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Treatment Strategies for Kidney Stones Following ESWL Failure: A Prospective Comparative Study of Three Surgical Approaches

Dursun Baba[1], İsmail Eyüp Dilek[1], Ekrem Başaran[1], Yusuf Şenoğlu[2], Ahmet Yıldırım Balık[1], Arda Taşkın Taşkıran[1], Alpaslan Yüksel[3], Muhammet Ali Kayıkçı[1], Ali Tekin[4]

[1]Düzce University Faculty of Medicine, Department of Urology, Düzce, Turkiye
[2]Marmara University Faculty of Medicine, Department of Urology, İstanbul, Turkiye
[3]İstanbul Medeniyet University Faculty of Medicine, Department of Urology, İstanbul, Turkiye
[4]Acıbadem University Atakent Hospital, Clinic of Urology, İstanbul, Turkiye

What's known on the subject? and What does the study add?

Nephrolithiasis is commonly treated with extracorporeal shock wave lithotripsy (ESWL), but in cases of failure, more invasive procedures, like retrograde intrarenal stone surgery (RIRS), mini percutaneous nephrolithotomy (PCNL), and PCNL, are used. However, there is limited consensus on the best approach for patients with 1-2 cm stones post-ESWL. This study provides a direct comparison of these three techniques, showing that RIRS and miniPCNL are associated with shorter hospital stays and fewer complications than PCNL, which, though quicker, requires more analgesia and causes greater hemoglobin reduction.

Abstract

Objective: This study aims to evaluate the efficacy and safety of retrograde intrarenal stone surgery (RIRS), mini-percutaneous nephrolithotomy (miniPCNL), and PCNL in patients with 1-2 cm kidney stones who failed extracorporeal shock wave lithotripsy (ESWL).

Materials and Methods: This prospective study analyzed the medical records of 90 patients who underwent RIRS (n=29), miniPCNL (n=31), or PCNL (n=30) after unsuccessful ESWL treatment. The groups were compared based on operative time, hospital stay, complication rates, narcotic analgesic use, catheterization requirements, perioperative hemoglobin changes, transfusion needs, and treatment efficacy. Statistical analyses were performed using appropriate methods based on variable distribution.

Results: RIRS resulted in significantly shorter hospital stays than miniPCNL and PCNL groups ($p<0.001$). MiniPCNL patients also had a shorter hospital stay than those in the PCNL group ($p=0.047$). The shortest operative time was observed in the PCNL group (59.9 min) compared to both the RIRS and miniPCNL groups ($p<0.05$). However, PCNL was associated with significantly higher narcotic analgesic use, greater hemoglobin reduction, and longer hospitalization. No significant differences were found among the three groups regarding transfusion requirements, residual stone rates, or overall complications.

Conclusion: All three surgical methods were effective and safe for treating kidney stones measuring 1-2 cm in patients who previously failed ESWL. However, considering the shorter hospital stay and lower complication rates, RIRS and miniPCNL may be preferable options, while PCNL should be considered in selected cases.

Keywords: ESWL, kidney stone, miniPCNL, percutaneous nephrolithotomy, RIRS

Correspondence: Dursun Baba MD, Düzce University Faculty of Medicine, Department of Urology, Düzce, Turkiye
E-mail: drbaba28@gmail.com **ORCID-ID:** orcid.org/0000-0002-4779-6777
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Introduction

Nephrolithiasis is a prevalent urological condition with a rising incidence worldwide, significantly affecting both patient quality of life and healthcare systems. Treatment strategies vary based on stone size, location, composition, and patient-specific factors, ranging from conservative medical management to surgical interventions (1-3). Among non-invasive approaches, extracorporeal shock wave lithotripsy (ESWL) is commonly preferred as a first-line treatment for small to medium-sized renal stones. However, its success rate is limited by factors such as stone density, unfavorable anatomical conditions, and lower pole stone location (4,5).

When ESWL fails, more invasive endourological procedures-retrograde intrarenal surgery (RIRS), mini-percutaneous nephrolithotomy (miniPCNL), and percutaneous nephrolithotomy (PCNL)-are utilized (4). According to the 2024 European Association of Urology guidelines, no specific endourological method is prioritized for 1-2 cm kidney stones, and both ESWL and surgical options are recommended. However, for stones larger than 1 cm in the lower pole or in cases where ESWL is not feasible, endo-urological techniques are the preferred treatment approach (6,7).

Although numerous studies have compared the efficacy and safety of RIRS, miniPCNL, and PCNL, most do not specifically focus on patients undergoing surgery after failed ESWL (8-10). Additionally, there is a lack of direct comparisons between these three techniques in this specific patient group. This study aims to fill this gap by prospectively comparing RIRS, miniPCNL, and PCNL in patients with 1-2 cm renal stones who did not benefit from ESWL, thereby providing valuable insights for clinical decision-making.

Materials and Methods

Study Design and Patient Selection

This prospective study was conducted at Düzce University Hospital between January 2015 and July 2017 and included patients who underwent RIRS, miniPCNL, or PCNL due to failed ESWL. Ethical approval was obtained from the Düzce University Clinical Research Ethics Committee (approval number: 2014/63, date: 28/10/2014), and the study was conducted in compliance with the principles of the Declaration of Helsinki. Written informed consent was obtained from all patients before undergoing surgical intervention. This study was designed and reported following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines to ensure transparency and completeness in the presentation of methods and results.

A total of 113 patients with single renal stones measuring 1-2 cm who had undergone at least two ESWL sessions without successful stone fragmentation were assessed for eligibility. After applying inclusion and exclusion criteria, 90 patients were included in the study. ESWL failure was defined as the absence of stone fragmentation on follow-up radiography or fluoroscopy in at least two applications performed a week apart. It also included patient intolerance due to pain, or inability to complete ESWL sessions, each consisting of 2,500 shocks at 18-22 kV (Stonelith-V5 Lithotripter; PCK Medical Systems, Ankara, Turkiye). The surgical procedure was planned three weeks after the unsuccessful ESWL treatment. Patients were comprehensively informed about all three surgical options-RIRS, miniPCNL, and PCNL-before undergoing the procedure. Following the attainment of patient consent for the surgical procedure selection, patients were prospectively divided into three separate groups according to the surgery being conducted. An intraoperative miniPCNL was performed on one patient in the RIRS group, because the stone could not be reached. The RIRS group included 29 patients, the miniPCNL group included 31 patients, and the PCNL group included 30 patients. Due to the nature of the study, randomization could not be implemented.

The flow diagram showing the patient selection and analysis process of the study is presented in Figure 1. This diagram summarizes the assessment, exclusion criteria, group separation, and final analysis stages of the patients included in the study.

Inclusion and Exclusion Criteria

Patients were eligible for inclusion if they had a single radiopaque renal stone measuring between 1 and 2 cm located in a single calyx or the renal pelvis, confirmed on imaging. They were required to have no active urinary tract infection and to meet the criteria for ESWL failure (no stone fragmentation on control radiography or fluoroscopy after at least two ESWL treatments performed one week apart or the patient was unable to continue treatment due to pain). Stone density was measured in Hounsfield units (HU) using non-contrast computed tomography.

Exclusion criteria included patients younger than 18 years or older than 85 years with a body mass index (BMI) greater than 35 with severe skeletal deformities, and with anatomical abnormalities such as a pelvic kidney or abnormal renal rotation. Patients with active urinary tract infections or those who required immediate emergency intervention were also excluded.

Surgical Procedures

All procedures were performed under general anesthesia after confirming a sterile urine culture and administering prophylactic antibiotic therapy. RIRS was performed using a 7.5 Fr Karl Storz (Karl Storz GmbH & Co. KG, Tuttlingen, Germany)

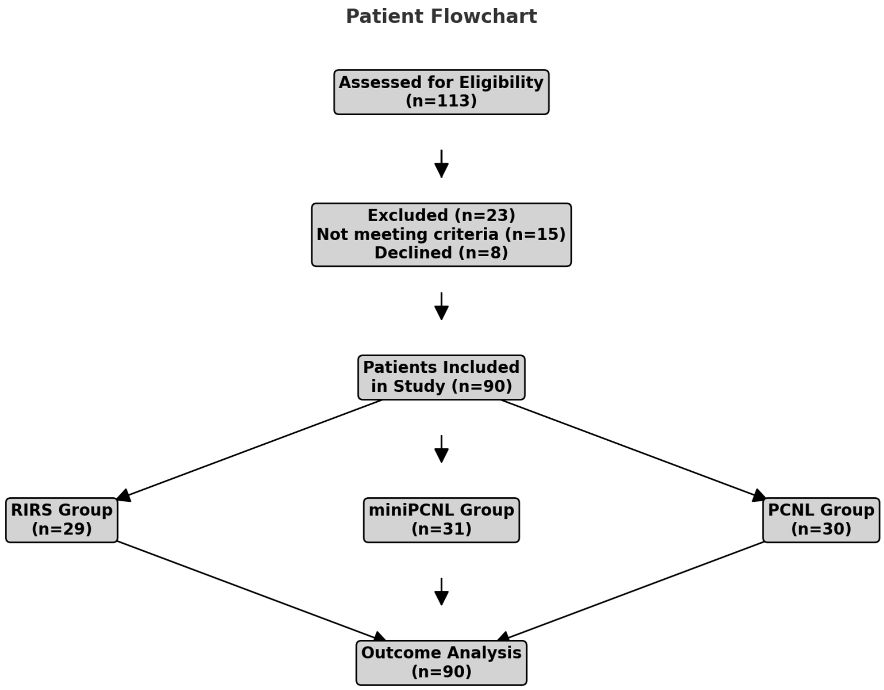

Figure 1. Patient flowchart

RIRS: Retrograde intrarenal stone surgery, MiniPCNL: Mini-percutaneous nephrolithotomy, PCNL: Percutaneous nephrolithotomy

Flex-X2S flexible ureteroscope with a 9 Fr ureteral access sheath. Lithotripsy was performed using a 270-micron laser fiber in dusting mode (0.5 J, 20 Hz), with energy and frequency adjustments made as necessary. A Double-J stent (DJS) was routinely placed postoperatively. MiniPCNL was performed using a 12 Fr nephroscope, part of the Minimally invasive PCNL system, manufactured by Karl Storz. Additionally, a 17.5 Fr sheath was used in this procedure. Stone fragmentation was performed using a 600-micron laser fiber in fragmentation mode (2 J, 10 Hz). Postoperatively, either a Malecot nephrostomy tube or a DJS was placed depending on the clinical indication. PCNL was performed using a 26 Fr Karl Storz nephroscope with a 30 Fr access sheath. A pneumatic lithotripter was used for stone fragmentation. Catheterization methods included the placement of a re-entry catheter, a Malecot nephrostomy tube, or a combination of a nephrostomy tube with a DJS based on intraoperative conditions (11).

Outcome Measures

The primary outcome measures were operative time, hospital stay duration, perioperative hemoglobin changes, transfusion requirements, complication rates classified using the Clavien-Dindo system, narcotic analgesic use, and residual stone presence. Residual stones were assessed using computed tomography (CT) imaging performed within two months postoperatively. Residual stones greater than 4 mm were classified as clinically significant, while those smaller than 4 mm were considered stone-free. Stone distribution according to renal anatomy (upper pole, middle pole, lower pole, and pelvis) was analyzed to determine any potential impact on treatment outcomes.

Statistical Analysis

Statistical analyses were conducted using IBM SPSS v23 software. Parametric variables such as operative time and hemoglobin change were analyzed using ANOVA and post hoc Tukey's tests, while non-parametric variables such as hospital stay were analyzed using the Kruskal-Wallis and Mann-Whitney U tests. Categorical variables, including transfusion requirements and complication rates, were compared using chi-square or Fisher's exact tests as appropriate. A priori power analysis was performed using GPower, and it was determined that a sample size of 75 patients would provide sufficient statistical power for detecting meaningful differences (7). A p-value of less than 0.05 was considered statistically significant.

Results

Between January 2015 and July 2017, 90 patients with 1-2 cm kidney stones following failed ESWL were included in the study. In one patient from the RIRS group, the procedure was switched to miniPCNL due to the inability to access the stone.

The mean age of the patients was 48.4 years, the average stone size was 16.5 mm, and the mean BMI was 25.5, with no significant differences observed between the groups (Table 1).

When examining the operation durations: the average time for all groups was found to be 76.3 minutes (RIRS: 78.17 minutes, miniPCNL: 90.45 minutes, PCNL: 59.9 minutes). A significant difference was found between the RIRS-PCNL and miniPCNL-PCNL groups (p=0.024; p<0.001). However, no significant difference was observed between the RIRS and miniPCNL groups (p=0.20) (Table 1).

The average hospital stay duration was found to be 3.62 days (RIRS: 1.76 days, miniPCNL: 4.13 days, PCNL: 4.9 days), with patients in the RIRS group having a significantly shorter hospital stay compared to the other groups (p<0.001). Additionally, the miniPCNL group was observed to have a shorter hospital stay compared to the PCNL group (p=0.047) (Table 1).

A comparison of the preoperative and postoperative hemoglobin changes between the RIRS and miniPCNL groups showed no significant difference (p=0.404). However, a significant difference was observed between the miniPCNL-PCNL and RIRS-PCNL groups (p=0.03 and p<0.001, respectively). In the PCNL group, two patients received blood transfusions, and in the miniPCNL group, one patient received a transfusion. No transfusions were performed in the RIRS group (Table 2).

No significant difference was found in preoperative and postoperative hemoglobin changes between the RIRS and miniPCNL groups (p=0.404). However, significant differences were observed between the miniPCNL-PCNL and RIRS-PCNL groups (p=0.03 and p<0.001, respectively). In the PCNL group, 2 patients received blood transfusions, while in the miniPCNL group, 1 patient received a transfusion, and no transfusions were performed in the RIRS group (Table 2).

Residual stones were observed in 8 patients in the RIRS group, 3 patients in the miniPCNL group, and 8 patients in the PCNL group. No significant difference was found between the groups (p>0.05) (Table 2).

A total of 5 patients developed complications. The complications were graded according to the standardized Clavien-Dindo classification for PCNL procedures. In the PCNL group, one patient developed a fever postoperatively (Clavien score 2); antibiotic treatment was started. Subsequently, a urinary tract infection was

Table 1. Baseline demographic and clinical characteristics

Features	RIRS (n=29)	MiniPCNL (n=31)	PCNL (n=30)	Total (n=90)	p-value
Age, year	51.10±15.07	47.48±14.76	46.77±18.52	48.41±16.13	>0.05*,**,**
Gender	18/11	22/9	13/17	53/37	>0.05*,**,**
Body mass index (<35)	25.6±3.8	26.1±3.2	24.8±4.1	25.5±3.4	>0.05*,**,**
Stone size	16.31±2.87	16.35±3.85	17.03±2.82	16.56±3.21	>0.05*,**,**
Stone density (Hounsfield unit)	1019.7±119.8	1021±123.8	1029.3±146.8	1023.7±129.3	0.96
Surgery duration (min)	76.17±22.7	90.45±30.31	59.90±23.35	76.31±28.48	0.20* ***0.024***** ***<0.001******
Hospitalization duration (average, min-max, median)	1.76 (1-3, med: 2)	4.13 (3-5, med: 4)	4.9 (2-13, med.: 4)	3.62	***<0.001*,***** ***0.047******

*: RIRS-miniPCNL, **: RIRS-PCNL, ***: miniPCNL-PCNL. Represents the p-value between the groups. Statistically significant differences are indicated in ***bold italics***. Groups with normal distribution are presented as mean and standard deviation, while those without normal distribution are shown with minimum-maximum and median values, RIRS: Retrograde intrarenal stone surgery, MiniPCNL: Mini-percutaneous nephrolithotomy, min-max: Minimum-maximum, PCNL: Percutaneous nephrolithotomy

Table 2. Preoperative and postoperative clinical outcomes

Features	RIRS (n=29)	MiniPCNL (n=31)	PCNL (n=30)	Total (n=90)	p-value
Hgb change (g/dL)	0.16±0.27	0.43±0.53	0.88±0.99	0.49±0.73	0.404* ***0.03***** ***0.001******
Transfusion requirement (n)	0	1	2	3	>0.05*,**,**
Complication (n)	0	2	3	5	>0.05*,**,***
Narcotic analgesia requirement (n)	0	4	13	17	0.125* ***0.004***** ***<0.001*****
Residual stone presence (>4 mm, n)	8	3	8	19	0.156*,**,***

*: RIRS-miniPCNL, **: RIRS-PCNL, ***: miniPCNL-PCNL. Represents the p-value between the groups. Statistically significant differences are indicated in ***bold italics***. Groups with normal distribution are presented as mean and standard deviation, RIRS: Retrograde intrarenal stone surgery, MiniPCNL: Mini-percutaneous nephrolithotomy, PCNL: Percutaneous nephrolithotomy

detected in the follow-up urine culture. In the miniPCNL group, one patient developed severe hematuria (Clavien score 3A), and a three-way catheter was applied. The other three complications were transfusions performed due to perioperative hemoglobin drop (Clavien score 2).

In the catheterization information, DJS was inserted in all patients in the RIRS group. In the MiniPCNL group, Malecot nephrostomy was placed in 6 patients and DJS in 25 patients. In the PCNL group, 6 patients underwent malecot nephrostomy, 21 patients underwent re-entry, and 3 patients underwent malecot nephrostomy + DJS (Table 3). The distribution of the stones between the groups is shown in Table 4. There was no statistically significant difference between the groups regarding the surgical procedure and the calyx distribution of the stones between the groups (p=0.33) (Table 4).

In the analysis of the treatment groups, complications were observed in a total of five patients. In the PCNL group, one patient developed postoperative fever (Clavien score 2), was started on antibiotic therapy, and a urinary tract infection was identified in a follow-up urine culture In the miniPCNL group, severe hematuria occurred in three patients, requiring the placement of a three-way catheter (Clavien score 3A). The other three complications involved perioperative low hemoglobin levels, which necessitated blood transfusions (Clavien score 2). Although the complication rates between the groups were not statistically significant, it was observed that no complications occurred in the RIRS group.

Table 3. Postoperative catheterization methods

	RIRS	MiniPCNL	PCNL	Total
DJ catheter	29	25	0	54
Nephrostomy	0	6	6	12
Re-entry	0	0	21	21
Nephrostomy + DJ catheter	0	0	3	3
Total	29	31	30	90

RIRS: Retrograde intrarenal stone surgery, MiniPCNL: Mini-percutaneous nephrolithotomy, PCNL: Percutaneous nephrolithotomy, DJ: Double J

Table 4. Stone distribution across groups

	RIRS	MiniPCNL	PCNL	Total	p-value
Upper pole	10	6	5	21	0.33
Middle pole	7	11	9	27	
Lower pole	4	8	11	23	
Pelvis	8	6	5	19	
Total	29	31	30	90	

RIRS: Retrograde intrarenal stone surgery, MiniPCNL: Mini-percutaneous nephrolithotomy, PCNL: Percutaneous nephrolithotomy

Discussion

In this study, the efficacy and safety of RIRS, miniPCNL, and PCNL were prospectively compared in patients with 1-2 cm kidney stones who had previously failed ESWL treatment. The results demonstrated that while all three surgical approaches were effective in achieving stone clearance, they differed in terms of operative time, hospital stay, perioperative complications, and analgesic requirements. RIRS and miniPCNL were associated with shorter hospital stays and lower perioperative morbidity, whereas PCNL had the advantage of a shorter operative time but was associated with greater hemoglobin decline and higher analgesic requirements.

The findings align with previous studies that have evaluated the outcomes of these surgical techniques separately (12,13). A systematic review and meta-analysis by Cabrera et al. (14) comparing miniPCNL and RIRS for 10-20 mm lower pole stones concluded that both techniques had similar stone-free rates, but miniPCNL was associated with a longer operative time and greater blood loss. Another study by Chen et al. (15) comparing PCNL and RIRS found that PCNL had a higher stone-free rate but was associated with greater morbidity. Similarly, our study supports the notion that PCNL remains a robust option for stone removal, but may be less favorable due to its increased invasiveness and postoperative recovery period.

The mean operative time in our study was the shortest in the PCNL group (59.9 minutes), which is consistent with prior research showing that PCNL is generally faster than RIRS and miniPCNL for stones of this size range. However, this shorter duration may be counterbalanced by the increased morbidity associated with PCNL, as seen in the higher rates of perioperative hemoglobin reduction and narcotic analgesia requirements. Previous studies have reported similar trends, with PCNL showing a significantly greater need for postoperative pain management, likely due to the larger renal access sheath and increased tissue trauma, compared to the other methods (16,17).

One of the most critical factors influencing treatment decisions is hospital stay duration. Our study found that RIRS had the shortest hospital stay (1.76 days), followed by miniPCNL (4.13 days), while PCNL had the longest hospitalization period (4.9 days). These results are in accordance with prior studies in which RIRS is consistently associated with a faster recovery due to its minimally invasive nature and lack of renal tract dilation (9,18). A multicenter study by Karakoç et al. (19) evaluating lower pole stones found that hospital stays were significantly shorter in patients undergoing RIRS compared to those undergoing PCNL, reinforcing the findings observed in our study.

Despite the differences in perioperative morbidity, no significant difference was observed in residual stone rates among the three techniques. The presence of residual stones (>4 mm) was slightly higher in the RIRS and PCNL groups than in miniPCNL, although this difference was not statistically significant. The stone-free rate is an important consideration in treatment selection, as residual stones may increase the risk of recurrence. While PCNL is traditionally considered superior in achieving complete stone clearance, recent advances in RIRS technology, including improved flexible ureteroscope designs and enhanced laser lithotripsy techniques, have significantly improved the stone-free rates associated with this approach (20,21).

Complications in our study were relatively low across all three techniques, with no major adverse events reported. PCNL had a higher incidence of perioperative hemoglobin drop, and required transfusions more frequently than miniPCNL and RIRS. These findings are consistent with a meta-analysis by Qiu et al. (22), which demonstrated that miniPCNL is associated with significantly less bleeding than standard PCNL. Furthermore, while RIRS was associated with fewer complications, it had a slightly higher residual stone rate, which is a known limitation of this method in cases where the stone burden is higher.

Additionally, ESWL failure can be attributed to factors such as stone density, location (especially in the lower pole), and stone size. Hard stones, in particular, are less likely to fragment efficiently under ESWL, as they resist the shock waves more effectively than softer stones. The hardness of the stone is often associated with its density, typically measured in HU; high-density (hard) stones may not break apart as effectively during ESWL treatment (23,24). Furthermore, the chemical composition of the stone plays a significant role; calcium oxalate stones, for example, are harder and may not respond well to ESWL, reducing its effectiveness. In our study, 113 patients, who did not achieve successful stone fragmentation despite undergoing at least two sessions of ESWL, were included. This highlights the limitations of ESWL in certain patient populations. Additionally, patient intolerance to the procedure and the inability to complete the recommended number of shock waves are key factors contributing to ESWL failure. These failures necessitate the use of more invasive treatments, such as RIRS, miniPCNL, and PCNL, which offer effective solutions for patients who do not respond to ESWL.

One of the key clinical implications of our study is the importance of individualized treatment selection. The choice between RIRS, miniPCNL, and PCNL should be based on patient-specific factors such as stone location, anatomy, comorbidities, and surgeon expertise. While PCNL remains the most efficient technique for large stone burdens, its increased morbidity may limit its use in cases where a less invasive approach could be equally effective. RIRS, on the other hand, offers a safer profile with a quicker recovery but may require staged procedures for complete stone clearance in larger stone burdens. MiniPCNL appears to be a middle ground, providing better stone clearance than RIRS while maintaining a lower complication profile than standard PCNL (25).

Study Limitations

This study has several limitations that must be considered when interpreting the results. Although the study was conducted prospectively, randomization was not feasible. Patients were provided with information regarding all three surgical options-RIRS, miniPCNL, and PCNL-before the procedure. As a result, the lack of random assignment may have introduced selection bias, influenced by patient preferences or physician recommendations. These factors could have contributed to the unequal distribution of confounding variables, including surgeon choice, patient-specific anatomical features, and stone characteristics. To minimize such biases and strengthen the evidence, a prospective, randomized controlled trial would be required.

Second, this study was conducted at a single center, limiting the generalizability of the findings to other institutions with different surgical expertise, technological capabilities, and patient demographics. The results might not fully reflect the variability in surgical outcomes that could be observed in multi-center or international studies. Additionally, the experience and technique of individual surgeons performing RIRS, miniPCNL, and PCNL can significantly influence outcomes such as operative time, complication rates, and stone-free rates, which were not standardized in this study.

Another limitation is the lack of long-term follow-up data. The primary outcome measures were assessed within two months postoperatively, focusing on short-term perioperative outcomes. Long-term factors such as stone recurrence rates, retreatment necessity, and overall patient satisfaction were not evaluated. Since nephrolithiasis is a chronic and recurrent disease, understanding long-term effectiveness and recurrence prevention strategies is crucial for optimizing treatment decisions. Future studies should incorporate follow-up periods of at least 12 months to assess stone regrowth, new stone formation, and potential complications such as ureteral stricture development or renal function deterioration.

Additionally, while stone-free status was evaluated using CT, the criteria for residual stone significance (>4 mm) is subject to debate. Some studies suggest that even residual fragments as small as 2 mm, although commonly used in the literature, could increase recurrence risk. Furthermore, factors such as infundibulopelvic angle, calyx neck width, stone-skin distance, and stone composition were not assessed, despite their known impact on stone fragmentation and clearance. The inclusion of these parameters, which were not assessed in our study, could provide more comprehensive insights into the factors influencing ESWL failure and surgical outcomes.

A further limitation is the lack of standardized pain assessment and postoperative recovery parameters, beyond hospital stay duration and narcotic analgesic requirements. While the study highlights that PCNL was associated with higher analgesic needs, the absence of a structured pain scoring system such as the visual analog scale makes it difficult to quantify and compare pain severity across groups objectively. Including validated pain assessment tools in future research would allow for a more precise evaluation of postoperative comfort and recovery trajectories.

Lastly, the cost-effectiveness of each procedure was not analyzed. While RIRS and miniPCNL demonstrated advantages in terms of shorter hospital stays and lower morbidity, the financial implications of these approaches compared to PCNL were not assessed. Factors such as procedure duration, equipment costs, hospital resource utilization, and patient return-to-work times play a significant role in clinical decision-making. Future studies should incorporate economic analyses to determine the most cost-effective strategy for treating ESWL-resistant kidney stones.

Conclusion

All three surgical methods-RIRS, miniPCNL, and PCNL-were found to be effective and safe for the treatment of 1-2 cm kidney stones following failed ESWL. RIRS and miniPCNL were associated with shorter hospital stays and lower perioperative morbidity, while PCNL demonstrated the shortest operative time but had higher analgesic requirements and greater hemoglobin decline. The choice of surgical technique should be tailored to individual patient characteristics, considering factors such as stone burden, renal anatomy, and patient recovery expectations. Future prospective studies with larger sample sizes and long-term follow-up are needed to further refine treatment algorithms for patients with ESWL-resistant kidney stones.

Ethics

Ethics Committee Approval: Ethical approval was obtained from the Düzce University Clinical Research Ethics Committee (approval number: 2014/63, date: 28/10/2014).

Informed Consent: Written informed consent was obtained from all patients before undergoing surgical intervention.

Footnotes

Authorship Contributions

Surgical and Medical Practices: Y.Ş., D.B., A.T., İ.E.D., E.B., Concept: D.B, A.Y.B., A.Y., Design: D.B., M.A.K., A.T., Data Collection or Processing: Y.Ş., A.T.T., Analysis or Interpretation: A.T., M.A.K., Literature Search: D.B., A.Y.B., A.T., Writing: D.B., M.A.K., A.T.

Conflict of Interest: Ali Tekin MD is section editor in Journal of Urological Surgery. He had no involvement in the peer-review of this article and had no access to information regarding its peer-review.

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