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Efficacy of Retrograde Intrarenal Surgery Versus Percutaneous Nephrolithotomy In Treating Lower Pole Stones Of 1-2 CMS.

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Abstract: Introduction Urologists are always inclined to find techniques with minimal complication and hospital stays with maximum stone-free rates to mitigate not only health concerns but financial burdens too. PCNL is known as the gold standard for large stones, however, RIRS is known for its less invasive and minor complications. **Methodology** This is a cross-sectional, prospective study conducted at the public hospital of Jamshoro. Patients with renal stones located at the lower pole, measuring 1-2 cm were included. Patients were evaluated before enrollment and detailed history was taken. Intraoperative and post-operative details were documented. SPSS 21 was used to analyze the data, and to assess significance chi-square test was used, a p-value < 0.05 was considered significant. **Results** The mean age was 42.7 ± 12.8 and 43.2 ± 13.2 in the RIRS and PCNL groups respectively. The RIRS group showed 07 (17.5%) partial clearance cases while PCNL group showed 02 (5%). Hemoglobin drop was measured as minimal (< 2.5ml) and excessive (>2.5ml) after surgery, and only 01 (2.5%) cases of RIRS had excessive blood loss, PCNL group had higher hemoglobin drop cases with 3 (7.5%) cases. Blood transfusion was required in 1 (2.5%) and 2 (5%) cases in the RIRS and PCNL groups respectively. **Conclusion** RIRS can be beneficial in small stones while PCNL can be an ideal procedure for lower pole renal stones of 1-2 cm size.

Keywords: Percutaneous Nephrolithotomy, Retrograde intrarenal surgery, Lower pole renal stone

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Introduction

Over the last two decades, minimally invasive techniques have nearly totally replaced open surgery in patients with kidney stones. Percutaneous nephrolithotomy (PCNL) is now the gold standard for treating big (>2 cm) stones [1]. However, the risk of complications outweighs the higher stone-free rates. Recent technological developments have resulted in a reduction in nephroscope diameter, to reduce the surgical morbidity of PCNL. Miniperc and micro perc have thus been implemented [2].

Although flexible URS was initially proposed to treat a lower pole stone resistant to shockwave lithotripsy (SWL), studies have shown its utility in the management of larger renal stones throughout the pelvicalyceal system [3]. When anatomic circumstances render SWL unsuitable, the European Association of Urology (EAU) recommendations from 2013 prescribe PCNL and RIRS as first-line treatments for lower pole stones. Although theoretically viable, the function of RIRS in the renal pelvis and residual calyces is being investigated for stones larger than 1.5 cm [4].

The primary disadvantages of retrograde access include the necessity for flexible scopes, restricted vision, smaller fragment removal sizes, and the need for flexible lithotrities and baskets. Cost is a significant impediment to RIRS, particularly in underdeveloped nations [5]. Despite the EAU guidelines for renal stone care, RIRS has been frequently utilized to treat renal stones larger than 2 cm by multiple investigators and has been linked with fewer problems than PCNL [6]. The stone-free rate (SFR) of RIRS has been reported to range from 77% to 96.7% with staged operations for renal stones larger than 2 cm. For renal stones larger than 2 cm, RIRS is becoming a safe alternative technique. PCNL, on the other hand, produces greater SFR with a single session as compared to RIRS; nonetheless, severe problems such as hemorrhage requiring embolization, sepsis, urinoma, and organ harm may occur after PCNL [7-9]. This study aims to assess the efficacy of RIRS versus PCNL in managing lower pole, 1 to 2 cms renal stones by evaluating the difference between stone-free rates, hemoglobin drop, postoperative complications including hospital stay, hematuria, and operative time.

Methodology:

This is a cross-sectional study conducted from January 2022 to February 2023 at the Urology departments of Liaquat Medical University Hospital Jamshoro. Approval for data collection was obtained from the institutional review board.

The sample size was calculated by keeping renal stone prevalence as a numerator (Lower pole stones mark 25- 30% of total burden[3]) with a 95 % confidential interval and a 05% margin of error, the minimum required sample size was 80. This sample was divided equally into two groups to assess the efficacy of RIRS and PCNL separately. The allocation of grouping was randomized and computerized randomization software was used to eliminate biases. Every case had equal chances to get into any group, Age (18-60 years), gender (both), size of the stone (1-2cms), and location of the stone (lower pole only) were kept similar to control confounding factors. The diagnosis was made with the help of computed tomography (CT pyelogram), Ultrasonography (US KUB), and blood workup including Blood count, creatinine, urea, and electrolytes were performed to get complete knowledge of any persistent underlying problem. Radiological investigations were performed to identify the stone location, number of stones, and degree of hydronephrosis. Patients with multiple stones, ureteric stones, bladder stones, severe HDN, recurrent stone disease, bleeding disorder, Urinary tract infection, and elevated creatinine were eliminated from the study.

Statistical Package for Social Science (SPSS) Version 21 was used to enter and analyze the data. Independent variables such as gender, age, stone size, total operative time, hemoglobin drop, and hospital stay were analyzed in mean and standard deviation. The impact modifiers such as age, gender, and stone size were controlled by stratification, and the chi-square test was used to examine the influence of modifiers on the postoperative outcome variable of both surgeries. A p-value of 0.05 was considered significant.

Results

A total of 80 patients were recruited in the study randomly separated into two groups, group A underwent RIRS while group B had PCNL to remove stones from the lower pole of the kidney. The mean age of the total study population was 51.4 ± 7.4 years, while within groups mean age was 42.7 ± 12.8 and 43.2 ± 13.2 in RIRS and PCNL groups respectively. Gender distribution indicated female dominance in the RIRS group while the male population was more in the PCNL group. Fig 01

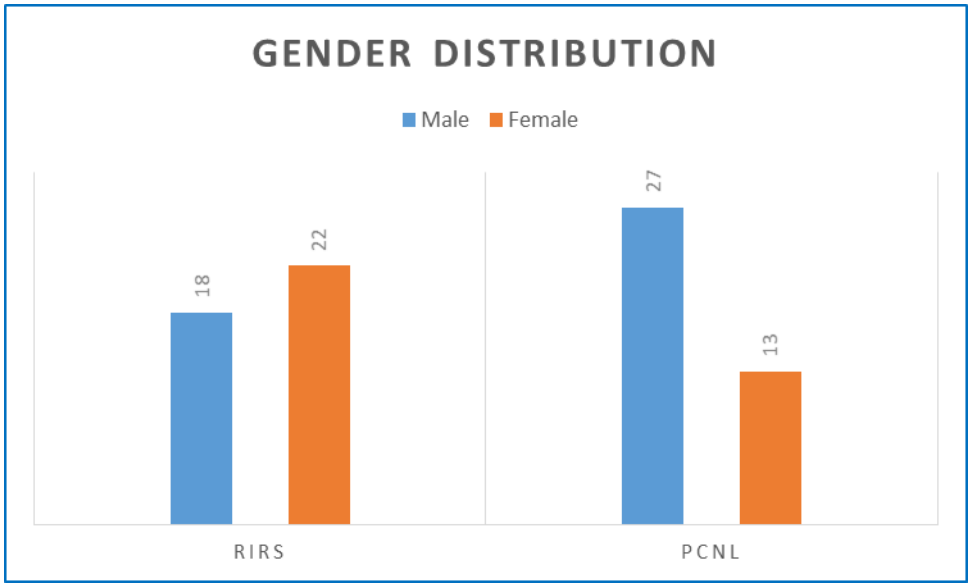

Figure 1: Gender distribution within groups

The overall difference between stone size measurements, creatinine level, operative time, and hospital stay between the two groups was kept minimal to discourage confounding factors and eliminate biased results. However, the p-value indicated a significant difference between RIRS and PCNL groups in operative time with 0.03, and hospital stays with 0.02 respectively. These p-values indicate that PCNL has elevated operative time and hospital stay as compared to RIRS. Table 1.

Table 1:

Variables	RIRS n=40	PCNL n=40	P-Value
Age (Years)	42.7 ± 12.8	43.2 ± 13.2	0.21
Stone size (cms)	1.4 ± 0.5	1.3 ± 0.7	0.43
Creatinine (mg/dL)	0.71 ± 0.32	0.82 ± 0.21	0.51
Operative time (Min)	41.8 ± 12.8	54.8 ± 18.5	0.03
Hospital stay (Days)	0.38 ± 0.71	1.02 ± 0.51	0.02

Stone-free rates were identified by assessing stone clearance after the procedure, RIRS group showed 07 (17.5%) partial clearance cases while the PCNL group showed 02 (5%). Hemoglobin drop was measured as minimal (< 2.5ml) and excessive (>2.5ml) after surgery, and only 01 (2.5%) cases of RIRS had excessive blood loss, PCNL group had higher hemoglobin drop cases with 3 (7.5%) cases. Blood transfusion was required in 1 (2.5%) and 2 (5%) cases in RIRS and PCNL groups respectively. Ultrasonography on follow-up after 7 days of procedure was used as final clearance confirmation, indicating 1 (2.5%) and 2 (5%) cases with residual stones in RIRS and PCNL groups respectively. Post-operative complications were documented, hematuria is known as the most common complication of urinary stone removal procedure with 27 (67.5%) and 33 (82.5%) patients with mild to moderate hematuria in RIRS and PCNL groups respectively. Similarly, fever was reported during hospital stays in 7 (17.5%) and 9 (22.5%) in RIRS and PCNL groups respectively. (Table 02)

Table 2: Post-operative complications and stone clearance.

Variables		RIRS	PCNL	P-Value
		n=40	n=40	
Stone free rates	Complete clearance	33	38	0.01
	Partial clearance	7	2	
HB drop	Minimal	39	37	0.17
	Excessive	1	3	
Transfusion	Not required	40	38	0.08
	required	1	2	
Residual stone on follow up	Present	1	2	0.03
	Absent	39	38	
Hematuria	Present	27	33	0.01
	Absent	13	7	
Fever	Present	7	9	0.04
	Absent	33	31	

Discussion

The best surgical treatment for lower pole renal stones is still being debated. Two minimally invasive treatments routinely used to treat lower pole renal stones are retrograde intrarenal surgery (RIRS) and percutaneous nephrolithotomy (PCNL) [10, 11]. Studies indicated comparatively higher stone clearance rates in the PCNL group with slightly longer hospital stays and elevated complications as compared to RIRS, however, RIRS has lower complication rates, and smaller hospital stays but residual stones are the main problem in RIRS[12, 13]. A meta-analysis of randomized controlled trials comparing the efficacy and stone-free rates between RIRS and PCNL, results found that RIRS was related to a minor threat of postoperative hemorrhage and the necessity for blood transfusion equated to PCNL [14]. The authors suggested minimal invasive nature of RIRS contributed to minimal blood loss. Another study compared the need for blood transfusion between RIRS and PCNL groups while treating lower pole stones, results indicated a higher rate of blood transfusion in the PCNL group as compared to RIRS [15]. According to the authors, there are many associated factors for excessive blood loss and the need for blood transfusion including the dimension and site of the stone, and the expertise and capability of the surgeon [16].

As our study, another study compared the operative time of RIRS and PCNL, and results showed a significantly higher duration of a procedure of PCNL as compared to RIRS with a mean difference of the operative time of 6.8 ± 5.8 minutes [17, 18]. The shorter operative time is considered a key determinant of lower post-operative complication risk and lesser post-operative pain for patients.

According to the study, RIRS was linked to a decreased risk of postoperative bleeding, shorter hospital stays, and faster recovery time, but PCNL had a greater stone-free rate and required fewer surgical sessions to accomplish complete stone removal. Both RIRS and PCNL are safe and effective treatment options for lower pole renal stones, according to the authors, and the decision between the two should be based on the individual patient's stone features, surgeon experience, and available resources [19-22]. Another study looked at the effectiveness of RIRS and PCNL for the treatment of lower pole stones smaller than 2 cm in size [23]. The researchers discovered that while both RIRS and PCNL had comparable stone-free rates, RIRS was associated with a shorter hospital stay and fewer problems. However, both RIRS and PCNL have advantages and limitations, and the procedure should be chosen after careful consideration of [24] of the individual patient's stone characteristics, surgeon experience, and available resources. For bigger or more complicated stones, for example, PCNL may be more successful, but RIRS may be

favored for smaller or less complex stones [25-28]. The higher stone-free rates in our study are reported in PCNL as compared to RIRS, the major reason behind this difference is the stone size and accessibility of PCNL.
The limitation of this study is the cross-sectional study design and single-center, small sample size can also be considered as a limitation. However, based on this study's results it is recommended to perform multi-center research with a large sample size.

Conclusion
RIRS and PCNL are effective in managing lower pole renal stones in the adult population. However, the efficacy of PCNL for stone clearance is significantly higher, while complication rates of RIRS are lower. Therefore, the clinical decision to opt for RIRS or PCNL should be based on stone characteristics and the degree of hydronephrosis. Recurrent stone disease patients with follow-up and small-size stones can easily go for RIRS while, a stone size larger than 1 cm can be a good candidate for PCNL.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE
Not applicable.

HUMAN AND ANIMAL RIGHTS
No animals were used in this study. The study on humans was conducted in accordance with the ethical rules of the Helsinki Declaration and Good Clinical Practice.

CONSENT FOR PUBLICATION
Not applicable.

AVAILABILITY OF DATA AND MATERIALS
None.

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CONFLICT OF INTEREST
The authors declare no conflict of interest, financial or otherwise.

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