

Comparison between mini-percutaneous nephrolithotomy and retrograde intra renal surgery for the management of lower calyceal calculi of size less than 1.5 cm: Our institutional experience



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ABSTRACT

Background: The treatment of lower calyceal calculi with a size < 1.5 cm remains a subject of debate. Mini-percutaneous nephrolithotomy (Mini PCNL) and retrograde intrarenal surgery (RIRS) are both effective options, but there is a need for comparative analysis to determine the optimal approach. Mini-perc has the advantage of direct visualization and efficient fragmentation and clearance, while RIRS is a minimally invasive technique with excellent visualization and minimal morbidity. **Aims and Objectives:** This study aims to evaluate and compare the efficacy, safety, and outcomes of mini-perc PCNL and RIRS in the management of lower calyceal calculi. **Materials and Methods:** This retrospective comparative cohort study included a total of 72 patients with lower calyceal calculi < 1.5 cm. Thirty-six patients underwent mini-perc, and 36 patients underwent RIRS. **Results:** No significant differences were observed in patient demographic characteristics, stone size, or stone location between the mini-perc and RIRS groups. The mini-perc group had a significantly higher stone-free rate (SFR) (94.4%) compared to the RIRS group (86.1%) ($P < 0.05$). The mini-perc technique had a higher success rate in first-session stone clearance (88.9%) compared to RIRS (77.8%) ($P < 0.05$). The mini-perc group had a longer operative time, higher estimated blood loss, and a longer post-operative hospital stay compared to the RIRS group ($P < 0.05$). **Conclusion:** Both mini-perc and RIRS techniques are effective for managing lower calyceal calculi < 1.5 cm. Mini-perc offers a SFR and a better success rate in first-session stone clearance compared to RIRS. However, mini-perc procedures are associated with longer operative time, higher estimated blood loss, and a longer post-operative hospital stay.

Key words: Mini-perc; Retrograde intrarenal surgery; Renal calculus; Post-operative blood loss; Operative time

INTRODUCTION

The treatment of lower calyceal calculi with a size < 1.5 cm remains a subject of debate. Although many treatments can be chosen to remove the stones, it is also extremely difficult to choose the best way from these treatments because many factors, such as patient body habitus, cost, patient preference, and local renal anatomy, must be taken

into account when determining the treatment for lower pole (LP) renal stones.¹⁻³ According to the current EAU Guidelines, percutaneous nephrolithotomy (PCNL), retrograde intrarenal surgery (RIRS), and extracorporeal shock wave lithotripsy (ESWL) are recommended as treatment options for LP renal stones between 10 and 20 mm.³ Mini-percutaneous nephrolithotomy (Mini PCNL) and RIRS are both effective options. Kidney stones are

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a common condition that can cause significant pain and discomfort for patients. Both procedures aim to remove the stone and relieve symptoms without the need for open surgery. The study will assess factors such as stone clearance rates, operative time, hospital stay, complication rates, and patient satisfaction to determine which procedure may be more suitable for this specific patient population.⁴ The findings of this comparative study could provide valuable insights for urologists and health-care providers when making treatment decisions for patients with lower calyceal stones. By comparing the efficacy and safety of mini-perc and RIRS, the study aims to contribute to the advancement of evidence-based guidelines for the management of kidney stones, ultimately improving patient outcomes and quality of care.

Aims and objectives

- To compare the outcomes of miniaturized PCNL (mini-perc) and RIRS in the management of lower calyceal renal stones with a diameter <1.5 cm.
- To compare stone-free rate (SFR), operative time, hospital stay, fluoroscopy time, post-operative pain, fever, hemoglobin (Hb) drop, and second procedure.

MATERIALS AND METHODS

Study design

This retrospective comparative cohort study was conducted from May 2022 to April 2023 (12 Months). 72 consecutive patients with lower calyceal calculus <1.5 cm were taken. Each patient had been explained about both surgical procedures (RIRS / Mini PCNL) by operating surgeon and patients were given the option to chose one procedure and consent obtained accordingly. Thirty-six patients underwent mini-perc, and 36 patients underwent RIRS.

Study place

The study was conducted in the Department of Urology, Government Mohan Kumaramangalam Medical College and Hospital, Salem.

Data analysis

Statistical data analysis was performed using Microsoft Excel (2019) software.

Ethics approval and consent to appropriate

The study protocol was approved by the institutional ethics committee, and all patients provided written informed consent before enrollment. IEC No.: GMKMC and H/114/IEC/2023.

Inclusion criteria

- Patients of either sex
- Age groups of 18–60 years diagnosed with lower

calyceal renal calculus of size <15 mm were included in the study.

Exclusion criteria

- Patients with anatomical abnormalities
- Concomitant stones at other sites (e.g., other calyx, ureter, and bladder)
- Children with morbid obesity, uncorrected coagulopathy, and previous open renal surgery were excluded from the study.

RESULTS

During 12 months, 72 patients with lower calyceal stones were treated, 36 by mini-perc PCNL and 36 by RIRS. Patient demographic characteristics are reported in Table 1. No significant differences were observed in patient mean age, stone size, or stone location between the mini-perc and RIRS groups. Fifty-three male patients and 19 female patients were included in the study, with male: female ratio of 23:13 for mini-perc PCNL and 30:6 for RIRS groups. All patients were DJ-stented 3 weeks before surgery in the RIRS group.

Table 2 shows the outcomes and complications of both techniques, in which the RIRS group has a higher operative time (71.14>52.61 min) than the mini-perc group, which

Table 1: Patients demographic characteristics

Variables	Mini PCNL	RIRS
Renal units	36	36
Age (years)	36.31	41.25
Sex (M:F)	23:13	30:6
Laterality (R:L)	13:23	25:11
Stone size (cm)	1.23	1.29
History of DJ stenting	3	36

PCNL: Percutaneous nephrolithotomy, RIRS: Retrograde intrarenal surgery

Table 2: Intra operative and post operative comparison

Parameter	Mini-PCNL	RIRS	P-value
Operative time (min)	52.61	71.14	0.05
Fluoroscopy time (s)	57.91	41.00	0.04
Pain score			
POD 1	4.53	3.26	0.05
POD 2	2.75	1.07	<0.01
Drop in Hb	0.96	0.46	<0.01
Post-operative fever	1	4	0.06
Hospital stay (days)	2.56	2.20	0.01
Stone free rate (%)			
POD 1	94.4	86.1	0.03
1 Month	91.8	86.7	0.015
Second procedure			
ESWL	2	4	0.04

PCNL: Percutaneous nephrolithotomy, RIRS: Retrograde intrarenal surgery, POD: post-operative day, Hb: Hemoglobin, ESWL: Extracorporeal shock wave lithotripsy

was clinically significant with $P=0.05$. The mini-perc has a higher fluoroscopy time (57.91 s) compared to the RIRS group (41 s) with $P=0.05$.

Pain analysis by visual analog scale shows RIRS has lesser post-operative pain on post-operative days (POD) 1 and 2, with $P=0.05$ and 0.01, respectively. The mini-perc group has a significantly higher SFR (94.4%) compared to the RIRS group (86.1%) ($P<0.05$) on POD 1. SFR is better for mini-perc after 1 month, but statistically, it is not significant. Both groups have clinically insignificant blood loss during surgery; the Hb drop was significantly lesser for the RIRS group compared to the mini-perc PCNL ($P<0.01$). Hospital stay was shorter for the RIRS group with $P<0.01$. Post-operative fever was reported to be more common in the RIRS group ($P<0.06$) managed with intravenous antibiotics. SFR reported more in the mini-perc PCNL compared to the RIRS group with $P=0.04$. Extra-auxiliary procedure ESWL is required for 2 patients in the (mini-perc) and 4 (RIRS) groups with $P<0.03$ and 0.015.

DISCUSSION

Operative time and fluoroscopy time in our study were similar to those in the study by Akman et al.⁴ The mean operative time is significantly less in the mini-PCNL group (52.6 vs. 71.14 min; $P<0.003$), probably due to the longer time required for stone vaporization in the RIRS group. The radiation exposure was more in the mini-PCNL group (57.91 vs. 41.0 s, $P=0.012$) due to the C-arm-guided initial puncture of the calyx. The mean hospital stay was almost the same in both arms (2.56 days in mini-PCNL vs. 2.20 days in RIRS; $P=0.01$). Study by Sabnis et al.,⁵ and Pelit et al.,⁶ which showed significantly lesser hospital stays; 1.9 days in mini-PCNL and 1.2 days in RIRS.

Pain analysis by visual analog scale shows the RIRS group has significantly lesser post-operative pain. $P=0.005$ on POD 1 and <0.001 on POD 2, which is similar to the study by Sabnis et al.,⁵ and Lee et al.⁷ The Hb drop is <1 g/dL in both groups, clinically not significant. The difference between the two groups is statistically significant ($P\leq 0.001$). The RIRS group has more post-operative fever or urosepsis. Raised intrarenal pressure, infective stones, and intravasation lead to sepsis. Similar findings were seen in a study by Sabnis et al.⁵ The SFR is defined as the absence of a clinically insignificant residual fragment <4 mm. In a study conducted by Pelit et al.,⁶ the mean operative times, fluoroscopy times, and hospitalization times were statistically higher in the PCNL group. The SFRs after a single procedure were 84.4% in the PCNL group and 75% in the RIRS group ($P=0.036$). After auxiliary procedures, the overall SFRs reached 91.1% for the PCNL group and 90.6% for the RIRS group ($P=0.081$).

Lesser SFR in the RIRS group for LP stones is attributed to poor accessibility of the lower calyx with an unfavorable anatomy of the LP (more acute infundibulopelvic angle and narrower and longer infundibulum).⁷ On the other hand, our study indicated PCNL and RIRS provided a lower retreatment rate and auxiliary procedure rate, while ESWL had a higher retreatment rate and auxiliary procedure rate. The result was accepted by many authors.⁸ A smaller sample size, more than one operating surgeon, and no follow-up CTKUB to demonstrate stone clearance was the limitations of this study. Further studies with a large sample size and a long duration need to consolidate the findings.

Limitations of the study

1. It is not a randomized controlled trial
2. Long-term follow-up is required
3. More number of patients need to be included in the study.

CONCLUSION

Both mini-perc and RIRS techniques are effective for managing lower calyceal calculi <1.5 cm. Mini-perc offers a higher SFR, lesser operative time, lesser post-operative complications, and lesser second procedures compared to RIRS.⁹ RIRS has less radiation exposure and less post-operative pain. However, estimated blood loss and post-operative hospital stay are almost the same in both techniques.

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REFERENCES

1. Knoll T, Jessen JP, Honeck P and Wendt-Nordahl G. Flexible ureterorenoscopy versus miniaturized PNL for solitary renal calculi of 10-30 mm size. *World J Urol.* 2011;29(6):755-759. <https://doi.org/10.1007/s00345-011-0784-y>
2. Mishra S, Sharma R, Garg C, Kurien A, Sabnis R and Desai M. Prospective comparative study of miniPerc and standard PNL for treatment of 1 to 2 cm size renal stone. *BJU Int.* 2011;108(6):896-899; discussion 899-900. <https://doi.org/10.1111/j.1464-410X.2010.09936.x>
3. Junbo L, Yugen L, Guo J, Jing H, Ruichao Y and Tao W. Retrograde intrarenal surgery vs. Percutaneous nephrolithotomy vs. Extracorporeal shock wave lithotripsy for lower pole renal stones 10-20 mm: A Meta-analysis and systematic review. *Urol J.* 2019;16(2):97-106. <https://doi.org/10.22037/uj.v0i0.4681>
4. Akman T, Binbay M, Ozgor F, Ugurlu M, Tekinarslan E, Kezer C, et al. Comparison of percutaneous nephrolithotomy

- and retrograde flexible nephrolithotripsy for the management of 2-4 cm stones: A matched-pair analysis. *BJU Int.* 2012;109(9):1384-1389.
<https://doi.org/10.1111/j.1464-410X.2011.10691.x>
5. Sabnis RB, Jagtap J, Mishra S and Desai M. Treating renal calculi 1-2 cm in diameter with minipercutaneous or retrograde intrarenal surgery: A prospective comparative study. *BJU Int.* 2012;110(8 Pt B):E346-E349.
<https://doi.org/10.1111/j.1464-410X.2012.11089.x>
 6. Pelit ES, Atis G, Kati B, Akin Y, Çiftçi H, Culpan M, et al. Comparison of mini-percutaneous nephrolithotomy and retrograde intrarenal surgery in preschool-aged children. *Urology.* 2017;101:21-25.
<https://doi.org/10.1016/j.urology.2016.10.039>
 7. Lee JW, Park J, Lee SB, Son H, Cho SY and Jeong H. Mini-percutaneous nephrolithotomy vs retrograde intrarenal surgery for renal stones larger than 10 mm: A prospective randomized controlled trial. *Urology.* 2015;86(5):873-877.
<https://doi.org/10.1016/j.urology.2015.08.011>
 8. Bozzini G, Verze P, Arcaniolo D, Dal Piaz O, Buffi NM, Guazzoni G, et al. A prospective randomized comparison among SWL, PCNL and RIRS for lower calyceal stones less than 2 cm: A multicenter experience: A better understanding on the treatment options for lower pole stones. *World J Urol.* 2017;35(12):1967-1975.
<https://doi.org/10.1007/s00345-017-2084-7>
 9. Zhang W, Zhou T, Wu T, Gao X, Peng Y, Xu C, et al. Retrograde intrarenal surgery versus percutaneous nephrolithotomy versus extracorporeal shockwave lithotripsy for treatment of lower pole renal stones: A meta-analysis and systematic review. *J Endourol.* 2015;29(7):745-759.
<https://doi.org/10.1089/end.2014.0799>

Authors Contribution:

JN- Interpreted the results; reviewed the literature and manuscript preparation; **PP-** Concept, coordination, interpretation and publication work; **MG-** Concept and design of the study, prepared first draft of manuscript; **TPV-** Finalised manuscript of the study; **KR-** Data collection, statistical analysis, preparation of manuscript.

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