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KEYWORDS: RIRS; Holmium; Laser; Efficacy.

LASER: BACKBONE OF LATEST MANAGEMENT OF RENAL STONES.

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ABSTRACT:

Introduction: RIRS (Retrograde Intra-Renal Surgery) has emerged as the most advanced minimally invasive treatment for renal stone disease. The introduction of Holmium-YAG Laser has made the procedure very easy and effective. The aim of this study was to find the safety and efficacy of laser RIRS in management of renal stones.
Methods and Materials: Data was collected from 108 patients prospectively who underwent RIRS in our institute. Surgical outcomes and complications were noted.
Results: RIRS was safely completed in all patients. In 98 cases (90.7%) a complete stone-free status was confirmed endoscopically. Ten (9.2%) patients showed residual fragments larger than 4mm. We did not observe any major complication. Overall complication rate was 8.3%.
Conclusion: We found RIRS very safe and effective treatment for renal stones less than 2 cm size.
Key words: RIRS; Holmium; Laser; Efficacy.

INTRODUCTION

Renal calculi are a common disease (About 10% of the population in the industrialized part of the world is afflicted by urinary stones).[1] Untreated, renal calculi can result in chronic kidney disease, infectious complications, and death.

During the last three decades treatment modalities for renal calculi have undergone several significant changes. Prior to the introduction of extracorporal shockwave lithotripsy (ESWL), open surgical removal of stones from the upper urinary tract was the treatment of choice. Although ESWL is a treatment modality with low morbidity, the stone-free rates are low; only up to 50% even for lower pole stones. Percutaneous nephrolithotomy (PCNL) offers a significant increase in stone-free rate, but the morbidity with PCNL is significantly higher than with ESWL.

The first flexible scopes to go retrogradely from urethra to kidney were used in the 1960's, but were limited by vision and the use of instruments to break calculi. In the late 1990s the development of new flexible ureteroscopes began. There was a significant improvement in the deflection angle, which now reaches 270°.[2]

Another very important step in the introduction of endoscopic treatment of renal calculi was the introduction of Holmium Laser systems to fragment stones. It has been universally accepted as the standard for intracorporeal lithotripsy.

Due to the low morbidity and the enhanced stone free rate in comparison to ESWL, it is expected that RIRS will probably become the treatment of choice in the future.

Patients & Methods

This prospective, descriptive study was conducted from year 2016 to 2018, at Kerala Institute of Medical Sciences, Trivandrum India, which is a multi specialty teaching hospital located in South Kerala. Approval certificate was obtained from the institutional human ethics committee.

The inclusion criteria for this study were
1. Patients with upper tract calculi of age >12 years to geriatric age
2. Stone size < 2 cm.
3. Previous history of ureteroscopy (URS), PCNL, or ESWL.
We excluded patients who had
1. Anatomically abnormal kidneys such as solitary kidney, horseshoe kidney, and ectopic kidney
2. Pediatric age group <12 years
3. Stone burden more than 2 cm.
4. Associated ureteric calculi

Data were recorded prospectively on patients who were admitted for the RIRS procedure after proper history, clinical examination and cross sectional imaging studies. Proper informed consent was obtained. Patient data obtained included: age, sex, history and physical examination findings, specific co-morbidities. The stone parameters evaluated were: size of the largest stone, the number of stones, stone location, previous treatments for stone, stone diameters and stone composition.

Stone location was classified as renal pelvis/ureteropelvic junction, superior/middle major calyces and lower calyx with or without other calyceal location. The preoperative assessment included routine urine and culture, CBC (complete blood count), RFT (renal function test), uric acid & non-contrast computed tomography (CT-KUB) and renal ultrasound (US). The indication for surgical treatment was noted. We routinely put DJS (double J stent) in patients 2 weeks prior to RIRS, only 3 patients underwent the procedure without prior stenting.

A prophylactic injectable antibiotic (cefaperazone + sulbactum) was administered 1 hour before the procedure.

The operative time was defined as the time that passed from insertion into the urethra of the cystoscope/semirigid ureteroscope for introducing the guidewire to the completion of basketing of larger stone fragments.

The UAS (ureteric access sheath) (12/14 Fr Cook Medical, Bloomington, IN, USA) was then advanced over the guide wire up to pelviureteric junction. All the RIRS were performed using flexible ureteroscope, URF-P5 (Olympus Europe, Germany). This has following properties.

Imaging system	Optical
Ventral deflection	275
Dorsal deflection	180
Working Channel (French)	3.6
Tip diameter (French)	5.3
Shaft diameter (French)	8.4

Stone fragmentation was performed with Holmium–YAG laser using 30 W laser machine (Sphinx ,Germany) with 270 µm laser fiber. Energy level was set at 0.8–1.2J and a rate of 7–12 Hz frequency levels was adjusted. Stone fragments larger than 4 mm were extracted using tip-less nitinol stone basket catheter. Perioperative complications were recorded.

Follow up

DJS was removed after 2 weeks postoperatively. Based on the EAU guidelines 2014, stone-free status was defined as the absence of stone fragments or asymptomatic insignificant residual fragments of <4 mm on follow up USG abdomen/X ray KUB. All patients were followed up to 6 months, with serial plain radiograph or renal ultrasound. Postoperative complications were assessed according to the modified Clavien-Dindo classification.

Data was entered in the Microsoft Word and Excel & was analyzed using EPI-Info statistical software package. Descriptive statistics (means, proportions, Percentages), categorical variables were compared using Chi square test and Fisher's test wherever necessary. Patients and stone data, procedure characteristics , results and safety outcomes were analyzed and compared by descriptive statistics. Complications were reported using the standardized Clavien-Dindo system.

Results

One hundred and eight patients underwent 133 RIRS procedures with Holmium Laser lithotripsy for renal stones including 21 bilateral and 4 second RIRS procedures. Mean age of patients was 48.1 years. Mean stone size was 12.5±7cm. Passive dilatation via DJS was performed in 105 (97.2%) of patient.

RIRS was safely completed in all patients with a mean operative time of 43.5 min (range 13–56 min). The UAS was placed in 105 patients. Among 108 patients 95 (92.8%) patients underwent primary RIRS with laser lithotripsy while as 13 (7.2%) patients underwent secondary (failed ESWL/RIRS) RIRS procedures.

In 98 cases (90.7%) a complete stone-free status was confirmed endoscopically. Ten (9.2%) patients showed residual fragments larger than 4mm on follow up US scans performed after 3 months. Among these ten patients 2 patients had stone size 6mm and 7mm each and were subjected to ESWL. Four patients with residual fragments of more than 4mm underwent Re-RIRS. Four patients did not opt for any treatment as they were completely asymptomatic and were managed conservatively. Total hospital stay in our patients was average 2 days.

We did not observe any major complication. Overall complication rate was 8.3%. Minor ureteral injuries were seen in 3 (2.7%) patients, which were managed by putting DJS. Post operative fever was seen in 4 (3.7%) of patients and were managed conservatively on antibiotic therapy. One patient was readmitted with features of nonobstructive pyelonephritis whose urine culture was positive for bacteria and was conservatively managed with sensitive antibiotics.

Table 1: Patient And Stone Parameters.

Parameter	Gender		Laterality			Co morbidities			Stone size	
	Male	Female	Left	Right	Bilateral	DM	HTN	Multiple	<1 cm	1-2cm
Number (%)	60 (55.6)	48 (44.4)	43 (39.8)	44 (40.7)	21 (19.4)	38 (35.2)	9 (8.3)	10 (9.3)	56 (51.9)	52 (48.1)

Table 2: Patient and stone parameters.

Parameter	Stone location		Presenting Symptoms			Post-op DJS	
	Upper, mid calyx or pelvis.	With lower calyx	Pain	Multiple	Asympt.	Yes	No
Number (%)	44 (40.7)	64 (59.7)	92 (85.2)	10 (9.30)	6 (5.6)	12 (11.1)	96 (88.9)

Table 3: Success rate in stone clearance.

	According to location		According to stone burden	
	upper & mid calyx & pelvic	lower calyx with or without others	<1cm	1-2 cm
Stone free rate	95.7 %	93.7%	98.2%	94.2%

Table 4: Distribution of Complication

Complication	Lumbalgia	Fever	Perforation of pelvis/calyx	Ureteral injury	Non obstructive pyelonephritis	Obstructive pyelonephritis
Number	1	4	0	3	1	0
Percentage	0.92	3.7	0	2.7	0.92	0

Discussion

Urinary calculi have plagued the mankind since antiquity, and even in the era of modern medicine ,urinary calculi continue to be one of the major disease encountered in urological practice. Over the last 10 years, RIRS has become an increasingly important option for the treatment of the majority of kidney stones even in the most complicated clinical scenarios such as pregnancy, obesity, coagulopathy, large renal stones, calyceal diverticula, and kidney malformations .

We enrolled 108 adult patients with renal stone disease who had stone burden of less than 2 cm. Total 133 RIRS procedures were performed including 21 bilateral and 4 Re-RIRS procedures. Of 108 patients, 105 patients (97.2%) had DJ stent placement under general anesthesia two weeks prior to RIRS with laser lithotripsy.
Jason et al in their study also studied the role of passive dilatation of ureter prior to RIRS[3].

Furthermore fluoroscopy-free technique can protect the surgeon from the negative effects of radiation. We did not face any difficulty of passing UAS in 105 patients without using fluoroscopy guidance. There are studies which have evaluated the role of fluoroscopy-free technique and described it safe and feasible in retrograde intrarenal surgery for renal stones.[4]

The routine use of a UAS is matter of debate. In this study, a UAS was used in 105(97.2%) of the cases. Kaplan has postulated that UAS

facilitates repeated passage of the ureteroscope, minimizes damage to the ureter, improves the flow of irrigation fluid and visualization within the urethra, and reduces operative times.[5]

Stone free rate (SFR) (90.7%) in our study was better as compared to previous studies. Our SFR after a single session is equivalent to the SFR reported in the previous studies. The procedure has high SFR (92.2%) for a stone burden < 2cm, and it is associated with low complication rate.[6,7,8]

In this study we did not find any significant differences in stone clearance between single versus multiple stones, single calyx versus multiple calyces and primary RIRS versus Secondary RIRS (i.e failed ESWL/PCNL).

The combination of flexible ureteroscopes, laser lithotripsy, and nitinol stone baskets provides excellent SFRs with low postoperative complication in the management of renal stones [8, 9]. In our study, while holmium laser and basket catheter were used in 41 (38%) cases, holmium laser without basket catheter was used in 57 (52.8%) cases that had heavy stone burden.

Among 108 patients, 10 patients had multiple co-morbidities including 5 patients who were on anti platelet medication because of underlying coronary artery disease. We accomplish the procedure without any bleeding risk and same was described by a systematic review of the literature which revealed that RIRS could be performed in patients receiving warfarin, low or high doses of aspirin, as well as clopidogrel. [10]

Total hospital stay was 2 days. Patients were discharged next day after surgery. The overall complication rate in this study was 8.3% ,being 4% intraoperative and 6% post-operative. A recent meta-analysis that included 2 randomized and 8 non-randomized studies showed an overall complication rate of RIRS of 10.4%.[11]

Conclusion

RIRS is an effective treatment option in patients with multiple unilateral intrarenal stones especially when the total stone burden is less than 20mm, and it is associated with high success and low complication rates. In order to recommend RIRS on the first line treatment, stronger studies with comparative data are needed. Furthermore, factors like stone hardness (HU value on CT), stone composition, calyceal anatomy, and surgeon expertise need to be addressed.

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