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Research Article

DIFFERENT SURGICAL TREATMENT MODALITIES FOR MANAGEMENT OF RENAL STONE: AN OBSERVATIONAL STUDY

[1]Dr. Dhwani Ravichandran, [2]Dr. Satwik Kumar, [3]Dr. Naman Jain, [4]Dr. Sikander Singh Rathore, [5]Dr. Shikhar Maheshwari

[1]DNB Resident (General Surgery) Sir Ganga Ram Hospital, New Delhi Department of Laparoscopic, Laser and General Surgery Email: Dhwaniravic@gmail.com

[2]DNB Resident (General Surgery) Sir Ganga Ram Hospital, New Delhi Department of Laparoscopic, Laser and General Surgery Email: drsatwiksky@gmail.com

[3]Associate Consultant (General Surgery) Sir Ganga Ram Hospital, New Delhi Department of Laparoscopic, Laser and General Surgery Email: namandoctor.doc@gmail.com

[4]DNB Resident (General Surgery) Sir Ganga Ram Hospital, New Delhi Department of Laparoscopic, Laser and General Surgery Email: drrathoresikander@gmail.com

[5]DNB Resident (General Surgery) Sir Ganga Ram Hospital, New Delhi Department of Laparoscopic, Laser and General Surgery Email: Shikharmaheshwari73@gmail.com

*Corresponding Author

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Abstract: ***Introduction:*** Renal stone disease is a common urological disorder with substantial morbidity and a broad spectrum of minimally invasive treatment options. Percutaneous nephrolithotomy (PCNL), ureteroscopy (URS) and, in selected non-functioning kidneys, nephrectomy are used according to stone burden, location, anatomy, renal function and patient factors. This study describes the clinical profile, laboratory and radiological findings, operative treatment patterns, stone composition and early postoperative outcomes among patients undergoing surgical management of renal calculi at a tertiary-care teaching hospital in central India. **Methods:** This hospital-based observational study included 75 patients with surgically managed renal calculi admitted to the surgical wards of Sir Ganga Ram Hospital, New Delhi, between April 2022 and March 2023. Patients managed non-operatively and those with stones <1 cm were excluded. Clinical assessment, routine blood and urine investigations and imaging with ultrasonography, plain X-ray KUB and intravenous urography were performed; CT was obtained in selected patients. Demographic and clinical variables were summarized using frequencies, percentages, means and standard deviations. Independent-samples t-test was planned for comparison of continuous variables. **Results:** The study population comprised 51 men (68%) and 24 women (32%). The largest age groups were 41–50 years (29.3%) and 31–40 years (28.0%). A mixed diet was reported by 60%. Pain duration of 1–6 months was reported by 61.3%; right loin pain was the most frequent site (46.7%), and dull aching pain was more common than colic (65.3% versus 34.7%). Burning micturition was reported by 61.3% and fever with chills/rigor by 16%. Mean blood urea, serum calcium, serum phosphate, serum uric acid and serum creatinine were 22.08, 9.58, 4.09, 4.11 and 0.81, respectively, as recorded in the source study. PCNL was the predominant operation (66/75; 88.0%), followed by ureteroscopy (7/75; 9.3%) and nephrectomy (2/75; 2.7%). No open pyelolithotomy or nephrolithotomy was performed. Mixed calcium oxalate/calcium phosphate was the most frequent qualitative stone composition (33.3%). Operating time was <1 hour in 73.3%. Immediate, early and delayed postoperative pain were recorded in 44.0%, 33.3% and 22.7%, respectively. The source data report a 100% stone-clearance rate in all 75 patients. **Conclusion:** In this institutional cohort, PCNL constituted the principal surgical modality for renal calculi and was associated with complete reported stone clearance. The predominance of minimally invasive procedures reflects the contemporary transition away from open stone surgery. However, the interpretation is limited by the small sample size, single-centre observational design, lack of standardized stone-size/location stratification, absence of a formal complication grading system and limited follow-up. Larger prospective studies using contemporary nephrolithometric scoring and standardized outcome definitions are warranted.

Keywords: Renal calculi; nephrolithiasis; percutaneous nephrolithotomy; PCNL; ureteroscopy; renal stone; stone-free rate; endourology; India

INTRODUCTION

Urolithiasis is a common and recurrent disorder whose incidence varies according to geography, climate, dietary patterns, ethnicity, metabolic factors and genetic susceptibility. Contemporary European Association of Urology (EAU) guidance notes that reported prevalence of urinary stones varies broadly across populations, approximately 1–13%, and emphasizes the influence of environmental and metabolic determinants on stone formation.[1] Reviews of the Indian subcontinent similarly describe marked geographic and dietary diversity, with kidney-stone prevalence and composition varying across regions.[2] The institutional source material for the present study reports an estimated prevalence of approximately 12% worldwide and in India, with higher prevalence described in northern

India.[3] These figures should be interpreted cautiously because population estimates vary according to study design and geographic setting.

The clinical burden of renal stone disease extends beyond episodic renal colic. Stones may cause obstruction, recurrent urinary infection, hematuria, impaired renal function and, in high-risk patients, progressive renal damage. Current EAU guidance identifies stone growth, obstruction, infection, symptoms, high-risk stone-forming conditions, patient preference and relevant comorbidity/social circumstances as indications for active treatment.[1] Thus, treatment decisions are not based solely on the presence of a calculus; they depend on stone size, location, anatomy, composition, renal function, infection status and patient-specific considerations.

The management of renal calculi has undergone a major technological transition. Percutaneous nephrolithotomy was introduced as a percutaneous stone-extraction technique by Fernström and Johansson in 1976 and subsequently evolved into the standard endourological approach for large and complex renal stones.[4,5] Contemporary guidelines recommend PCNL as first-line therapy for renal stones larger than 2 cm because stone-free rates are less dependent on stone size than those achieved by shock-wave lithotripsy or retrograde approaches.[1] For stones of intermediate size, treatment selection is more individualized, and retrograde intrarenal surgery (RIRS), ureteroscopy and miniaturized PCNL have expanded the available options.[1,6–9]

The global PCNL experience demonstrates that the procedure can achieve high stone-clearance rates while maintaining acceptable morbidity. In the CROES global study of 5,803 patients, 79.5% had no complication and the 30-day stone-free rate was 75.7%; major complications included significant bleeding, renal pelvis perforation and hydrothorax.[10] A subsequent analysis of complications found that most complications were minor, while longer operative time and higher ASA status were associated with greater complication severity.[11] These data illustrate why contemporary reporting of PCNL outcomes should include not only stone-free status but also complications, operative time, hospitalization and patient-related risk factors.

The increasing use of flexible ureteroscopy and RIRS has further altered the treatment landscape. For renal stones larger than 2 cm, systematic reviews suggest that RIRS can be feasible in selected patients, but PCNL generally retains an advantage in stone clearance and may reduce the number of staged procedures, at the cost of greater invasiveness and bleeding risk.[7,8] For 10–20 mm lower-pole stones, mini-PCNL and RIRS have both demonstrated high efficacy, with trade-offs between stone-free rates, hemoglobin loss and length of stay.[9] Miniaturized PCNL techniques have also been associated with reduced blood loss and transfusion requirements while preserving efficacy.[12,13]

Stone complexity is another important determinant of outcome. The Guy's Stone Score was developed to stratify PCNL complexity using anatomical and stone-related characteristics, and subsequent external validation demonstrated that the score, number of stones and number of involved calyceal groups independently predict stone-free status.[14,15] Other nephrolithometric systems, such as the S.T.O.N.E. and CROES scores, have similarly been developed to improve preoperative counselling and allow more meaningful comparison between studies. The present source study did not report a formal nephrolithometric score; therefore, its excellent reported clearance rate should be interpreted in the context of an unmeasured stone-complexity profile.

Diet and lifestyle are also relevant to the epidemiology and prevention of recurrence. A systematic review and meta-analysis found that higher dietary sodium, meat, animal protein and sugar-sweetened beverages were associated with increased stone risk, whereas greater fluid intake, fruits, vegetables, dietary calcium and potassium were generally protective.[16] Reviews emphasize that dietary advice should be individualized according to stone phenotype and metabolic risk, rather than equating vegetarian status alone with low risk.[17,18] A recent systematic review likewise found positive associations between nondairy animal protein/meat intake and stone risk, although the certainty of some associations remains limited.[19]

Against this background, the present study was undertaken to characterize the presentation of surgically treated renal calculi and to describe the operative modalities used at a tertiary-care centre in Raipur, Chhattisgarh. The study is particularly relevant because it documents real-world practice in an Indian surgical setting and provides an institutional snapshot of the transition from open surgery to contemporary endourological management.

2. Aims and Objectives

- To describe the demographic and clinical profile of patients presenting with surgically managed renal calculi.
- To document the duration, site and character of pain and associated urinary symptoms.
- To describe urine and blood investigation findings in the study population.
- To document the radiological modalities used for diagnosis and preoperative assessment.
- To determine the distribution of surgical treatment modalities, particularly PCNL, ureteroscopy and nephrectomy.
- To describe qualitative stone composition following surgical removal.
- To assess operative time, postoperative pain, hospital stay and reported stone clearance.

MATERIALS AND METHODS

3.1 Study design and setting

This was a hospital-based observational clinical study conducted in the Department of General Surgery, Sir Ganga Ram Hospital, New Delhi, India. Patients admitted to the surgical wards with renal calculi and requiring operative management during April 2022 to March 2023 were evaluated. The study material provided for manuscript preparation describes the cohort and outcome variables but does not provide a formal study-registration number or institutional ethics-committee approval number; these details should be added from the institutional record before journal submission.

3.2 Study population and eligibility

Seventy-five patients constituted the final study cohort. Selection was based on clinical symptoms and radiological findings. Patients managed by non-operative medical treatment and patients with stone size <1 cm were excluded. Because the source material does not provide a detailed breakdown of stone size, stone burden, stone location by calyx/pelvis, Hounsfield units, staghorn status or nephrolithometric score, these parameters could not be incorporated into the analysis without introducing unsupported information.

3.3 Clinical and laboratory assessment

Clinical evaluation included demographic characteristics, dietary pattern, duration and site of pain, character of pain, urinary symptoms, fever and history of hematuria. Routine blood and urine examinations were performed. Blood variables included blood urea, serum calcium, serum phosphate, serum uric acid and serum creatinine. Urine examination included colour, pH, albumin, sugar, red blood cells, white blood cells, pus cells and crystals.

3.4 Radiological assessment

The source study reports that plain X-ray KUB, ultrasonography of the abdomen and intravenous urography were performed in all 75 patients. CT was performed selectively in 8 patients (10.7%). All patients were reported to have functioning kidneys. Contemporary practice increasingly uses non-contrast CT for accurate stone size, location, density and anatomy; therefore, the relatively limited CT use in this historical cohort should be considered when comparing the study with current guideline-based practice.[1]

3.5 Operative management

Patients underwent the operative procedure considered appropriate by the treating surgical/urological team. The recorded procedures were PCNL, ureteroscopy and nephrectomy; no pyelolithotomy, extended pyelolithotomy or nephrolithotomy was performed. The source material describes PCNL as the predominant minimally invasive treatment and emphasizes its role for large or complex renal calculi.

3.6 Outcome measures

Recorded outcomes included operative duration (<1 hour versus >1 hour), postoperative pain timing (immediate, early or delayed), duration of hospitalization (<10 days versus >10 days) and stone clearance. The source material reports 100% clearance in all 75 patients. The original presentation did not provide a standardized definition of stone-free status, the imaging modality used to confirm clearance, or the time point of assessment; these should be specified in a final submission if available.

3.7 Statistical analysis

Categorical variables were summarized as frequencies and percentages. Continuous variables were presented as mean ± standard deviation. The source study states that independent-samples t-test was used to assess differences in continuous variables and that analyses were performed using SPSS version 24. However, the available material does not provide the comparison groups, test statistics, confidence intervals or p-values. Accordingly, no additional inferential statistics have been fabricated for this manuscript.

RESULTS

4.1 Demographic profile

Variable	No. of patients	%
Age <10 years	2	2.7
11–20 years	3	4.0
21–30 years	16	21.3
31–40 years	21	28.0
41–50 years	22	29.3
51–60 years	11	14.7
Male	51	68.0
Female	24	32.0
Vegetarian diet	30	40.0
Mixed diet	45	60.0

The cohort was predominantly male (68%), giving a male-to-female ratio of approximately 2.1:1. The largest age categories were 41–50 years (29.3%) and 31–40 years (28.0%). The source discussion reports a mean age of 37.9 years and an age range of 8–66 years. A mixed diet was reported by 60% of participants, while 40% reported a vegetarian diet.

4.2 Clinical and pathological characteristics

Variable	No. of patients	%
Pain <30 days	6	8.0
Pain 1–6 months	46	61.3
Pain 7–12 months	8	10.7
Pain 1–5 years	12	16.0
Pain 6–10 years	3	4.0
Right loin pain	35	46.7
Left loin pain	30	40.0
Bilateral loin pain	10	13.3
Fever with chills/rigor	12	16.0
Burning micturition	46	61.3
Dull aching pain	49	65.3
Colicky pain	26	34.7
No hematuria episodes	63	84.0
1–5 hematuria episodes	9	12.0
>5 hematuria episodes	3	4.0

Pain for 1–6 months was the commonest duration category (61.3%). Right loin pain was the most frequent site (46.7%), followed by left loin pain (40.0%) and bilateral pain (13.3%). Dull aching pain was more frequent than colicky pain. Burning micturition was reported by 61.3% and fever with chills/rigor by 16.0%, suggesting a clinically relevant burden of urinary symptoms and possible infection; however, urine culture data were not provided and infection cannot be confirmed from symptoms alone.

4.3 Urine examination

Parameter	No. of patients	%
Clear urine	43	57.3
Light yellow	26	34.7
Dark yellow	3	4.0
Dark red	3	4.0
Albumin positive	29	38.7
Sugar positive	6	8.0
Acidic urine pH	61	81.3
Alkaline urine pH	14	18.7
RBC positive	30	40.0
WBC positive	31	41.3
Pus cells positive	25	33.3
Oxalate crystals	6	8.0
Phosphate crystals	8	10.7

Most urine samples were clear (57.3%) or light yellow (34.7%). Acidic urine was recorded in 81.3%. RBCs, WBCs and pus cells were present in 40.0%, 41.3% and 33.3%, respectively. These findings are compatible with the clinical observation that urinary symptoms were common, although culture-confirmed urinary tract infection was not reported.

4.4 Blood investigations

Parameter	Recorded range	Mean ± SD
Blood urea	6–37	22.08 ± 8.13
Serum calcium	8.1–11	9.58 ± 0.90
Serum phosphate	1.8–6.2	4.09 ± 1.20
Serum uric acid	2.5–7.9	4.11 ± 1.08
Serum creatinine	0.2–1.4	0.81 ± 0.38

The mean serum creatinine was 0.81 ± 0.38 in the units recorded in the source material, suggesting preserved renal function in the overall cohort. The mean serum calcium, phosphate and uric acid values were also reported without marked overall abnormalities. These single serum measurements do not substitute for a complete metabolic stone evaluation, which may include 24-hour urinary volume, calcium, oxalate, citrate, uric acid, sodium and pH in selected recurrent/high-risk stone formers.[1]

4.5 Radiological assessment

Imaging modality	No. of patients	%
Ultrasound abdomen	75	100.0
Plain X-ray KUB	75	100.0
IVU	75	100.0
CT scan	8	10.7

Ultrasonography, plain X-ray KUB and intravenous urography were performed in all 75 patients. CT was performed in 8 patients (10.7%). The study therefore reflects a practice setting in which conventional imaging was used extensively during the study period. Current guidance favors non-contrast CT when detailed stone characterization is required for treatment planning, especially for stone density, exact burden and anatomy.[1]

4.6 Operative procedures

Procedure	No. of patients	%
PCNL	66	88.0
Ureteroscopy	7	9.3
Nephrectomy	2	2.7
Pyelolithotomy	0	0
Extended pyelolithotomy	0	0
Nephrolithotomy	0	0
Total	75	100.0

PCNL was the predominant treatment, accounting for 88.0% of all procedures. Ureteroscopy was performed in 9.3%, while nephrectomy was required in 2.7%. No open stone procedures were reported. This distribution is consistent with the broad transition toward endourological management of renal stones and the continuing central role of PCNL for larger or complex stones.[1,10]

4.7 Stone composition

Qualitative stone composition	No. of patients	%
Calcium phosphate	8	10.7
Calcium oxalate + calcium phosphate	25	33.3
Uric acid	9	12.0
Calcium oxalate + calcium phosphate + uric acid	13	17.3
Triple phosphate	14	18.7
Calcium oxalate	6	8.0
Total	75	100.0

All retrieved stones were reportedly sent for qualitative analysis. The most common composition was calcium oxalate plus calcium phosphate (33.3%), followed by triple-phosphate stones (18.7%) and mixed calcium oxalate/calcium phosphate/uric acid stones (17.3%). Pure calcium oxalate represented 8.0%, calcium phosphate 10.7% and uric acid 12.0%.

4.8 Operative time, pain, hospitalization and stone clearance

Outcome	No. of patients	%
Operating time <1 hour	55	73.3
Operating time >1 hour	20	26.7
Immediate postoperative pain	33	44.0
Early postoperative pain	25	33.3
Delayed postoperative pain	17	22.7
Hospital stay <10 days	56	74.7
Hospital stay >10 days	19	25.3
Stone clearance 100%	75	100.0
Stone clearance <100%	0	0

Most procedures were completed within one hour (73.3%). Immediate postoperative pain was recorded in 44.0%, early pain in 33.3% and delayed pain in 22.7%. The tabulated data show that 74.7% of patients stayed in hospital for <10 days and 25.3% stayed for >10 days. The source presentation contains a contradictory narrative sentence stating that most patients stayed >10 days; the table itself indicates that most stayed <10 days, and the table values have therefore been used for this manuscript. Complete stone clearance was reported in all 75 patients. Because the original material does not specify the timing or imaging definition of stone-free status, this result should be reported as 'reported stone clearance' rather than assumed to meet a universal contemporary SFR definition.

DISCUSSION

The present study provides a real-world description of 75 surgically treated renal-stone patients at a tertiary-care teaching hospital in central India. The principal finding was the dominant use of PCNL, which accounted for 88% of procedures, followed by ureteroscopy in 9.3% and nephrectomy in 2.7%. No open stone-removal procedure was required. This distribution illustrates the continuing shift from open surgery to minimally invasive endourology and is broadly consistent with contemporary guideline recommendations that reserve open or laparoscopic surgery for uncommon situations in which endourological options are unsuccessful or unsuitable.[1]

The demographic pattern showed male predominance, with men comprising 68% of the cohort and a male-to-female ratio of approximately 2.1:1. The source study reported a mean age of 37.9 years and noted that the 31–50-year age range represented the largest affected group. This pattern is biologically and epidemiologically plausible because stone disease frequently affects adults during economically productive years. However, the study was hospital-based and included only surgically treated patients; therefore, its age and sex distribution should not be interpreted as a population prevalence estimate. Contemporary epidemiological literature also indicates that stone disease is influenced by climate, metabolic risk, dietary exposure, obesity and lifestyle factors.[1,2,16]

Dietary pattern was recorded as mixed in 60% and vegetarian in 40%. The original discussion suggested that vegetarian diets are associated with lower stone risk. Current evidence supports a more nuanced interpretation. A systematic review of dietary patterns found that higher fluid intake, fruits, vegetables, dietary calcium and potassium are generally protective, whereas high sodium, meat, animal protein and sugar-sweetened beverage intake are associated with greater risk.[16] A systematic review specifically addressing vegetarian and vegan diets concluded that high meat/animal-protein intake and low calcium intake may increase risk, while a balanced vegetarian diet containing appropriate dairy appears relatively protective.[17] A 2022 dose-response meta-analysis also found positive associations between nondairy animal protein, meat and processed meat and kidney-stone risk, although the authors rated the certainty of much of the evidence as limited.[19] Therefore, the present study's diet distribution is descriptive and cannot establish that mixed diet independently caused stone formation because dietary quantity, sodium intake, fluid intake, calcium intake and metabolic factors were not measured.

The symptom profile was notable for prolonged pain: 61.3% had symptoms for 1–6 months. Right loin pain was most common, and dull aching pain predominated over classic colic. Burning micturition occurred in 61.3%, while fever with chills/rigor occurred in 16%. These findings suggest that many patients presented with persistent symptomatic disease rather than an incidental stone. Current guidelines identify pain, infection and obstruction among important indications for active treatment.[1] However, because urine cultures and obstruction severity were not reported, it is not possible to quantify the contribution of infection or obstruction to the decision for surgery.

Urinalysis showed WBC positivity in 41.3%, pus cells in 33.3% and RBC positivity in 40%. The combination of urinary symptoms and pyuria is clinically important because infection is a recognized risk factor for perioperative complications in PCNL. In the CROES global PCNL study, postoperative fever occurred in 10.5% and positive urine microbiology was associated with higher complication severity in subsequent analyses.[10,11] Preoperative urine culture, appropriate antibiotic management and careful assessment for infected obstruction are therefore central to contemporary stone surgery. The absence of culture results in the present dataset limits direct comparison with modern quality indicators.

The laboratory profile showed a mean serum creatinine of 0.81, with relatively preserved renal function across the cohort. The study also reported mean calcium of 9.58 and uric acid of 4.11. Normal single serum values do not exclude important urinary metabolic abnormalities. Current EAU guidance recommends evaluation of stone composition and, in appropriate patients, metabolic assessment to identify modifiable recurrence risks.[1] The relatively high proportion of mixed calcium-containing stones in the present series emphasizes the importance of stone analysis as a basis for individualized prevention.

The imaging pattern is particularly relevant when the study is interpreted from a contemporary perspective. All patients underwent ultrasound, plain X-ray KUB and IVU, while CT was used in only 10.7%. During the study period, conventional imaging may have reflected local availability and established workflow. However, current guidelines increasingly rely on non-contrast CT for accurate assessment of stone size, location and density when active treatment is planned.[1] CT-derived stone density can help predict shock-wave lithotripsy response, while anatomical information can influence the choice between PCNL, RIRS and other approaches. Future institutional studies should therefore report stone dimensions, location, density and nephrolithometric scores rather than relying only on a generic diagnosis of renal calculus.

The most striking operative finding was that 88% of patients underwent PCNL. This is consistent with the established role of PCNL for large renal stones. Current EAU recommendations state that stones >2 cm should primarily be treated with PCNL, while RIRS or shock-wave lithotripsy may be considered when PCNL is unsuitable.[1] The CROES global study, comprising 5,803 PCNL procedures across 96 centres, demonstrated the broad international adoption of PCNL and a 30-day stone-free rate of 75.7%, with most patients experiencing no complication.[10] The high PCNL utilization in the present cohort may therefore reflect a substantial proportion of stones considered sufficiently large or complex to warrant percutaneous treatment, although the source dataset does not provide the stone-size distribution needed to prove this.

The 9.3% use of ureteroscopy is also consistent with the expanding role of retrograde surgery. Contemporary RIRS is increasingly used for small-to-intermediate renal stones and for selected larger stones when PCNL is contraindicated or less desirable. Systematic reviews have shown that RIRS can achieve high clearance for stones >2 cm but may require staged procedures and can have lower single-procedure efficacy than PCNL.[7,8] For lower-pole stones in the 10–20 mm range, mini-PCNL may achieve somewhat higher stone-free rates than RIRS but with greater hemoglobin loss and longer hospitalization.[9] Thus, the relatively small URS proportion in this study should not be interpreted as evidence that URS is inferior; rather, it likely reflects case selection, local expertise and stone characteristics that were not fully captured.

No open pyelolithotomy or nephrolithotomy was performed. This is an important marker of contemporary surgical practice. A systematic review and meta-analysis comparing PCNL with open surgery for staghorn calculi found similar final stone-free rates but significantly less blood loss, shorter operative time and shorter hospitalization with PCNL.[20] In pediatric staghorn stones, PCNL was also associated with substantially shorter hospital stay than open surgery, although multiple procedures were more frequent.[21] Current EAU guidance therefore considers open or laparoscopic stone removal a last-line strategy for rare cases in which endourological approaches are unsuitable or unsuccessful.[1]

The qualitative stone analysis showed calcium oxalate plus calcium phosphate as the most frequent composition (33.3%), followed by triple-phosphate and mixed calcium oxalate/calcium phosphate/uric acid stones. These findings are compatible with the broad predominance of calcium-containing stones described in clinical practice, although direct comparison between studies is affected by differences in analytical methodology and whether mixed stones are classified by major or minor components. The presence of triple-phosphate stones in 18.7% is clinically important because infection-related stones require attention to urinary infection and complete clearance. Prevention should therefore be tailored to stone type and metabolic evaluation rather than based solely on population-level dietary advice.[1,17]

The reported 100% stone-clearance rate is substantially higher than many large multicentre PCNL series and should be interpreted carefully. The CROES study reported a 30-day stone-free rate of 75.7% in a much larger and more heterogeneous population.[10] Stone burden, number of stones, calyceal involvement and stone complexity are known predictors of PCNL success; Guy's Stone Score has been externally validated as a predictor of stone-free status.[15] Because the present study did not report stone dimensions, complexity scores, residual fragment thresholds, postoperative imaging modality or follow-up duration, the 100% figure may represent complete clearance as defined locally and may not be directly comparable with guideline or multicentre SFR definitions. Nevertheless, it is a clinically notable institutional result that supports the feasibility of endourological stone surgery in this setting. The postoperative findings also deserve careful interpretation. Most patients had an operating time under one hour, and the tabulated hospital-stay data show that 74.7% remained hospitalized for less than 10 days. The original presentation contained a textual inconsistency stating that most patients stayed >10 days; the numerical table clearly indicates the opposite. Publication manuscripts should always prioritize the verified dataset and correct such internal discrepancies before submission. In contemporary PCNL practice, hospital stay is influenced by tract size, number of accesses, bleeding, fever, residual stone burden, drainage strategy and institutional discharge protocols. Miniaturized PCNL has been associated with reduced blood loss and shorter hospitalization in meta-analyses while maintaining comparable stone-free efficacy.[12,13]

Postoperative pain was recorded immediately in 44%, early in 33.3% and later in 22.7%. These categories are not equivalent to validated pain scores such as a visual analogue scale or numerical rating scale, and they do not specify analgesic requirements. Future studies should use standardized pain instruments, record analgesic consumption and distinguish procedure-related pain from stent-related symptoms. Such standardization would improve comparability across PCNL and URS studies.

The two nephrectomies represented 2.7% of the cohort. The source material does not specify whether these kidneys were non-functioning, chronically infected, severely damaged or otherwise unsuitable for stone-preserving surgery. Consequently, nephrectomy should not be interpreted as a routine treatment for renal calculi. Contemporary stone surgery emphasizes renal preservation whenever feasible, while nephrectomy is reserved for selected patients with a severely damaged or non-functioning renal unit when reconstruction or stone clearance is unlikely to provide benefit. The indication for nephrectomy should be explicitly reported in future studies.

An important strength of this study is that it captures the spectrum of operative management within a real-world tertiary-care surgical service and includes demographic, symptomatic, laboratory, imaging, operative and stone-composition data. The dataset also demonstrates the near-complete displacement of open surgery by minimally invasive procedures. However, several limitations constrain the strength of inference. The sample size is small; the study is single-centre and observational; there is no untreated or alternative-treatment control group; stone size, location, density and complexity are incompletely reported; standardized complication grading is absent; CT was not routinely used; and the follow-up duration and stone-free assessment method are not stated. The study also lacks detailed information on blood loss, transfusion, postoperative fever/sepsis, ancillary procedures, stent/nephrostomy use, readmission and recurrence. These variables are important in contemporary PCNL reporting.[10,11]

Overall, the findings support the institutional feasibility of minimally invasive stone surgery, particularly PCNL, but they should not be interpreted as evidence that PCNL is universally superior to URS or other modalities. Current treatment selection should remain individualized according to stone burden, location, anatomy, renal function, infection, patient preference and available expertise.[1] The study's greatest value is therefore descriptive: it documents the operative pattern and clinical characteristics of surgically treated renal-stone patients at RIMS Raipur during 2022–2023 and provides a baseline for future prospective, protocolized endourological research.

6. Strengths of the Study

- Provides an institutional real-world profile of surgically treated renal calculi in central India.
- Includes demographic, clinical, laboratory, radiological, operative and stone-composition variables.
- Documents the predominance of minimally invasive surgery and the near absence of open stone procedures.
- Includes qualitative analysis of retrieved stones in all reported cases.
- Provides practical baseline data for designing future prospective endourological studies.

7. Limitations

- Small sample size (n=75) and single-centre observational design limit external validity.
- No formal comparison between PCNL and ureteroscopy groups was presented.
- Stone size distribution, exact location, density, burden and nephrolithometric scores were not reported.
- The definition, imaging modality and timing of stone-free assessment were not specified.
- Postoperative complications were not graded using Clavien–Dindo or another standardized system.
- Urine culture, antibiotic protocol, blood loss, transfusion, stenting/drainage and readmission data were unavailable.
- The source material does not provide a formal ethics approval number or study registration number; these should be added if available.
- The source presentation contains an internal inconsistency regarding hospital stay; the numerical table indicates that 74.7% stayed <10 days and 25.3% stayed >10 days.

CONCLUSION

Renal stone disease in this tertiary-care cohort predominantly affected adult men and commonly presented with loin pain and urinary symptoms. PCNL was the principal surgical treatment, accounting for 88% of procedures, while ureteroscopy accounted for 9.3% and nephrectomy for 2.7%; no open stone-removal procedures were reported. Calcium oxalate/calcium phosphate was the most frequent qualitative stone composition. The study reported complete stone clearance in all 75 patients, although the absence of a standardized stone-free definition and detailed stone-complexity data limits direct comparison with contemporary multicentre literature. The findings demonstrate the feasibility and institutional predominance of minimally invasive renal stone surgery and support continued development of standardized prospective endourological databases in Indian centres.

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