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Original Article

Small renal pelvis stones: Shock wave lithotripsy or flexible ureteroscopy? A match-pair analysis

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ABSTRACT

Objective: Kidney stones in renal pelvis may be treated using various methods. For larger stones, percutaneous nephrolitotomy (PNL) is the first choice of option; where for smaller stones, shock wave lithotripsy (SWL) or flexible ureteroscopy (F-URS) could be more suitable options. In this article we aimed to compare the outcomes of F-URS and SWL on the treatment of renal pelvis stones <10 mm.

Material and methods: Files of patients treated with SWL and F-URS for renal pelvis stones <10 mm between March 2013 and May 2016 in our clinic were analyzed. For comparison, a match-pair analysis was designed. Complete stone removal was considered success.

Results: Forty patients were treated using F-URS (Group 1) and 40 patients underwent SWL (Group 2). Patients were assessed the day after the last session of the procedure. The early stone-free rates were 70% (28/40) in Group 1, and 15% in Group 2 ($p<0.05$). The same analysis was performed after three months. Stone-free rates were 100% and 92.5% in Groups 1 and 2, respectively ($p=0.079$). Three patients in Group 2 were not stone free after 3 sessions of SWL and considered unsuccessful. They were all successfully treated by F-URS.

Conclusion: Even though there is no statistical difference among groups, our data may be interpreted as having better outcomes and tolerability with F-URS than SWL. We believe F-URS may have a great treatment prospect in this particular patient group.

Keywords: Flexible ureteroscopy; kidney stone; shock wave lithotripsy.

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Introduction

Kidney stones in renal pelvis may be treated using various methods. For larger stones, percutaneous nephrolitotomy (PNL) is the first choice of option; but for managing smaller stones, urologists tend to choose less invasive approaches, such as shock wave lithotripsy (SWL).[1]

With the advancements in urology and technology, endoscopic retrograde renal surgery performed using flexible ureterorenoscopy (F-URS) has gained popularity. Nowadays, for smaller stones, F-URS or SWL is the first option of choice.[1]

Shock wave lithotripsy requires usually more than one session and a considerable number of patients describe SWL as a painful procedure[2]; on the other hand F-URS is performed under general anesthesia and may cause serious complications.[3]

In this study, we aimed to compare the outcomes of F-URS and SWL on the treatment of renal pelvis stones <10 mm.

Material and methods

After the local ethics committee approval, files of patients treated using SWL and F-URS for renal pelvis stones <10 mm between March 2013 and May 2016 in our clinic were analyzed. For comparison, a match-pair analysis was designed. Matching criteria were sex, age, stone size and degree of hydronephrosis. Patients in Group 1 underwent F-URS and Group2, SWL.

For F-URS, a Flex-X^2 (Karl Storz, Tuttlingen, Germany) flexible ureterorenoscope was used. An 11.5/9.5 F ureteral access sheath was used in all cases. Holmium laser lithotripsy (Ho YAG Laser; LISA Laser, CA, USA) was used to fragment stones for F-URS. Routine Double J stent placing was not preferred unless intraoperative complications occurred.

Electrohydraulic extracorporeal lithotripter (Multimed Classic; Elmed, Ankara, Turkey) was used for SWL. In each lithotripsy session, 2500-3000 shocks were given at 14-17 kv. If fragmentation was not achieved in three sessions, SWL was considered unsuccessful. Patients with anomalous kidneys, ureteropelvic junction obstruction, solitary kidney or history of open or percutaneous interventions to ipsilateral kidney were excluded from the study.

All patients had been evaluated with complete blood count, plasma urea and creatinine levels, coagulation profiles, intravenous urography or non-contrast computed tomography (CT), urinalysis and urine cultures. Stone size was measured on plain x-ray. Stone clearance rates were determined using postoperative x-ray and non-contrast CT. Success was defined as being stone free at evaluation.

Statistical analysis

Data were analyzed with IBM Statistical Package for the Social Sciences (IBM SPSS Corp; Armonk, NY, USA) version 20 for Mac with the chi-square, Student's t test and Fisher's exact test. Statistical determinations were within the 95% confidence interval and $p<0.05$ was considered statistically significant.

Results

Eighty-seven patients were treated using F-URS and 76 patients using SWL. Forty of those patients who had been treated with F-URS had had renal pelvis stones smaller than one cm. For the SWL group patients with similar stone size, age and degree of hydronephrosis were selected. Mean patient age was 39.6±2.0 and 41.25±2.27 years for Groups 1 and 2 respectively (p=0.588). Mean stone size was 8.05±0.16 mm for Group 1 and 8.15±0.15 mm for Group 2 (p=0.650). In addition, Group 1 had 23 patients without hydronephrosis, Grades 1 (n=10), and 2 hydronephrosis(n=7) and Group 2 had 19 patients without hydronephrosis, Grades 1 (n=12), 2 (n=8), and 3 hydronephrosis (n=1).

All patients in Group 1 were treated with one session of F-URS. Patients in Group 2, on the other hand, were managed by 1.85±0.11 sessions of SWL ($p<0.05$). All patients were treatable with F-URS. However, two patients in SWL group complained of mild hematuria and discomfort, and therefore discontinued the therapy. They were successfully treated with F-URS.

Patients were assessed the day after the last session of the procedure. The early success rates were 70% (28/40) and 15% in Groups 1, and 2, respectively ($p<0.05$). The success rate was evaluated again at three months. Stone free rates were 100% and 92.5% in Groups 1 and 2, respectively (p=0.079). Three patients in Group 2 were not stone free after SWL sessions (two patients discontinued because of discomfort and one stone could not be fragmented) and considered unsuccessful. They were all successfully treated with F-URS. Main results are summarized in Table 1.

Six patients in Group 1 and 4 patients in Group 2 suffered from hematuria. Two patients in Group 2 had urinary tract infections treated with oral antibiotics. In Group 1, one patient had mild fever following the procedure and treated with anti-inflammatory agents (p=0.762). There were no intraoperative complications, so any double J stents were not placed.

Discussion

Even though there are a number of treatment alternatives for larger kidney stones, treatment of smaller stones is rather challenging. PNL is usually not a treatment option and laparoscopic or open surgery is almost never preferred. Mainly the selection is made between two alternatives namely SWL or F-URS.

Table 1. Demographic data and operative outcomes

	Group I (n=40)	Group II (n=40)
Mean patient age (year)	39.6±2.0	41.25±2.27
Sex		
Male	28	26
Female	12	14
Laterality		
Right	18	20
Left	22	20
Stone Size (mm)	8.05±0.16	8.15±0.15
Success Rate (After Day 1)	28/40 (70%)	6/40 (15%)
Success Rate (After Day 90)	40/40 (100%)	37/40 (92.5%)

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In this study, we found similar stone-free rates for SWL and F-URS in patients with small renal pelvis stones. But F-URS is more advantageous in early success rates. Probably due to the ureteral dilatation using access sheaths which facilitates passage of ureteral stone. Also, treatment with a single session is a clear benefit of F-URS. Even though, the data seem to reveal similar outcomes, we believe that F-URS has important advantages.

Wiesenthal et al.[4] reported their findings of SWL, F-URS and PNL for treating moderate-sized renal stones. They reported similar outcomes when SWL treatment is used for two sessions. However, most patients treated with SWL had to undergo auxiliary procedures. We reported similar outcomes in terms of auxiliary treatments. In our cohort, 3 patients in SWL group had to be treated using F-URS but none of the patients in the F-URS group required any auxiliary procedures.

Kanao et al.[5] reported their data of 507 stones treated in 435 patients and proposed a nomogram to predict the stone-free status of the stones. They reported 89.3% stone-free rate when treating renal pelvis stones smaller than 5 mm. When the stone size was between 6 and 10 mm, the stone-free rates dropped to 77.9%. Parallel to our study, when only pelvis stones were taken into account, the success rates rised to 92.5%.

Moon et al.[6] designed a study on renal pelvis stones to determine the efficacy and safety of different shock wave frequencies. They reported 100% success after 1.6 sessions of SWL therapy. They did not describe the exact stone sizes for groups but in brief description, they reported the stone sizes as between 5-20 mm. In our study, 92.5% of the patients were stone free after 1.85 sessions of SWL.

In their article, Atis et al.[7] treated solitary renal pelvis stones with F-URS and reported a success rate of 86.4% after one month. In another study, Takazawa et al.[8] reported a 99% success rate of all kidney stones and proposed a trend shift toward F-URS in Japan for following years. Similar to Takazawa, after three months, our success rate of F-URS was 100%. We believe that treating small renal pelvis stones was the key for this perfect success rate.

Hyams et al.[9], on the other hand, reported their outcomes of patients with 2-3 cm renal stones treated using F-URS and they reported almost a perfect success rate. Similar to those findings, Ferroud et al.[10] published their findings of F-URS and reported a success rate of 88% in 43 patients treated using F-URS. Their patients had renal pelvis stones smaller than 2 cm. Another study reported a success rate of 82.8% with F-URS.[11] Chung et al.[12] reported a relatively unsuccessful outcome with F-URS in patients with 1 to 2 cm kidney stones. Their population consisted of 12 patients. Perlmutter et al.[13] reported similar outcomes and proposed similar outcomes independent of stone location. In another study designed to report the results of F-URS, the authors indicated a success rate of 77% on postoperative day 1 and 92.7% after three months.[14] Similar to those authors, we have an early postoperative success rate of 70% and 100% in three months.

The retrospective design of the study and relatively small number of patients are the limitations of this study. In addition, as important limitations of the study, body mass indices, Hounsfield units for stones were not evaluated, and stone analyses were not performed.

This study reveals similar and high success rates of SWL and F-URS in treating renal pelvis stones <1 cm. Even though there is no statistical difference among groups, our data seem to reveal better outcomes and fewer complications with F-URS than SWL. We believe that F-URS has a great prospect for stone treatment in this particular patient group. Prospective randomized trials on large cohorts are necessary to support these findings.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Adana Numune Training and Research Hospital (ANEAH.EK.2013/52).

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