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Original Research Article

A Hospital-Based Study to Evaluate the Safety and Efficacy of Retrograde Intrarenal Surgery (RIRS) in the Treatment of Kidney Stones

Sajal Kumar

Associate Professor, Department of General Surgery, Narayan Medical College and Hospital, Sasaram, Bihar, India

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Corresponding author: Dr. Sajal Kumar
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Abstract

Aim: The aim of the present study was to evaluate the safety and efficacy of retrograde intrarenal surgery (RIRS) in the treatment of kidney stones greater than 2 cm.

Methods: The present study was conducted in the Department of General Surgery. A total of 100 patients admitted to our clinic and underwent RIRS for the period of 2 years was reviewed retrospectively.

Results: The size, location, and number of the stone(s); age; gender of the patient; prior history of open surgery or ESWL; degree of hydronephrosis were compared. The result showed statistically significant differences in prior history of surgery, localization of the stone and mean stone size. The mean hospital stay was 1.56±0.8 days and the mean duration of surgery was 102.28±32.24 minutes.

Conclusion: Currently, PCNL is the gold standard treatment for kidney stones greater than 2 cm. However, single or multi-session RIRS may provide successful results in stones greater than 2 cm. Therefore, RIRS with a holmium laser may be an alternative to PCNL in selected patients with large- sized renal stones.

Keywords: Kidney stones; flexible ureteroscopy; retrograde intrarenal surgery

Introduction

Retrograde intrarenal surgery (RIRS) has been advocated as an alternative to PCNL or ESWL in the treatment of renal stones. It has been shown to achieve high SFR with a low rate of complications. [1-4] Meanwhile, with the advances in flexible ureteroscopic instrumentation and holmium laser lithotripsy, retrograde intrarenal surgery (RIRS) has become an increasingly considered option for intrarenal stone removal. Some studies [5,6] reported a stone-free rate near to 92% in patients with large stones. RIRS has been widely accepted in the management of larger renal stones as an alternative to PCNL. However, it remains unclear which is the superior modality.

Every year, the European Association of Urology (EAU) publishes its guidelines for stone disease treatment. For renal stones more than 20 mm, percutaneous nephrolithotripsy (PCNL) remains the treatment of choice independent of stone position within the kidney. [7] New treatment methods, however, appear to be less invasive and safer but also less effective in retrospective studies. Retrograde intrarenal surgery (RIRS) is a procedure that has evolved since the advent of flexible laser fibers. Since its introduction in 1990, it has been used for small renal stones and after extracorporeal shockwave lithotripsy (SWL) failure. [8] With flexible ureteroscopes, urologists are now able to access even the lower calices of the kidney. [9] Unfortunately, these procedures have quite long learning curves and are burdened with high rates of fiber breakage. This may increase the complication rate and costs of the procedure. Therefore, RIRS with a flexible ureteroscope is used for smaller stones or, subsequently, after RIRS with a semirigid ureteroscope to disintegrate stone debris in the lower calix.

The aim of the present study was to evaluate the safety and efficacy of retrograde intrarenal surgery (RIRS) in the treatment of kidney stones greater than 2 cm.

Materials and Methods

The present study was conducted in the Department of General Surgery, Narayan Medical College and Hospital, Sasaram, Bihar, India. A total of 100 patients admitted to our clinic and underwent RIRS for the period of 2 years was reviewed retrospectively. Patients with severe comorbidities, renal failure, history of previous pyelonephritis, preoperative diagnosis of a renal scar, and morbidly obese patients and patients by whom multiple access was required during surgery were not included in the study. Demographic data of the patients, the size and

the site of stones, the duration of operation, stone free rates, and the duration of the hospital stay were analyzed. The stone-free state was determined at the postoperative third month on computerized tomography (CT). Complete blood count, serum creatinine, bleeding and clotting times, and urine culture of the patients were analyzed. The patients with a positive urine culture had surgery after treatment with antibiotics for an appropriate duration. All patients had X-Ray direct urinary system X-ray or urinary system ultrasonography and spiral CT without contrast. Before surgery, all patients signed informed consent forms. The stone size was determined as the surface area calculated according to the guidelines of European Association of Urology. [10]

For RIRS, a guidewire and a ureteral access sheath (11 or 12 F) were placed into the ureter and the procedure was per- formed using a Storz FLEX-X2 ureterorenoscope (Tuttlingen, Germany). A holmium laser device was set at the energy of level 1.0–2 J and the rate of 5–10 Hz. Later, stone-free rates were followed up in the outpatient clinic at the postoperative third month, with low-dose spiral CT. Complications were scored according to the modified Clavien- Dindo classification. [11,12]

Statistical Analysis

Statistical analysis was performed with Statistical Package for the Social Sciences 18.0 program (SPSS for Windows, Chicago, IL, USA). The chi-square test ($\chi 2$ test) was used for comparisons of the categorical variables and the Student's t-test was used for the comparison of the two groups. Pearson correlation analysis was used to analyze correlations among the variables. The confidence interval was set at 95% and $p<0.05$ was considered statistically significant.

Results

Table 1: Demographic characteristics of the patients and the characteristics of the stones

Parameters	RIRS	p
Number of patients	100	
Mean age	45.05±15.75	0.254
Gender		
Female	36 (36%)	0.684
Male	64 (64%)	
Prior history of open surgery		
(−)	35 (35%)	0.002
(+)	65 (65%)	
History of ESWL		
(−)	10 (10%)	0.634
(+)	90 (90%)	
Degree of hydronephrosis		
None or mild	85 (85%)	0.155
Moderate or severe	15 (15%)	
Number of stones		
One	34 (34)	0.512
Multiple	66 (66)	
Localization of stone		
Upper calyx	12 (12)	
Middle calyx	17 (17)	
Lower calyx	30 (30)	<0.001
Pelvis	26 (26)	
Complex	15 (15)	
Mean stone size (cm)	2.54±0.64	<0.001

The size, location, and number of the stone(s); age; gender of the patient; prior history of open surgery or ESWL; degree of hydronephrosis were compared. The result showed statistically significant differences in prior history of surgery, localization of the stone and mean stone size.

Table 2: Postoperative data and complications

Parameters	RIRS	p
Duration of surgery (min)	102.28±32.24	<0.001
Hospital stay (days)	1.55±0.5	<0.001
Postoperative amount of fall in hemoglobin (g/Dl)	0.46±0.54	<0.001
Complications		
Fever	0	0.15
Blood transfusion	0	0.28
Stone street	3	0.55
Number of patients with residual stones	20	<0.001
Postoperative increasein creatinine	-	

The mean hospital stay was 1.56±0.8 days and the mean duration of surgery was 102.28±32.24 minutes.

Discussion

Developments in the treatment of urinary stones have made minimally invasive techniques such as percutaneous nephrolithotomy (PCNL), retrograde intrarenal surgery (RIRS), extracorporeal shock wave lithotripsy (ESWL), and laparoscopic stone surgery feasible treatment options in cases that previously could only be treated with open surgery. European Urology Guidelines recommend ESWL as the first treatment option in renal stones smaller than 2 cm in size and PCNL in stones larger than 2 cm. [13] With advances in technology, new generation flexible ureteroscopes with safe and effective lithotripters such as holmium laser have been developed and RIRS became an important alternative in the treatment of large urinary stones.

The size, location, and number of the stone(s); age; gender of the patient; prior history of open surgery or ESWL; degree of hydronephrosis were compared. The result showed statistically significant differences in prior history of surgery, localization of the stone and mean stone size. The mean hospital stay was 1.56±0.8 days and the mean duration of surgery was 102.28±32.24 minutes. Bozkurt et al [14] compared the results of 42 PCNL and 37 RIRS patients treated for clearance of renal stones with sizes of 1.5–2 cm. They reported the success rate as 92.8% for PCNL and 89.2% for RIRS. Lately, RIRS can be used in stones greater than 2 cm thanks to advances in technology. Breda et al [15] reported a cumulative post- procedural success rate of 93% after 2.3 sessions on average in stones with a diameter of 2–2.5 cm. Riley et al [16] performed 1.8 procedures on average for stones greater than 2.5 cm and reported a success rate of 90.9%.

No studies in the current literature have investigated the relation between bleeding in RIRS and the duration of operation. [17] On the other hand, high intrarenal pressure during RIRS has been reported to cause temporary intrarenal reflux affecting the renal function. [18] RIRS with the small caliber ureteroscope is an endoscopic surgery through the natural orifice, thus renal parenchymal damage can be avoided. The overall complication rates have decreased, with major complication rates reported to be <1–1.5%. Of course, flexible ureteroscopy is also faced with some problems. First and foremost, urologists require a higher level of technology. Second, flexible ureteroscope fiber easily damaged and may increase the costs. Our experience is that we must ensure the fiber straightly before adjusting operation. Technical improvements in flexible ureteroscopy, including smaller caliber ureteroscopes with digital optics and dual deflection, have recently made RIRS a more popular and feasible option.

Conclusion

Currently, PCNL is the gold standard treatment for kidney stones greater than 2 cm. However, single or multi-session RIRS may provide successful results in stones greater than 2 cm. Therefore, RIRS with a holmium laser may be an alternative to PCNL in selected patients with large- sized renal stones. Nevertheless, these results must be confirmed by further prospective randomized trials.

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