



## EFFICACY OF RETROGRADE INTRARENAL SURGERY WITH EXTRA CORPOREAL SHOCKWAVE LITHOTRIPSY FOR LOWER POLE RENAL CALCULI: A COMPARATIVE ANALYTICAL STUDY FROM BANSADHARA HOSPITAL, BERHAMPUR

**Dr. Manoj Kumar Panigrahi**

Ex Associate professor General Surgery and Consultant Urologist Sikkim Manipal Institute of Medical Science

Conflicts of Interest: Nil

Corresponding author: Dr. Manoj Kumar Panigrahi

### ABSTRACT

**Background:** The location of the stone and the amount of stone load determine the treatment for renal stone disease. Depending on the patient and stone features, current treatment options include shock wave lithotripsy (SWL), percutaneous nephrolithotripsy (PCNL), and retrograde intra-renal surgery (RIRS).

**Aims & objectives:** The goal of this study is to examine the efficacy of RIRS against ESWL for lower pole renal calculi, as well as to assess the safety of RIRS versus ESWL for lower pole renal calculi.

**Material & methods:** The study included 120 patients, 60 of whom received RIRS and 60 of whom underwent ESWL for lower pole renal calculi measuring 1.5cm.

**Results:** ESWL has a success rate of roughly 73 percent, while RIRS has a success rate of 93 percent. For SWL, we kept the success size at 4 mm, and for flexi URS, we kept it at 3 mm. The minor and significant issues that arose were examined.

**Conclusion:** For stones larger than 1.5cm, ESWL can be utilised as a first-line treatment. RIRS can be used in patients who have failed ESWL, are morbidly obese, or have a kidney anatomical anomaly.

**Keywords:** Renal calculi, shock wave lithotripsy (SWL), Percutaneous nephrolithotripsy (PCNL), Retrograde Intra-Renal Surgery (RIRS)

### INTRODUCTION

The prevalence of stones in the Western population ranges from 5% to 15%. The patient may have dull aching abdomen discomfort, colicky abdominal pain, or an unintentional diagnosis. The type of pain and the extent to which it is radiated is determined by the position of the stone<sup>1</sup>. Stone illness is treated mostly based on the location of the stone and the amount of stone load. Because of its anatomical significance, treating lower calyceal stones is important. Open surgery was the sole option to treat lower calyceal calculi before the advent of endo-urological procedures. Depending on the patient and stone features, alternatives now include shock wave lithotripsy (SWL), percutaneous nephrolithotripsy (PCNL), and retrograde intra-renal surgery (RIRS)<sup>2</sup>. Because shockwave lithotripsy has a high

failure rate and percutaneous nephrolithotripsy is associated with increased problems, retrograde intrarenal surgery (RIRS) is being used more frequently nowadays<sup>3</sup>. With minimal morbidity, RIRS has a good success rate in treating lower pole renal calculi. The goal of this study was to examine the efficacy of RIRS against ESWL for lower pole renal calculi, as well as to assess the safety of RIRS versus ESWL for lower pole renal calculi.

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### Materials and Methods

The research was carried out in the Department of Urology of a tertiary healthcare facility in Central India. The study included 120

patients, 60 of whom received RIRS and 60 of whom underwent ESWL for lower pole renal calculi measuring less than 1.5 cm. The research was place over a two-year period.

RIRS: Stone size under 1.5 cm, anatomical abnormality, failed ESWL, and bleeding diathesis were all considered. The size of the stone had to be greater than 1.5 cm to be excluded. Complete urine analysis, blood tests such as complete blood count and renal function test, and plain X-ray KUB, Ultrasound KUB, Intravenous pyelogram (or) Contrast Enhanced CT-KUB were performed on all RIRS patients. Patients were informed about the RIRS procedure after the diagnosis of lower pole renal calculi was confirmed. Either the patient or a first-degree family signed a written consent form. They were discharged after undergoing pre-operative stenting with a 5F Double J stent under regional anaesthetic. Patients were admitted after two weeks. The stent that had been inserted two weeks prior was withdrawn under general anaesthesia while the patient was in the lithotomy position. The scope was an Olympus P.5 with a single deflection and a 5.3 F at tip, 8.4F, 0.032" Biwire. The temperature ranged from 9 to 11 degrees Fahrenheit in the Access Sheath. The scope was deflected 1800 and 2700 degrees

upward and downward, respectively. Then a Zebra guide wire of size 0.032" was put inside the ureter using an 8-9.5F long ureteroscope. The ureteroscope was then withdrawn, but the guide wire remained in place. Over the zebra guide wire, a size 9 to 11F access sheath was added. C-ARM was used to track the positioning of the access sheath. The zebra guide wire was removed once the access sheath was placed. Through the access sheath, flexi scope is introduced. Holmium laser lithotripsy was performed after locating the stone in the lower calyx. After fragmenting the calculi, a 5F Double 'J' stent was put, which was withdrawn two weeks later if the stone had cleared.

ESWL: The Dornier compact delta II gadget was used in this ESWL. The surgery was performed in a daycare setting. Fluoroscopy was used to locate the stone. A total of 2500 shock waves were delivered. The energy level was kept between 4 and 5 on the scale. The shockwave rate was 60 times per minute.

### Results

Our research included 120 patients, 60 of whom received RIRS and 60 of whom underwent ESWL.

**Table 1: Mean age of patients**

Group	N	Mean Age	Std. Deviation
ESWL	60	42.33	11.42
RIRS	60	38.45	14.11

**Table 2: Body mass index of patients**

Group	N	Mean BMI	Std. Deviation
ESWL	60	24.25	4.45
RIRS	60	24.40	3.33

**Table 3: Frequency of hospital stay**

No. of days	Frequency	Percent
2	30	50 %
3	16	27 %
5	10	16 %
7	4	7 %
<b>Total</b>	<b>60</b>	<b>100 %</b>

Patients with RIRS developed sepsis in 23% of cases, had hematuria in 33% of cases, had post-procedure pain in 40% of cases, had residual calculi in 7% of cases, ureteral laceration in 17% of cases, and ureteral avulsion in 7% of cases. The length of stay in the hospital for all of the patients who received RIRS was examined. In two to three days, two-thirds of the patients were discharged. Severe sepsis was treated with intravenous antibiotics, and 14 patients were admitted to the hospital for 5 to 7 days.

**HOSPITAL STAY IN RIRS:** To determine the cause of the RIRS group's prolonged hospital stay, factors such as sepsis, hematuria, and post-operative discomfort were investigated.

**SEPSIS IN RIRS:** In the RIRS group, 10 patients had sepsis and stayed for 5 days, while the remaining 4 stayed for 7 days. This was confirmed to be statistically significant using the Chi square test.

**RIRS hospital stay with hematuria:** Of the 20 patients who developed hematuria after RIRS, eight patients (40 percent) were discharged on the third day, eight patients (40 percent) on the fifth day, and four patients (20 percent) on the seventh day. The number of hospital days spent by patients who acquired hematuria was determined to be statistically significant using the chi square test.

**POST-PROCEDURE PAIN IN RIRS:** Of the sixty patients, 24 developed considerable pain that necessitated continuous analgesia. Ten patients (41.7%) had a three-day hospital stay, eight patients (33.3%) had a five-day hospital stay, and four patients (16.7%) had a seven-day hospital stay. When applying the chi square test to compare these variables in post-procedural discomfort with hospital stay, it was discovered to be statistically significant.

**Parameters analysed in ESWL:** Ten percent of ESWL patients developed sepsis, 17 percent had hematuria, 20 percent experienced post-procedure discomfort, 27 percent had residual calculi, and 7% had Steinstrasse.

**ANALYSING COMPLICATIONS AFTER ESWL:**

**SEPSIS AND AGE/BMI:** Using an independent sample test, it was discovered that sepsis had a statistically significant association with age (0.003) but not with BMI (.360).

**HEMATURIA AND AGE/BMI:** The age and BMI of five patients who acquired hematuria were studied. The patients who developed hematuria had a mean age of 56.20 and a mean BMI of 24.40. Hematuria and age (0.03) were found to have a statistically significant relationship, but not with BMI (.961).

**POST-PROCEDURE PAIN AND AGE/BMI:** The average age of the 12 patients who acquired pain was 54.33 years old, with a BMI of 25.17. Using an independent sample test, it was discovered that there is a significant relationship between post-operative discomfort and age (0.005), but not with BMI (0.716).

**RESIDUAL CALCULI WITH AGE/BMI:** After ESWL, 16 patients had residual calculi, which were analysed using an independent sample test that took age and BMI into account. The patients with residual calculi had a mean age of 42.88 and a mean BMI of 31.00. Using an independent sample test, a statistically significant relationship between patients with residual calculi and BMI (.000) was discovered, but there was no such relationship with age.

**SEPSIS IN THE RIRS AND ESWL GROUPS:** Six patients in the ESWL group experienced sepsis, while 14 patients in the RIRS group acquired sepsis. When comparing sepsis in the ESWL and RIRS groups using the chi square test, there is no statistical significance.

**HEMATURIA:** In the ESWL group, 10 patients had hematuria, while in the RIRS group, 20 patients acquired hematuria, for a total of 16 percent and 33 percent in each group, respectively. This number was not statistically significant when compared using the chi-square test.

**POST PROCEDURE SIGNIFICANT PAIN:** In the ESWL group, 12 patients suffered considerable pain that required prolonged analgesia, while in the RIRS group, 24 patients developed significant pain that required prolonged

analgesia. In the ESWL and RIRS groups, this was around 20% and 40%, respectively. Using the chi-square test to compare post-procedure pain in the ESWL and RIRS groups, it was discovered that there is no statistically significant link.

**RESIDUAL CALCULI:** Significant residual calculi were seen in 16 patients in the ESWL group and 4 patients in the RIRS group. This was around 26% in the ESWL group and 6% in the RIRS group. The ESWL group had significantly more residual calculi than the RIRS group when evaluated using the chi-square test ( $p = 0.03$ ).

### Discussion

Shock wave lithotripsy is a significant development in the treatment of urinary stones, and it is now considered routine treatment for the majority of patients<sup>4</sup>. According to studies, ESWL for renal pelvic calculi has a success rate of roughly 90%. However, when it comes to lower calyceal stones, the ESWL has a lesser success rate, necessitating the development of alternate techniques<sup>5</sup>. According to the 2012 EAU guidelines, ESWL should be used first for pelvis, upper calyx, and middle calyceal stones that are less than 2 cm in size, however for lower calyceal stones, the stone size should be less than 1.5 cm<sup>6</sup>. SWL is also contraindicated in the presence of an active infection that is unmanageable, bleeding diathesis, pregnancy, and renal/aortic artery aneurism. Obesity, skin-to-stone distance, and patient preference all have a role in the therapy outcome<sup>7</sup>. After the introduction of flexi URS and laser energy, a breakthrough in the treatment of lower calyceal calculi was achieved. The RIRS device features a larger operational channel (3.6-4 fr) and a smaller outside diameter (6.75-9 fr), allowing for dual deflection. Catheters, guide wires, expanders, and access sheaths were all made in accordance with those specifications<sup>8</sup>. Holmium YAG laser energy was employed, with a wavelength of 2100 nm and a tissue penetration depth of roughly 0.4 mm. To break the stone, a higher dose and frequency (15w-10 Hz) is employed. The energy is transmitted by quartz fibres. Fever, discomfort, hematuria,

ureteral (or) pelvi-calyceal epithelial abrasion, acute urinary retention, extravasations, and serious complications such as forniceal tear; urinoma, avulsion, sub capsular hematoma, and steinstrasse are all RIRS-specific complications. According to studies, more than 90% of RIRS patients were discharged after one day<sup>9</sup>. Following RIRS, around 77 percent of patients were discharged in two to three days, while the remaining 23 percent were discharged in five to seven days due to complications such as sepsis, hematuria, and post-procedure discomfort<sup>10</sup>. There are no established criteria for defining stone load, fragmentation, and stone free rate and duration when discussing the success of RIRS for lower calyceal calculi. However, when compared to ESWL, the stone-free rate was higher for lower calyceal calculi<sup>11</sup>. In our study, the ESWL success rate was around 73 percent, and the RIRS success rate was around 93 percent, which is very similar to other studies. 37 individuals underwent SWL and 62 patients underwent RIRS in a study by El-Nahaswith. The stones ranged in size from 10 to 20 mm in diameter<sup>12</sup>. The stone-free percentage for ESWL was 67.7%, while it was 86.5 percent for RIRS, a statistically significant difference. Another study indicated that when flexi URS was compared to PCNL for lower calyceal stones with a diameter of 15 to 20 mm, the success rate for flexi URS was 89.2 percent versus 98.2 percent for PCNL. According to research, the effectiveness rate of flexi URS for stones less than 1 cm is 82-100 percent. The success rate of ESWL is 60.80 percent for stones less than 1 cm and 59.60 percent for stones greater than 1 cm for stones with a size of 1-2 cm. However, as the stone size grows larger, the success rate of RIRS diminishes, and it appears that a complete stone clearing for a stone larger than 3 cm is difficult. As a result, a diameter of 2 cm is utilised as the RIRS cutoff value. The high success rate of RIRS for stones less than 1.5 cm, compared to the lower SWL success rate and increased morbidity associated with PCNL, demonstrated that RIRS is a viable option for stones between one and two centimetres in size<sup>13</sup>. The success size in

our study was 4 mm for SWL and 3 mm for flexi URS. Minor problems with RIRS included temporary hematuria in 20 patients, substantial post-procedure discomfort in 24 patients, and temporary hematuria in 10 patients and severe post-procedural pain in 12 patients in the ESWL group. Sepsis occurs in 14 patients in the RIRS group and 6 patients in the ESWL group, necessitating a longer stay in the hospital for IV antibiotics. In addition, four patients in the RIRS group had partial ureteral avulsion and ten had ureteral laceration. The small sample size of our study has limitations, and we did not mention how we handled with residual calculi. Considering the efficacy of both ESWL (73%) and RIRS (93%) for lower calyceal calculi, both are viable options<sup>14,15</sup>. However, given the morbidity and length of stay associated with RIRS, ESWL can be utilised as first-line therapy for lower pole renal calculi less than 1.5 cm in size, with RIRS being considered if ESWL fails, the patient is morbidly obese, or the kidney is anatomically aberrant.

### Conclusion

According to our findings, ESWL can be used as first-line therapy for stones smaller than 1.5 cm, while RIRS can be utilised for individuals who have failed ESWL, are morbidly obese, or have a kidney anatomical anomaly. Physical treatment, especially for lower calyx stones, upper ureter stones, and renal pelvic stones, is useful in improving SFR after ESWL and RIRS with few side effects. External physical vibration lithotripsy (EPVL) may give a more homogeneous and repeatable technique for physical therapy clinical practise. To examine the details of physical treatment, well-designed RCTs with a large sample size are still required.

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