

Can Retrograde Intra Renal Surgery Replace Mini Percutaneous Nephrolithotomy in Renal Stone of Size Upto 25 mm a Retrospective Analysis: RIRS Vs Minipcnl

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Abstract:

Background: Renal tone diseases are common in Indian population, prevalence is about 13%, but it constitutes major cause of chronic renal diseases in unattended patients.

Methods: In this study we have compared mini PCNL with RIRS for the management of stone diseases in renal stone size up to 25 mm. it's a retrospective study to assess which one is better. In this study we took 150 cases of mini PCNL and 142 cases of RIRS

Results: The RIRS group had a similar operative time, but less hemoglobin drop, shorter hospital stays than that in MPCNL group. In the MPCNL group, total complication occurred 24/150 while in the RIRS group vs 11/142. However, the differences was statistically significant (16% in PCNL vs. 7.7% in RIRS, p=0.315). The stone-free rate after a single procedure was similar in both groups.

Conclusion: (1) RIRS showed higher SFR compared to MPCNL after a single session can get a satisfactory stone-free rate. (2) MPCNL can achieve a similar stone-free rate, but still with potential severe bleeding complication, which can occur by chance or technical problems. (3) Patients with much more number of risk predictors (lower pole location, severe hydronephrosis, and multiple calyces) will get lower stone-free rate after RIRS, and this model has good preoperative predictive accuracy for SFR. (4) the RIRS may be the first option to treat these group of patients with 2–3 cm stones.

Keywords: minipcnl, RIRS, renal stone.

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Introduction

Percutaneous nephrolithotomy (PCNL) is now the treatment of choice for large burden (>2 cm) renal stones because of the high rate of stone clearance [1,2]. However, considering the risk of surgical morbidities associated with PCNL, which include bleeding, pain, and urine leakage [3,4], minimally invasive procedures are getting more attention, especially miniaturized PCNL (mini-PCNL) and retrograde intrarenal surgery (RIRS). In recent years, retrograde intrarenal surgery (RIRS) results in a reduced risk of postoperative complications and is, therefore, of considerable interest. The European Urological Guidelines recommend RIRS as a standard treatment for small to medium (<2 cm) renal stones because of high stone-free rate (usually more than 90%) for these size of stones. With the

development of flexible ureteroscopes and holmium laser, RIRS in the management of larger (>2 cm) renal stones have been reported to get good outcomes[5]. Currently, lower pole renal stone treatment is controversial, and choosing the appropriate treatment modality has become a challenge for urologists and endourologists [4, 12].

AIMS & Objective: It is to compare stone clearance, blood loss, duration of surgery, hospital stay, complications analgesia required, stone clearance at 3 months related to both the procedures

Materials & Methods

It is a retrograde analysis of all patients admitted to SCB medical college and hospital with stone

diseases from January 2019 to March 2023. A total of 292 patients of which 150 underwent mini pcnl and 142 RIRS. Patients are subjected to mini pcnl and RIRS alternatively irrespective of sex, stone size, stone location after proper pre-operative imaging and routine investigations. All patients underwent pre operative USG. NCCT KUB, and CT urography. Intra operative stone clearance is assessed by both endoscopically and imaging with C-Arm. Post operative care given, post op routine investigation, and discharge accordingly. follow up at 3 months with NCCT KUB. Mini PCNL is performed with Karl Storz MIP and RIRS with Olympus P7R and standard aseptic precautions and protocols observed. The study is approved by institutional ethical committee of SCB medical college.

Inclusion Criteria

1. Age 15 - 70 yrs
2. Renal stone size upto 25 mm
3. No major comorbidities

Exclusion Criteria

1. Renal anomalies
2. Age <15 yrs
3. B/l renal stones
4. Major comorbidities
5. Blood dyscrasias
6. 6.coagulation disorder

Preoperative preparation: Preoperatively medical history taken and physical examination performed in all patients. Laboratory studies; urine analysis, complete count, renal function test, serum electrolytes, coagulation profile, fasting blood sugar and virology markers done for all patients. Preoperative ECG, echocardiography and chest X-ray done for selected patients. Imaging studies in form of ultrasonography, intravenous pyelography including (KUB) or CT-urography done to locate the site, size, and laterality of stone and anatomy of the pelvicalyceal system.

Operation preparation: Preoperative medical written consent taken from all patients and prophylactic antibiotic inform of third generation cephalosporine 1 g iv administered at the induction of anesthesia. The choice of the surgical method was decided by the surgical team discussion with patient's expectation and outcome.

Mini-PCNL technique: After induction of general or spinal anesthesia, patients were placed in the dorsal lithotomy position, 5 fr ureteric catheter is placed on the diseased side with the help of cystoscope of 17 fr. Then the patient was turned to prone position and 50% diluted nonionic contrast material pushed through the ureteric catheter under fluoroscopy and all calices were allowed to fill with radio-opaque contrast and under C arm guidance targeted calyx is punctured with 18 G IP needle and 0.032 terumo

glide wire passed upto the PUJ & then serial dilatation done with the help of Alken dilator set. Then a 16 Fr operating sheath was inserted above the dilators, and the lower calyx was entered with 12 Fr nephroscope(MIP) and the pelvicalyceal system and stones were evaluated then stones were fragmented with the help of holmium laser. At the end of surgery, fluoroscopy and nephroscope (MIP) were used to confirm was complete stone clearance. Additionally, JJ stent insertion was optional depending on local tissue trauma and presence the amount of gravel's left behind.

RIRS technique: After induction of spinal anesthesia, the patient put on dorsal lithotomy position, and semirigid URS performed in the relevant side, a 0.032 Fr ureteric guide wire put under vision. A 12 Fr ureteric access sheath fixed over the guide wire. 7.5 Fr flexible ureteroscope (OLYMPUSP7R) introduced through the access sheath upto the collecting system. After localization of the stone, fragmentation of stones performed with the help of Holmium laser (Holmium laser system) lithotripter with 200 μ m fiber for lithotripsy. The laser machine was adjusted according to the type of stones treatment either fragmentation or dusting modes. Dusting mode use high frequency (10–20 Hz) low energy (0,5 J) energy while fragmentation mode of low frequency (5–10 Hz) and high energy (2–3 J). Stone fragments were removed by nitinol stone basket. At the end of procedure JJ stent was put depending on local criteria and operating time. All calices were checked for residual stone by flexible URS and fluoroscopy for radio-opaque stones intraoperatively.

Follow up: During hospital stay, patients received iv fluid, iv antibiotic and analgesia. Follow up of patients done regarding stone free rate by imaging studies {Ultrasonography, plain abdominal x-ray (KUB)} and non-contrast CT after 3 months and JJ stent removed after confirmation of stone clearance.

Comparison was done in both the groups using Pearsons Chi square test and the Fischers exact test.

Results

A total of 292 cases (MPCNL in 150, RIRS in 142) were carried out into the final analysis. Most of the patient demographics and basic renal stone characteristics were similar between the MPCNL and RIRS groups ($p > 0.05$, Table 1). The mean stone size was a little larger in RIRS group as compare to MINIPCNL

Preoperatively mean age was 45.5 ± 15 in RIRS and 42.2 ± 14.3 in MINIPCNL group, mean BMI was similar in both the groups. males were predominant in both the groups and on the basis of laterality in RIRS group both the sides were equally involved but in mini PCNL group RT side was predominant. Mean stone size was equivalent in both the groups,

with lower calyx involved in 38 and 51 in RIRS and MINIPCNL group respectively. In both the groups stone usually occupies all the calyx but maximum occupancy was in pelvis + 1 calyx i.e 72 in RIRS and 83 in MINIPCNL. Both the group had hydronephrosis with 81.69% and 83.33% in RIRS and MINIPCNL respectively. Maximum had normal renal function but 9/142 in RIRS and 15/150 in MINIPCNL group had deranged Renal function test.

Perioperative and postoperative parameters are compared in Table 1 & 2. The RIRS group had a similar operation time, but less hemoglobin drop, shorter average hospital stays than that in MPCNL group. In the MPCNL group, total complication

occurred 24, of which 15 had fever and 4 of which developed urosepsis, 2 required transfusion, 4 cases had urinary extravastion 3 had subcapsular hematoma, required more amount of analgesic in form diclofenac or tramadol and 3 had pleural effusion. In the RIRS group, most of the complications was fever 11/142 and 1 case of urinary extravastion analgesic requirement was quite less as compare to mini PCNL group and 2 of them developed urosepsis. However, the differences of the overall complication rates was statistically significant between the two groups (16% in PCNL vs. 7.7% in RIRS, p=0.315). The stone-free rate after a single procedure was equivalent in the RIRS group compared to the MPCNL group (97.2% vs. 95.6%)

Table 1: Pre operative characteristics

Variables	RIRS (142)	MiniPCNL (150)
Mean age	45.5 ± 15	42.2 ± 14.3
Mean BMI	24.7 ± 3	25.1 ± 3.1
Gender (M:F)	94:48	112:38
Laterality (R/L)	72:70	79:61
Mean stone size (mm)	15.43	14.84
Stone number	1.7 ± 0.8	1.4 ± 0.6
Lower calyx involved	38	51
positive urine culture	15	19

Table 2: Post operative characteristics.

Variables	RIRS (142)	MiniPCNL(150)
Operative time	35.2±15	33.4±18
Hb drop	0.33	1.027
Hospital stay	1.8±0.7	3.2±1.4
Complications	24	39
RFT	10	15
Transfusion	0	2
Urinary extravastion	1	4
Pleural effusion	0	3
Initial SFR	100	100
Auxillary procedure	15	21
Subcapsular hematoma	0	3
Analgesic requirement	Less	More
JJ stent	142	150
Final SFR	97.2	95.6

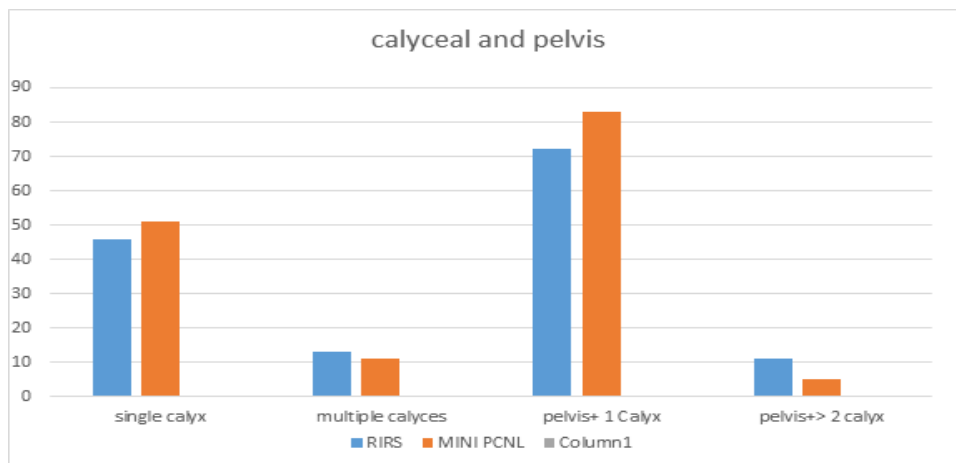


Figure 1: Location of stone in various calyces and pelvis

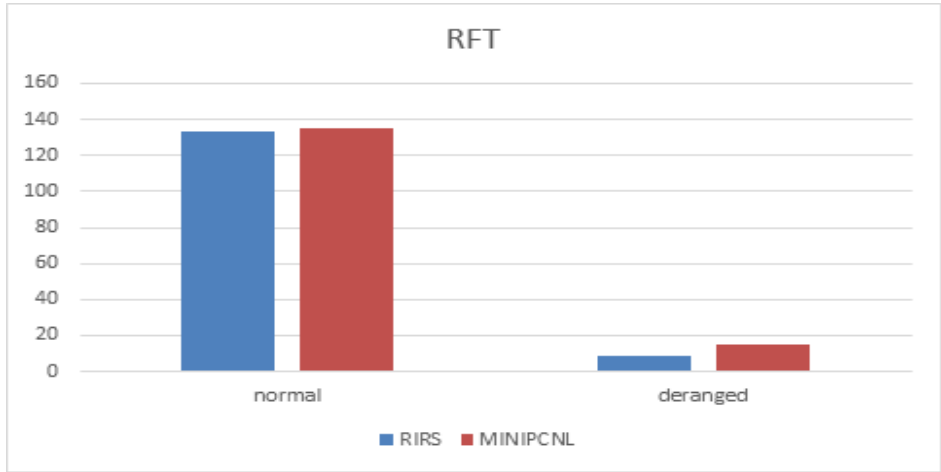


Figure 2: Renal function in miniPCNL and RIRS

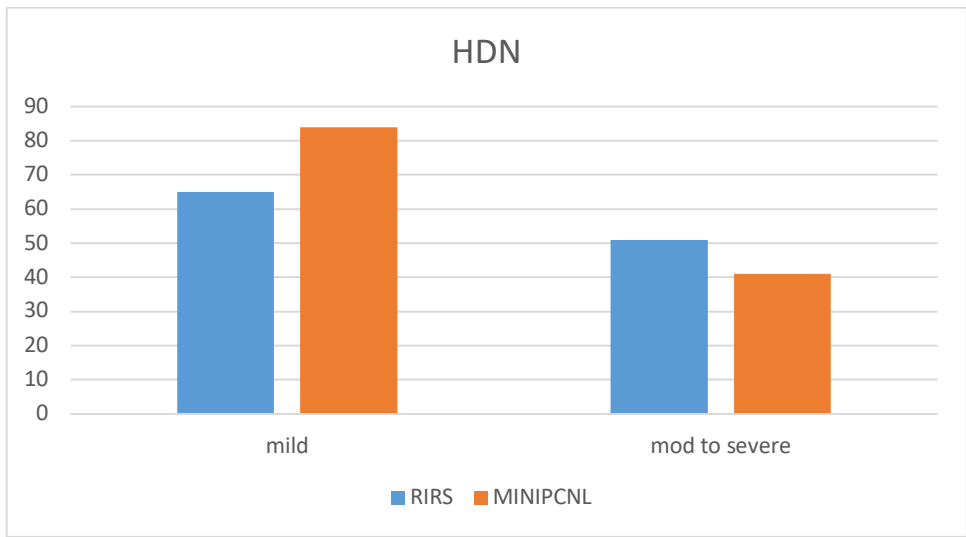


Figure 3: Degree of hydronephrosis in MINI PCNL and RIRS

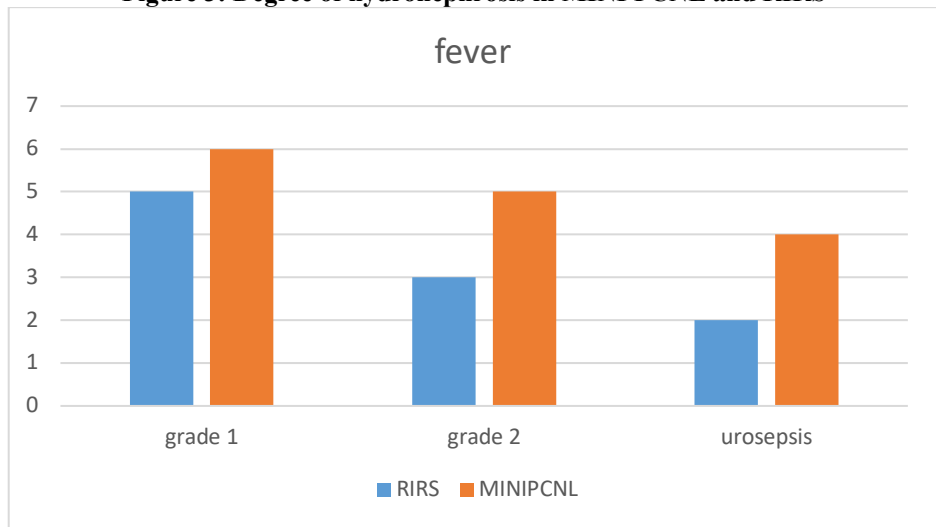


Figure 4: Post operative fever in mini PCNL and RIRS

Discussion

Stone-free rate represents one of the key parameter for evaluating the efficacy of a stone removal procedure, but the cost, fewer procedure sessions,

and avoiding major complications needs to be balanced by urologists. Although PCNL is generally recommended as the gold standard treatment option for renal calculi larger than 2 cm, major

complications are rare in experienced hands but if occurred leads to morbidity and mortality as well. Retrograde intrarenal surgery (RIRS) [6,7-10], as a less invasive modality, has achieved an increasing success rate due to its advancements in flexible ureteroscope and lasers and stone retrieval techniques.

Mini-PCNL is effective with less blood loss in small and medium size stone and with proper and good puncture technique. Even a large stone burden can be easily done by mini-PCNL. The comparisons were not adjusted for different technical details like usg guided puncture or any other guidance, dilators type, length of tract, and the type of lithotripter used. The preoperative stone size and the stone location are one of the important parameters, for selecting the better option. PCNL must be done under anesthesia after puncturing followed by dilation nephroscope is advanced into the pelvi calyceal system. Stones are fragmented by using laser. Retrograde intrarenal surgery is a minimally invasive surgical procedure using flexible ureteroscope retrogradely entering the pelvi calyceal system through urethra. The stones can be seen through the scope, then treated with intracorporeal lithotriptors and removed by using stone baskets or biprong or triprong. At present, RIRS is commonly used.

Nowadays, stone clearance is still one the essential aim in renal stone disease. Large stones can also be done in staged manner using RIRS or by auxillary procedure to RIRS. The overall success rate of RIRS has been reported to be 77 to 93% [11] after additional sessions for stones >2 cm. The need of multiple sessions is an obvious disadvantage for RIRS, but in our study we did all RIRS in single session. RIRS would take a bit longer operative time compare to miniPCNL but was statistically insignificant. longer treatment period, and higher cost, but is superior with respect to invasiveness. Our study demonstrated that RIRS showed higher SFR for 2–3 cm stones compared to MPCNL.

The mean age of the patients in the RIRS group was 35.2±15, while for the miniPCNL group was 33±18.4, (P = 0.923), and males constituted the majority of the patients in both groups; 74.6% for the RIRS group and 66.19% for the other group. About 50% of the stones were in the right side for the RIRS group, while right side stones constituted 52.6% for the other group (P = 0.114). Regarding the stone size, there was no significant differences between both groups, while the position of the stone showed no any significant correlation between both groups (P value 0.797) [8]. The stone free rate in RIRS and miniPCNL group was 97.2% and 95.6% respectively (P = 0.053). The stone free rate in the current study for both miniPCNL and RIRS group is regarded as an acceptable rate when compared to other published articles which showed approximate

rates [5]. Both the group had JJ stents in all the cases. Ten percent of patients with the miniPCNL showed a mild deterioration in the renal function after surgery that return to normal few days later, and the duration of the hospital stay was higher in patients with miniPCNL. The majority of the patients had mild postoperative pain. The mean operative time for patients in the RIRS group was 35.2±15, while for those in the miniPCNL was 33.4 ± 18 difference was statistically insignificant (p value > 0.05). studies have shown average operative times ranging from 40 to 59 min which is comparable to our average of 40.1 min.

In this study, overall, it was found that RIRS carries lesser complication rates (16.9% vs. 26%) compared with mini PCNL. With respect to the infectious complications, including fever, urosepsis and septic shock, even though there was no statistical significance noted, there seemed to be a relatively higher risk of urosepsis in RIRS group. Especially, urosepsis cause severity status of patients, longer hospital stay and higher medical costs. Intrarenal refluxing of bacterial contamination combined with high intrarenal pressure from irrigation and long operative time during the RIRS might be responsible for these serious complications [20]. Therefore, the preoperative infection control, and early diagnosis and timely treatment are very important to be applied. On the other hand, bleeding issues were the most concerned complication in miniPCNL complications, as evidenced by larger decrease in hemoglobin. Two patients required renal embolization in the PCNL group. Bleeding in our cohort is not strongly associated with stone size or tract size. The occasional inferior puncture skills in miniPCNL did also be an important factor associated with renal bleeding. Clinically, the bleeding is one of the most frightening events for the surgeons during PCNL.

There are some limitations to this study. This is a retrospective study from a single institution. Therefore, our outcomes should be studied by other research groups. Despite this limitations, this study is the first to highly select a subset of patients with 2–3 cm who may benefit from RIRS compared to MINIPCNL.

Conclusion

Based on our study, we could get some information as follows: (1) for treatment 2–3 cm kidney stones, RIRS showed higher SFR compared to MPCNL after a single session can get a satisfactory stone-free rate. (2) MPCNL can achieve a similar stone-free rate, but still with potential severe bleeding complication, which can occur by chance or technical problems. (3) Patients with much more number of risk predictors (lower pole location, severe hydronephrosis, and multiple calyces will get lower stone-free rate after RIRS, and this model has

good preoperative predictive accuracy for SFR. (4) the RIRS may be the first option to treat these group of patients with 2–3 cm stones in lower calyceal stone with acute infundibulopelvic angle and long infundibulum has required more auxillary procedures in RIRS which were easy to manage in MINIPCNL. Our new predictive models might be of use for surgical planning to select SFR-adapted treatment approaches for patients with 2–3 cm stones, and can help urologist tell the patients a more specific possible results and guide the patients making a surgical option. However, these conclusions only come from a retrospective study from a single institution with extensive experience in MPCNL and RIRS.

Compliance with ethical standards

Conflict of interest The author(s) declare no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study

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