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Research Article

Flexible Ureterorenoscopy for Treating Kidney Stones > 2 cm; Effectiveness and Complications

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Abstract

Objective: To present a single center experience using FURS in the field of larger kidney stones, we conducted this study. The continuous improvement in technology has made the FURS associated with less complication rate and comparative SFR to PCNL in treating kidney stones > 2-cm in size.

Material and methods: 30 patients were candidates for this retrospective study. They were grouped into 2-groups, Group A, patients with stone size between 2–2.5-cms. Group-B patients with stone size ≥ 2.6 -cm. Effectiveness was measured in terms of the number of sessions and the time needed to reach the stone free rate (SFR), and the reported procedure- associated serious complications. The follow-up period extended up to 24- months.

Results: SFR within 6- months was unremarkably different between the groups, 72.8%, 62.5% for G-A and G-B respectively. There was a considerably larger percentage of patients in G-B who were not cleared from the stones after 6-months, 37.5% VS 9% for G-A. The same trend between the two groups also seen in the number of sessions performed. However, the average procedure time was significantly less in G-A. The rate of complication was not increased as the stone size increases.

Conclusion: FURS is a safe, less morbid, and effective tool of treatment that could replace PCNL in treating kidney stone > 2-cm. The time needed to reach stone-free status and the average procedure time should be taken into consideration. Future development in clearing stone fragments might push less invasive procedures to take the lead.

Keywords: Effectiveness; Flexible ureteroscopy; Large Kidney stone; Stone free rate

Abbreviations: ESWL: Extracorporeal Shockwave Lithotripsy; FURS: Flexible Ureterorenoscopy; IRB: Institutional Review Board; PCNL: Percutaneous Nephrolithotomy; SFR: Stone Free Rate

1. Introduction

Historically, PCNL and ESWL considered the treatment options of choice for kidney stones >2-cm. Percutaneous Nephrolithotomy (PCNL) still considered the gold standard approach to treat large renal stones with a clearance rate of 77 to 95 % 2,3. ESWL was one of the options to treat large renal stones as well, however, because of its low SFR (21-57 %), its indication is currently limited to stones <2-cm [1,2,3,4]. Since the introduction of FURS in the clinical practice by Bagley et al, it gained an increasing interest in the field of treating larger kidney stones [5]. The rapid and continuous development in technology has served in the manufacturing improvement in FURS both in its diameter miniaturization, deflection properties, and its optics as well. A recent systematic review addressing renal stones > 2 cm treated with FURS showed a cumulative SFR of 91% with 1.45 procedures/patient; 4.5% of the complications were > Clavien III [6-8]. We present our single-center experience in treating kidney stones with size >2-cm by flexible ureteroscopy to compare the outcome with the published worldwide experiences.

2. Material and Methods

After obtaining the approval from the IRB of the institute (Hamad Medical Corporation), we reviewed retrospectively the medical records of 483 patients who underwent FURS for kidney stones between July 2015 and September 2019 at the Urology Department in Al Wakra General Hospital / Hamad Medical Corporation/Qatar. A total of 30 patients were illegible to enroll in our study according to the inclusion criteria. They underwent FURS for kidney stone disease with stone burden ≥ 2-cm. They were divided into two groups, Group A, patients with stone size between 2 – 2.5-cms. Group-B patients with stone size ≥ 2.6 -cm. All the patients were pre stented for at least 14-days. The flexible ureteroscope used was Karl STORZ FLEX-Xc, 8.5 french tip size. Ureteral access sheath used in all cases; the size depends on the ureteric lumen capacity. Lumenis VersaPulse® 100-watt Laser system using 272-micron fiber size used for lithotripsy. Negative urine culture was mandatory to take the patient to the procedure. Second-generation cephalosporins (Cefuroxime 1.5 g IV was used on the induction of anesthesia) as a pre-operative prophylactic antibiotic. Indwelling double J stent was removed 7-14 days after the

procedure, unless pre-planned for a second look. Operative time represents the time from insertion of the cystoscopy until the time of urethral catheter insertion at the end of the procedure. Intracorporeal operative time was intended not to exceed 90-minutes. Follow-up radiological imaging was by ultrasound or conventional KUB x-ray with bowel preparations. The out-patient follow-up visits continued up to 24-months. Stone free status is defined as complete stone clearance or presence of residual fragments ≤ 4-mm1.

3. Results

In this study, we are sharing our experience and observations in one endourology center. The patient's demographic data summarized in Table-1. 30-patients were included in this study, 23 males and 7 females. Mean age 43.8 years (23-78 years). 22-patient included in Group-A (G-A) (2 – 2.5-cms), 8-in Group-B (G-B) (≥ 2.6 -cm). Comparison between the two groups was aimed to assess the efficacy of FURS in treating larger stones. Accordingly, the SFR, number of FURS sessions needed, the need for another type of lithotripsy, and the mean length of the procedure were the variables studied to reach the objective of this study. The post- procedure complications have been studied as well. The SFR within 6-months for the whole cohort was 70%, 13% had stone clearance more than 6-months (4- patients needed 8, 14, 18, and 20 months to have stone free status). 17% of the whole cohort have their stones not being cleared. Within 6-months,72.8% of patients in G-A and 62.5% of G-B patients cleared from the stones. 9% (2/22) of G- A and 37.5% (3/8) of G-B have not been cleared from the stones. For the whole cohort, 47% had one session, 33% 2-session and 13% required another modality of lithotripsy i.e., ESWL. One session was enough to clear 40% of G-A and 50% of G-B from their stones. 32% and 38% of G-A and G-B respectively underwent 2-session to clear their stone burden. All patients (4-patients) who required post-procedure ESWL were from G-A. The mean Intracorporeal working time was significantly longer in G-B, near double (95.5 VS 171.2 minutes). 2-patients developed postoperative urosepsis in our study, 6.6%. Both were from G-A who were treated conservatively without Intensive Care Unit admission (Clavien-Dindo grade-II).

		G - A	**G - A**
		N=22	**N=8**
Age		23-65	24-78
		Mean= 44.1	Mean= 48.7
Gender	M	18	5
	F	4	3
Co-morbidity	DM	4	3
	HTN	9	3
	CKD	3	-
Location	L	7	1
	P	5	1
	U&M	2	-
	P, M&L	-	1
	M&L	4	2

	P&M	2	-
	P&L	2	3
L-lower pole, P-pelvic, U-upper and M-middle pole.			

Table 1: Patient's demographics

		Total cohort	**G – A**	**G – B**
		N=30	**N= 22**	**N= 8**
Stone clearance	1-3 M	9	8	1
		30%	36.40%	12.50%
	>3-6 M	12	8	4
		40%	36.40%	50%
	> 6 M	4	4	0
		13%	18.20%	0%
	Not cleared	5 17%	2 9%	3 37.50%
Number of sessions	1-session	14	9	4
		47%	40%	50%
	2-sessions	10	7	3
		33%	32%	38%
	>2 sessions	2	1	1
		7%	5%	12%
	ESWL	4	5	0
		13%	23%	0%
Procedure time	Mean	93.33	95.5	171.2
		(40-180 min.)	(40-180 min.)	(40-130 min.)
Complications	Urosepsis	2	2	0
		6.60%		
Number of sessions/patients		47	34	13
		1.5 s/p	1.5 s/p	1.6 s/p
M = months min.= minutes				

Table 2: Procedures' observations and outcome

4. Discussion

The recent European Urology Association guidelines in 2020 stated that retrograde renal surgery cannot be recommended as a first-line treatment for stones > 20 mm in uncomplicated cases due to its inferior stone-free rate (SFR) compared to PCNL and the need for staged procedure. Never the less, it may be a first-line option in patients where PCNL is not an option or contraindicated 9. The puncture or dilation of the

nephrostomy tract will damage the renal parenchymal which leads to the major complications related to PCNL. A global study for PCNL reported the major complication rates, including 7.8% significant bleeding, 3.4% renal pelvis perforation, and 1.8% hydrothorax 10. In terms of effectiveness and SFR, still, PCNL regarded as the gold standard treatment for larger stones with a SFR of 77 - 95 % 11-16. FURS and PCNL represent two different approaches to solve the same problem. The FURS procedure is less invasive, given its endoluminal nature; however, in a significant number of cases, multiple hospitalizations and anesthesia are necessary17. Michel MS et al. reported high SFR with a single FURS procedure is achievable only for stones <1 cm (90.5%). For stones 1–2 cm, 2–3 cm, and >3 cm in diameter, the primary SFRs are less appealing at 78.8%, 70.5%, and 55%, respectively [17]. Giusti et al. treated kidney stones >2 cm in diameter via FURS. The success rate was 87.7% with an average of 1.48 operative sessions per patient18.In our study we noticed a SFR of 70% within 6-months for the whole cohort with 40% of them cleared after the first 3-months. This rate was not markedly different in both groups of the study (G-A = 72.8% SFR with 6-months, 36.4% within the first 3-months), (G-B = 62.5% SFR within 6- months, however, most of the patients have been cleared from the stones after 3-months of the procedure, 50%, with a significant percentage of this group haven't cleared their stones, 37.5%). We reported a mean FURS sessions/patient of 1.5 in the whole cohort (G-A 1.5, G-B 1.6). In our study, we reported the time frame needed for stone clearance and its impact on the follow-up time. We noticed that a considerable percentage of patients had their stone-free status after 6-months from the first procedure.

Regarding the additional type of treatment, we reported 4-patients underwent ESWL post incomplete FURS treatment. All of them had the stones in the lower pole, 2-of them requested less invasive procedure after they had significant stone residual after their first sessions, the other two requested ESWL after the second session. Of notice, the SFR for those patients extended after 6-months from the first FURS session. The average ESWL sessions were 2- for them. This supports the fact that the lower pole stones have less SFR after FURS than stones in the other calyces [19]. FURS was considered to be safe and effective when used to treat kidney stones >2 cm in diameter18. One of the meta-analysis reported cumulative FURS related complications to be 8.6 %, of the 5.5 % were minor (Clavien <III) and 4.5% major complications (Clavien ≥III)8. We reported 2-cases have developed post-operative urosepsis treated conservatively without ICU admission (6.6%. Clavien II). Fortunately, we haven't reported any major complications. These 2-cases were reported in G-A of our study. We reported average operative time for the whole cohort 93.3 minutes (comparable to average time reported in the literature, 96-minutes)8. However, we noticed that the average operative time for G-B was significantly longer, 171.2-minutes, than that in G-A, 95.5 minutes, almost double, which is expected due to the larger stone burden in the former group. We found that in our study the criteria pertaining to the effectiveness of the FURS procedure i.e., SFR, number of sessions per patient, the average length of the procedure, and procedure-related complications, are consistent with those in the published literature.

5. Conclusion

Although, FURS has the significant advantage of being safe and less invasive compared with PCNL, and being the first choice in specific situations, however, for kidney stones >2.5 cm its SFR, the need for multiple procedures (FURS/ESWL) and the prolonged operative time make it inferior choice than

PCNL in treating this type of stones. Therefore, proper patient selection and detailed counseling is crucial Technical development to clear stone residuals might increase its popularity to treat bigger kidney stones.

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