at six month postoperative.

Table 1. The characteristics of patients, operative data and complications.

No. patients / No. procedure	21/22
No. male / female	13/8
Mean age, years (range)	42.6 (32-63)
Mean serum creatinine level, mg/dl (range)	1.8 (1.0-4.8)
Mean stone size, mm.(range)	8.7 (7-13)
Mean stone forceps use (range)	1.3 (1-3)
Mean operative time, minutes (range)	36.2 (26-48)
Mean hospitalization time, days (range)	3.1 (1-7)
Mean time for DJ stent removal, days (range)	10.1 (7-21)
No.re-treatment (%)	1 (4.5)
No. complications(%)	
LUTS	14 (63.6)
Fever	2 (9.0)
Flank and pelvic pain	5 (22.7)
Mild hematuria	14 (63.6)
Mucosal injury	1 (4.5)
Migrated calculi	1 (4.5)

Results

The characteristics of patients, operative data and complications are shown in Table-1. Twenty-two procedures were performed on the patients. No patients underwent a second procedure. However, one patient who underwent successful URSL due to non-opaque calculi came back again to the hospital due to anuria 2 months after the first procedure, and URSL was performed on the patient due to previous renal calculi which descended to the distal ureter. Successful fragmentation was achieved in 21 (95.4%) procedures. Urinary leakage was stopped on the third day after the procedure in the patient who experienced leakage from the nephrostomy tract. Twenty patients were stone-free at postoperative one week and one patient in two weeks. The serum creatinine level and urine output were normal in 13, whereas the serum creatinine level was high in 8 patients with complete obstruction (Gradel

hydronephrosis in 4 patients, grade II in 4). Urine cultures were normal in patients without ureteral obstruction. Stone forceps were performed to retrieve large stone fragments (≥ 4 mm) in 16 (72.7%) of the procedures. Major complications (such as sepsis, perforation) were not observed during the procedure, except for mucosal injury which was managed successfully with DJ stent insertion for three weeks in one patient. Calculi which had migrated in to the renal collecting system was treated successfully with a DJ stent insertion and subsequent SWL after one week in one patient, and fever managed successfully with antibiotic regimen in two patients. All of the minor complications (such as LUTS, flank and pelvic pain and hematuria) improved in one week after DJ stent removal. Post-obstructive diuresis was observed in patients who had high serum creatinine levels in a volume range of 6 to 10 liters during the first 24-48 hours, and serum creatinine levels returned back to normal within 2 to 7 days. Stone analysis results were available in 6 (28.5%) patients: calcium oxalate in 5 and uric acid in one patient. No long-term complications were observed on IVU at six months postoperative.

Discussion

Ureteroscopic lithotripsy (URSL) has been recognized as a highly effective, minimally invasive procedure for treating ureteral calculi. The main advantages of URSL are offering both immediate relief from symptoms and stone fragmentation. Nowadays, most of the ureteral calculi can be treated with URSL. However, URSL for the management of ureteral calculi in patients with a solitary kidney has not been well documented. Quick ureteral stone removal is very important in patients with a solitary kidney since these patients are more likely to have acute obstructive renal failure. SWL may be an alternative treatment option, however, this method may be initially unsuccessful in 10% to 30% of patients, requiring multiple sessions, and taking a lengthy for stone-free status (1,2,5,6). Although SWL is of a non-invasive nature, nowadays some authors recommend URSL for distal ureteral calculi as a first-line treatment since it provides higher success rates and quick stone clearance with minimal complications (1,2). The AUA ureteral stones clinical guidelines panel and EAU: guidelines on urolithiasis have reported that URSL stone-free rates (97%) were better than SWL rates (86%) even in distal ureteral stones ≤ 10 mm (7).

In the present study, the mean stone size was < 10 mm and the stone-free rate was 95.4%, and re-treatment rate was 4.6%. Our URSL stone-free rate is similar to the URSL stone-free rate in patients with both kidneys.

We worked only with a semi-rigid ureteroscope, and the stones were fragmented with a pneumatic lithotripter. The pneumatic lithotripter uses a simple method with compressed air, at a lower cost, providing good results (6,8,9), however, it has some disadvantages. The main disadvantages of pneumatic lithotripsy are that it produces larger fragments that potentially may cause more problems in term of spontaneous passage (10) or retropulsion of larger fragments during the procedure (11). Therefore, some authors recommend using baskets or graspers to remove larger fragments produced by the ballistic lithotripter to reduce complications and the re-treatment rate (12, 13, 14). We also used stone forceps in most of the procedures to reduce the necessity of a second or auxiliary procedure. Thus, the second procedure was not performed in any of our patients. However, use of stone forceps caused mucosal injury in one patient (4.5%) who was treated with DJ stenting for 3 weeks. Similarly, we believe that forceps use for removal of all large stone fragments may reduce a second or auxiliary procedure especially in patients with a solitary kidney, although it may involve some disadvantages. On the other hand, ureteroscopic laser lithotripsy is regarded as the "gold standard" in ureteroscopic stone treatment, and all of these problems (repulsion of stone fragments or necessity of stone forceps use) can be minimized by using laser lithotripsy because the stones are pulverized to tiny fragments about 2-3 mm in size (10). However, lasers are costly and are not available everywhere.

The complication rate of ureteroscopy has dramatically decreased in recent years due to the advances achieved in endourologic technology and increased surgical skill. In patients with both kidneys, the rates for ureteral perforation and ureteral stricture with ureteroscopy in contemporary series have ranged from 0–4 % and 0–2%, respectively (1,2). In the present study, perforation, ureteral stricture and sepsis were not determined in any patient, but fever ($> 38^{\circ}$) was observed in two patients (9.5%) who were treated with an antibiotic regimen successfully.

Stents are generally placed for 3 or 5 days after URSL. The AUA ureteral stones clinical guidelines panel and EAU guidelines on urolithiasis have reported that stenting following uncomplicated ureteroscopy is optional. However, in this report, it was noted that a solitary kidney is one of the indications for stenting after URSL (7). Likewise, in the present study, the DJ stent was placed in all patients and removed approximately 10 days after URSL. Duration of the DJ stent may seem to be long, but, 38.0% of the patients had high serum creatinine levels, so the DJ stents were not removed

until serum creatinine levels returned to normal. Additionally, the DJ stent was removed 3 weeks after the procedure due to mucosal injury in 1 patient and 2 weeks after the procedure because of migration of stone fragment to the kidney in another patient. We also believe that DJ stenting is necessary after URSL in patients with a solitary kidney, and we think that DJ stents should not be removed until stone-free status is achieved and normal serum creatinine levels are obtained or until recovery from some complications.

The hospital stay for URSL is generally 1 day. However, the hospital stay in our study is much longer. This situation may be explained by the fact that 8 (38%) of the patients had acute obstructive renal insufficiency, post-obstructive diuresis was observed after the procedure in the patients in the first 24-48 hours, and

serum creatinine levels returned back to normal within 2 to 7 days. Also, fever was observed in 2 (9.5%) patients. Thus, the patients were not discharged until normal serum creatinine levels and temperature were achieved.

Conclusion

It appears that URSL may provide safe and effective treatment with minimal morbidity for distal ureteral calculi in patients with a solitary kidney. It may differ from URSL of distal calculi in patients with both kidneys in terms of the necessity of DJ stenting, hospital stay and duration of the DJ stent. The removal of all large stone fragments during pneumatic lithotripsy may be necessary to reduce risk of a second or auxiliary procedure. In experienced hands, URSL may be considered as first-line treatment for distal ureteral calculi in patients with a solitary kidney.

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