

NAVIGATING CLINICAL COMPLICATIONS: A STUDY ON STONE-FREE RATES AND COMPLICATIONS POST RETROGRADE INTRARENAL SURGERY PATIENTS

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Abstract

Background: Urolithiasis is a prevalent and growing health concern that imposes significant health and economic burdens. Retrograde Intrarenal Surgery is an emerging minimally invasive and effective treatment modality. This study aimed to evaluate the stone-free rate and clinical complications associated with RIRS. **Materials and Methods:** This retrospective study included 52 patients with renal calculi at the Government Royapettah Hospital over 12 months. The patients underwent preoperative evaluation, including imaging, clinical assessments, and antibiotics for positive urine cultures. Surgery with an OTU-Wi scope and holmium laser was followed by postoperative NCCT at three months to assess stone-free rates and document complications using the Clavien-Dindo grading system. **Result:** The mean patient age was 46.21±11.17 years, with a male predominance (67.3%). Among patients with multiple stones, two (28.6%) achieved a stone-free status, whereas five (71.4%) had residual fragments. In contrast, among those with a single stone, 42 patients (93.3%) were stone-free, and 3 patients (6.7%) had residual fragments. There was no significant difference between the stone-free rate and the number of stones (p=0.067). Postoperative complications were minimal, with 76.9% of patients experiencing no complications, and grade 1 or 2 complications were observed in 21.2%. Preoperative stenting was performed in 63.5% of patients, and the mean operative time was 60.31±8.09 minutes. **Conclusion:** Retrograde Intrarenal Surgery is a highly effective and minimally invasive treatment for kidney stones, offering high success rates and low complication rates. Proper patient selection and preparation significantly enhance outcomes, positioning RIRS as a superior alternative to traditional methods.

INTRODUCTION

Kidney stone disease, or urolithiasis, is a growing global health issue, with a prevalence ranging from 1% to 20%, depending on geographic and demographic factors.^[1] It affects approximately 5-9% of individuals in Europe, 8-13% in the United States, and 1-5% in Asia.^[2] This disease not only imposes a significant healthcare burden but also reduces the quality of life of affected individuals through symptoms such as severe pain, recurrent infections, and potential kidney damage. The increasing incidence is attributed to lifestyle changes, dietary habits, and broader shifts in metabolic health.^[3] Historically, open surgery has been the primary approach for treating kidney stones, especially large

or complex calculi. Although effective in removing stones, traditional open procedures have significant drawbacks, including extended hospital stays, higher rates of postoperative complications, increased pain, and prolonged recovery periods.^[4] These challenges highlight the need for minimally invasive alternatives that can reduce the physical and economic burden associated with stone management.

Retrograde Intrarenal Surgery (RIRS) has emerged as a transformative solution to urological care. This technique, employing a flexible ureteroscope and holmium laser, is designed to access and fragment stones through natural anatomical pathways, avoiding the need for external incisions.^[5] RIRS has several advantages over traditional and other minimally invasive techniques, such as percutaneous

nephrolithotomy (PCNL) or extracorporeal shock wave lithotripsy (ESWL). Specifically, RIRS offers shorter operative times, reduced hospital stays, lower morbidity, and faster recovery than PCNL, particularly for stones ≤ 20 mm.^[6] Additionally, RIRS demonstrates lower rates of complications such as significant bleeding and infections compared to PCNL.^[7]

While RIRS has established itself as a safe and effective intervention for managing renal stones, outcomes such as the stone-free rate (SFR) and the risk of clinical complications remain influenced by factors such as stone size and the anatomy of the kidney's collecting system.^[8] For example, lower pole stones with an unfavourable infundibular pelvic angle are known to have lower SFRs, highlighting the need for careful patient selection and preoperative planning.^[9]

Given the growing prevalence of urolithiasis and the increasing adoption of RIRS, it is crucial to systematically evaluate the efficacy and safety of this procedure in real-world settings. This study aimed to analyse the stone-free rate and clinical complications among patients who underwent RIRS at a tertiary care centre for over one year. By focusing on these outcomes, we aimed to contribute to a broader understanding of RIRS as a minimally invasive yet effective treatment for renal stones.

Aim: This study aimed to evaluate the clinical complications and SFRs in patients who underwent retrograde intrarenal surgery.

MATERIALS AND METHODS

This retrospective observational analysis was conducted on 52 patients diagnosed with renal calculus who underwent retrograde intrarenal surgery at the urology ward of Government Royapettah Hospital, Chennai, between October 2022 and October 2023. This study was approved by the Institutional Ethics Committee before initiation, and informed consent was obtained from all patients.

Inclusion criteria

Patients aged 18-75 years diagnosed with renal calculus and deemed suitable for RIRS were included.

Exclusion criteria

Patients with matrix calculi, stones not detected intraoperatively, and paediatric patients were excluded.

Methods: All eligible patients underwent detailed preoperative evaluation, including demographic data collection, clinical assessments, and imaging studies using computed tomography for stone

characterization. Preoperative management included antibiotic treatment for patients with positive urine cultures, tailored based on pathogen susceptibility, for at least one week before surgery.

Surgical procedures were performed using an OTU-Wi scope (flexible fiberoptic ureteroscope) and holmium laser with specific settings for dusting (0.5-0.8J and 20 Hz), fragmentation (0.8-1.5J and 10-15 Hz), and popcorning (1 J and 18 Hz). Operative parameters, such as stone location, size, operative time, and need for preoperative stenting, were recorded.

Postoperative evaluation included non-contrast computed tomography (NCCT) at three months to assess the stone-free rate. Patients with clinically insignificant residual fragments (CIRF) ≤ 4 mm were considered stone-free. Those who did not meet these criteria were rescheduled for a second-look procedure. Complications occurring within 30 days were documented and classified using the Clavien-Dindo grading system.

Statistical analysis: Data are presented as frequencies and percentages. Categorical variables were compared using Pearson's chi-square test. Significance was defined as $p < 0.05$, using a two-tailed test. Data analysis was performed using IBM-SPSS version 21.0 (IBM-SPSS Corp., Armonk, NY, USA).

RESULTS

The mean age of patients undergoing retrograde intrarenal surgery was 46.21 ± 11.17 years. Of the 52 patients, 35 (67.3%) were male and 17 (32.7%) were female. A negative preoperative urine culture was observed in 90.4% of patients, whereas 9.6% showed a positive culture. The most common comorbidity was diabetes mellitus, which was present in 14 (26.9%) patients, followed by systemic hypertension in 10 (19.2%) patients. Other comorbidities included coronary artery disease (CAD) in 2 patients (3.8%) and hypothyroidism in 3 (5.8%) patients [Table 1]. Among the 52 patients, 27 (51.9%) had stones on the left side and 25 (48.1%) had stones on the right side. Single stones were predominant in 45 (86.5%) patients, and the most common stone location was the lower pole 26 (50%), followed by the interpolar region 20 (38.5%). Grade 1 complications were observed in 7 patients (13.5%), while 40 (76.9%) patients experienced no complications. Grade 1 complications were observed in seven (13.5%) patients, while four (7.7%) patients had grade 2 complications and one patient had grade 3 complication (1.9%).

Table 1: Demographic and preoperative characteristics.

		Frequency (%)
Sex	Female	17 (32.70%)
	Male	35 (67.30%)
Pre-OP urine culture	Negative	47 (90.40%)
	Positive	5 (9.60%)
Comorbidities	DLP	1 (1.90%)

	DM	14 (26.90%)
	SHTN	10 (19.20%)
	CAD	2 (3.80%)
	Hypothyroidism	3 (5.80%)
	Bronchial Asthma	1 (1.90%)
	Nil	31 (59.60%)

Table 2: Clinical profile and postoperative outcomes

		Frequency (%)
Stone laterality	Left	27 (51.90%)
	Right	25 (48.10%)
Number of stones	Multiple	7 (13.50%)
	Single	45 (86.50%)
Stone location	Interpolar	20 (38.50%)
	Lower polar	26 (50%)
	Upper polar	5 (9.60%)
	Pelvic ureteric junction	1 (1.9%)
	Renal pelvis	9 (17.30%)
Calvien Dindo Grade	1	7 (13.5%)
	2	4 (7.7%)
	3	1 (1.9%)
	No	40 (76.9%)
Duration of postoperative stay in hospital	2	44 (84.60%)
	3	4 (7.70%)
	4	1 (1.90%)
	5	3 (5.80%)
Post operative complications	Fever	1 (1.90%)
	Nausea and vomiting	6 (11.50%)
	Subcapsular hematoma	1 (1.90%)
	Urosepsis	4 (7.70%)
	No	40 (76.90%)
Preop DJ stenting	No	19 (36.50%)
	Yes	33 (63.50%)
Residual fragment	No	40 (76.90%)
	Yes	12 (23.10%)
CIRF (< 4mm)	No	4 (36.40%)
	Yes	8 (72.70%)

Table 3: Comparison of stone-free rates between single and multiple kidney stones

		Number of stones		P value
		Multiple	Single	
Stone free rate	NO	2 (28.60%)	3 (6.70%)	0.067
	YES	5 (71.40%)	42 (93.30%)	

Most patients 44 (84.6%) had a postoperative hospital stay of 2 days. Most patients 33 (63.5%) underwent preoperative DJ stenting, 40 (76.9%) achieved complete stone clearance, and 12 (23.1%) had residual fragments postoperatively. Among those with residual fragments, a significant portion of eight (72.7%) had clinically insignificant residual fragments (CIRF <4 mm), while four (36.4%) did not [Table 2].

Among patients with multiple stones, 5 (71.4%) achieved a stone-free status, while 2 (28.6%) had residual fragments. For patients with single stones, 42 (93.3%) achieved a stone-free status, with 3 (6.7%) showing residual fragments. The p-value for this association was 0.067, suggesting a trend but no statistically significant relationship between the number of stones and SFR in this cohort [Table 3].

DISCUSSION

This study evaluated the effectiveness and safety of Retrograde Intrarenal Surgery for the management of kidney stones. These findings highlight a high rate of

successful stone removal with minimal severe complications, positioning RIRS as a reliable and minimally invasive option for treating kidney stones. The study population, with a mean age of 46.21 ± 11.17 years, included 67.3% male participants, consistent with previous findings that urolithiasis is more common in middle-aged men.^[10] Notably, 90.4% of the patients had negative preoperative urine cultures, which is a crucial factor in minimizing surgical risks. Preoperative stents were used in 63.5% of the cases, following standard practices to improve ureteral access and simplify the procedure.

The study found an SFR of 76.9% after the initial surgery, with 23.1% of the patients having residual stone fragments. Among these, 72.7% of the fragments were < 4 mm, classified as clinically insignificant residual fragments, underscoring the effectiveness of RIRS in managing complex cases. The reported SFR aligns with previous research, such as that by Sanguedolce et al. (2017), which recorded similar outcomes for RIRS.^[11] Additionally, Zhang et al. (2015) documented the superior effectiveness of

RIRS over extracorporeal shock wave lithotripsy (ESWL), particularly for stones ≤ 20 mm.^[6]

Most of the postoperative complications were minor. Approximately 76.9% of patients experienced no issues, while 13.5% had mild symptoms such as nausea or fever. Only one patient had a significant complication (subcapsular hematoma), reflecting the favourable safety profile of the procedure. These results are consistent with findings by Stachura et al. (2022), who reported low rates of severe complications following RIRS.^[7]

The analysis revealed a connection between the SFR and stone characteristics. Patients with single stones had better outcomes than those with multiple stones, although the difference was not significant ($p=0.067$). This observation agrees with prior research linking surgical success to stone size and number.^[9]

The strengths of the study include its practical clinical setting and thorough data collection, providing relevant insights into RIRS outcomes in a tertiary care facility. However, limitations such as the small sample size and single-centre focus may affect the generalizability of the findings. Additionally, the retrospective design introduced a potential bias.

CONCLUSION

Our study highlights the effectiveness and safety of Retrograde Intrarenal Surgery (RIRS) in managing renal calculi, demonstrating high stone-free rates and low complication rates. The findings suggest that patient factors, including the number of stones, may influence procedural success, with single stones showing a trend toward higher stone-free rates. RIRS offers a minimally invasive alternative to traditional surgical methods, particularly for stones ≤ 20 mm, ensuring shorter recovery times and reduced morbidity. Further studies with larger sample sizes are needed to explore the impact of stone characteristics on outcomes and refine patient selection criteria for optimal results.

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