Original Article

Factors affecting use of flexible ureteroscope in large renal stones; stone size or stone composition

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Abstract

Introduction: After advances in flexible ureteroscopes' design, accessories, and lithotripters, flexible ureteroscope has been used widely for the treatment of large renal calculi >2 cm.

Objectives: The objective was to evaluate the role of flexible ureteroscopy with laser lithotripsy in the treatment of large renal calculi >2 cm and find out which factor can affect the results.

Patients and Methods: Prospectively, we have studied 47 patients who have passed through flexible ureteroscopy with laser lithotripsy for renal calculi >2 cm. Preoperative, operative, and postoperative data were recorded. Results and complications were recorded, too.

Results: In 47 patients, the mean stone size is 26.2 ± 4.1 cm and the total stone-free rate (SFR) is 89.4%, while in stone size ≤3 cm, the SFR is 90.7%, and for stone size >3 cm, the SFR is 75%. Overall stone density is 1020 ± 286 HU. The SFR is 95.5% in stones ≤1000 HU and 84% in stones >1000 HU. The mean operative time is 99.2 ± 29.3 min. The intraoperative complications are 17%, while postoperative complications are 36% and all complications are mild.

Conclusion: Flexible ureterorenoscopy (FURS) is safe and effective for the treatment of large renal calculi >2 cm. Stones >3 cm may have lower results even after staged therapy.

Keywords: Flexible ureteroscopy, large renal stones, laser

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INTRODUCTION

Management of large renal stones, more than 2 cm, has been changed during the last decades. It has been shifted from open surgery to percutaneous nephrolithotomy (PCNL). Although the advantages of PCNL over open surgery have been approved, there is fear of associated complications of PCNL, e.g., bleeding complications, anterioventricular fistulas, and injury of nearby organs.[1] Shock wave lithotripsy (SWL) is a noninvasive modality with the least efficacy. Flexible ureteroscopy has been used mainly with renal stones less than 2 cm. Recently, FURS has been introduced as an alternative to PCNL in the treatment of larger renal stones. It has the advantage of fewer complications as it is not invasive like PCNL. Hence, it has fewer bleeding complications, shorter hospital stay, and comparable results.[2] Many individual experiences have been published in using FURS with larger stones fragmentation with good results.[3]

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The purpose of this study is to see how far FURS is effective in the treatment of large renal stones and what stone factors could affect the results.

PATIENTS AND METHODS

Adult patients were collected prospectively with renal stones more than 2 cm in size. Patients were discussed about the procedure, possibly staged therapy, advantages, possible complications, and other alternatives. All patients had done computed tomography kidney-ureter-bladder (CT-KUB) preoperatively for assessing stone size, number, location, and density. Patients with difficult situations, stone in diverticulum, or higher bleeding tendency were excluded. Urinary tract infection (UTI) was treated first with proper antibiotics.

Procedure

Under general anesthesia, the procedure was done in a dorsal lithotomy position with the head titled down. By visualizing of ureteric orifice using cystoscpe and insertion of a guidewire were carried out. Dilation of ureter using semi-rigid ureteroscope was followed by ureteral access sheath insertion when it was possible under C-arm. Ureteral access sheath allows easy multiple entries and keeps intrarenal pressure low.[4]

Using Flex X2 or Flex XC Storz flexible ureteroscope, holmium laser lithotripsy was carried out using fiber sizes 200 or 365 μ. A dusting of the stone was our main concern, while fragmentation was the effective procedure in hard stoned. A 2.2-μ nitinol stone basket was usually used for stone or stone fragments repositioning from lower pole to upper pole. Finally, stenting of the ureter was carried out for 1–2 weeks.[4]

Follow-up

Patients were usually discharged home a day after surgery and followed up in the outpatient clinic. Perioperative and early postoperative possible complications were recorded. Clinical examinations, laboratory investigations, and early ultrasonography were carried out before discharge.

Oral chemolysis with potassium citrate for stone fragments was applied after FURS for 1 month. CT-KUB was always done after 1 month to diagnose possible complications, assess residual stones, and determine the type of second procedure if needed. If there were residual stones, or fragments 4 mm in size or more, a second FURS was done.

Patients were divided into groups according to stone density and stone size. Data were collected using Microsoft Excel and analyzed using IBM SPSS Statistics version 21.

RESULTS

Patient data

Forty-seven patients were included in the study with 60 procedures being carried out. The mean age was 34.9 years and ranged between 17 and 66 years. 35 patients were males and 12 patients were females. 21 patients presented with lion pain, 11 patients presented with renal colic, 8 patients presented with hematuria, 6 patients presented with recurrent UTI, and one case presented with pyelonephritis [Table 1].

Stone characteristics

For stone size, the mean stone diameter was 26.2 cm and ranged between 20 and 40 cm. 43 cases had a stone diameter less or equal to 3 cm. 4 cases had a stone diameter more than 3 cm. The average stone density was 1020 HU, with 22 cases having a stone density less or equal to 1000 HU and 25 cases having a stone density more than 1000 HU. Most of the cases had multiple stones (n = 29), and 18 patients had single stones. 12 patients had renal pelvis stones, and 6 patients had lower calyceal stones [Table 2].

Operative data

The mean operative time was 99.2 ± 29.3 min. The mean number of procedures is 1.45 per case. Access sheath was used in 40 cases (85.1%). Postoperative stenting was done for all cases and usually removed within the 1st week postoperatively. Minimal intraoperative complications were mainly mild bleeding in 6 cases and ureteral mucosal laceration in 2 cases. Postoperative complications were mainly pyelonephritis in 3 cases, steinstrasse in 5 cases,

Table 1: Patient demographics

Variable	Result (%)
Age (years), mean	34.9±10.3
Gender	
Male	35 (74.5)
Female	12 (25.5)
Presentation	
Lion pain	21 (44.7)
Renal colic	11 (23.5)
Hematuria	8 (17)
UTI	6 (12.7)
Pyelonephritis	1 (2.1)

UTI: Urinary tract infection

Table 2: Stone-free rate

Variable	Result	SFR (total %)
Stone size (cm)	26.2±4.1	89.4
≤3 (43 case)	25±2.9	90.7
>3 (4 case)	35±4.4	75
Stone density (HU)	1020±286	89.4
≤1000 (22 case)	759±177	95.5
>1000 (25 case)	1249±111	84

SFR: Stone-free rate

and mild hematuria in 9 cases. All patients were discharged the next day postoperatively, while only patients who developed pyelonephritis ($n = 3$) stayed in the hospital until improved (4–7 days postoperatively) [Table 3].

Outcomes

After the first procedure, 29 patients were stone free (61.7%), and after the second procedure, 42 patients were stone free (89.4%). Stone free was defined to have residual fragments less than 4 mm. The remaining patients ($n = 5$) were not stone free after the second procedure because of high stone burden causing larger residual fragments.

According to stone size, there were 43 patients with stone size less or equal to 3 cm with an overall stone-free rate (SFR) of 90.7%. The other 4 patients with a stone size more than 3 cm achieved an overall SFR of 75%.

Twenty-two patients showed stone density less or equal to 1000 HU; they had an overall SFR of 95.5%. The other 25 patients with a stone density more than 1000 HU showed an overall SFR of 84% [Table 2].

DISCUSSION

There is no doubt that the use of flexible ureteroscopy with laser lithotripsy is a helpful tool for the treatment of renal stones less than 2 cm. For stones larger than 2 cm, PCNL is the recommended tool as the first line of treatment. Although PCNL has a higher SFR up to 95%, its complications are higher. Because of its bleeding complications and the possibility of injury to nearby organs, FURS has been introduced as an alternative procedure for the treatment of larger renal stones. Lower complications of FURS have encouraged researchers to extend its use to larger stones.

Grasso *et al*.[5] have used FURS in the treatment of renal stones more than 2 cm with a SFR of 91% and one-third of patients have needed a second session of FURS. Breda *et al*.[6] have achieved a 93.3% SFR for renal stones between 20 and 25 mm with an average of 2.3 procedures.

Table 3: Operative data

Operative time	99.2±29.3
Intraoperative complications (%)	17
Postoperative complications (%)	36
Use of access sheath (%)	85.1
SFR (%)	
SFR after 1 procedure	61.7
SFR after 2 procedures	89.4

SFR: Stone-free rate

Although our results are similar to the previous reports. The SFR was 89.4% for renal stones of average size 26.2 cm. According to stone size, 47 cases were divided into two groups with stone size equal to or less than 3 cm or more than 3 cm. The SFR was 90.7% for the first group and 75% for the second group. The SFR was compared according to the stone density into two groups of 1000 HU or less and more than 1000 HU. The SFR for the first group was 95.5% and for the second group was 84%.

When we compare SFR in both groups, we found that using FURS for renal stones less than 3 cm showed better results than stones more than 3 cm. On the contrary, the results of FURS in stone density, both groups have good satisfying results. This could mean that FURS has acceptable results for renal stones of stone size equal to or less than 3 cm. The group of stones more than 3 cm has few cases not comparable to the number of cases in the first group.

Riley *et al*.[7] have used FURS for average stone size 3 cm and SFR of 90.9% in an average number of procedures of 1.82.

Intraoperative complications were noted in 17% of cases, while postoperative complications appeared in 36% of cases. Geraghty *et al*. reported overall complications of 8.8 with no intraoperative complications. All complications were Clavien class II complications.[8]

Limitations of this study include: (1) the number of cases reviewed and the number of patients having stones more than 3 cm are too few to compare; and (2) the study does not include stone different positions and the number of stones that may affect the final results.

CONCLUSION

Flexible ureteroscopy with laser lithotripsy can be recommended as an alternative therapy for larger renal stones more than 2 cm with high safety and efficacy. Larger stones more than 3 cm have a lower result even after staged FURS.

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Conflicts of interest

There are no conflicts of interest.

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