Original Article

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Urology Section

Standard versus Miniature Percutaneous Nephrolithotomy in the Treatment of Renal Stone sized between 1-2 cm: A Prospective Interventional Study

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ABSTRACT

Introduction: Urinary tract stone disease affects 1-15% of the population. While Percutaneous Nephrolithotomy (PCNL) has replaced open surgery for kidney stones, it poses risks such as bleeding and renal damage. Mini-PCNL and Ultra-mini PCNL (UMP) reduce complications by using smaller tracts but face challenges, including limited visibility and longer operative times.

Aim: To compare the efficacy and safety of standard, mini and UMP for stones measuring 1 to 2 cm, focusing on stone clearance, operative time and postoperative outcomes (pain, fever, haematuria and sepsis).

Materials and Methods: In this prospective interventional study conducted between October 2022 and September 2024 at Dr. D. Y. Patil Medical College, 60 patients with 1 to 2 cm renal stones were grouped into Standard (group A), Mini (group B), or UMP (group C) groups. Preoperative assessments included medical history, imaging and anaesthesia evaluations. Standard PCNL utilised a 24 Fr sheath, mini-PCNL a 15/16 Fr sheath and UMP an 8.5 to 11 Fr sheath. The outcomes measured were operative time, stone clearance and postoperative outcomes (pain, fever, haematuria, sepsis and hospital stay). Statistical Package for the Social Sciences (SPSS) version 21.0 was used for statistical analysis.

Results: In the present study, the average ages were 46.4 years (Group A), 53.25 years (Group B) and 48.1 years (Group C). Nephrostomy use was higher in group A (100%) compared to group B (75%) and group C (85%) groups. Group A had the shortest operative time (43.95 minutes, p-value <0.001). Hospital stays were shorter for group B (70%) and group C (90%) groups compared to group A (25%, p-value=0.0001). Stone-Free Rates (SFR) were similar across groups (90%, 95%, 95%). Complications were lowest in the group C (5%), while the group A showed the highest haemoglobin drop (p-value=0.027). No cases of sepsis occurred and the number of ancillary procedures was lower in group B (5%) and group C (5%) groups than in group A (10%).

Conclusion: Standard PCNL had the shortest operative time but resulted in longer hospital stays and greater haemoglobin drops. Mini-PCNL and UMP reduced complications and hospital stays, with UMP offering the best overall outcomes.

Keywords: Complications, Kidney stones, Mini scopes, Minimally invasive surgery

INTRODUCTION

Urinary tract stone disease is the third most common urological condition, with a lifetime prevalence of 1-15% [1]. Over the past two decades, open surgery for managing kidney stones has been largely replaced by PCNL and Extracorporeal Shock Wave Lithotripsy (ESWL) [2]. Currently, open surgery is used in only 1-2% of cases involving renal stones [3]. PCNL was first described by Fernström and Johansson in 1976 [4]. According to the updated European Association of Urology (EAU) guidelines, it is now recommended as the treatment of choice for large renal calculi (>20 mm) and smaller stones (10-20 mm) in the lower renal pole under unfavourable conditions [5]. PCNL has shown excellent SFR, ranging from 76-98% [6].

Standard PCNL is a minimally invasive, gold-standard procedure for removing large or complex kidney stones, including staghorn calculi and treatment-resistant cases. It involves accessing the renal collecting system percutaneously, fragmenting and extracting stones. A 20-30 F nephroscope sheath is used [7]. To reduce morbidity associated with larger instruments, the technique has evolved into minimally invasive PCNL (mini-PCNL or mini-Perc), which uses smaller access tracts (11-20 F). This approach was first implemented by Jackman SV et al., in the paediatric population with an 11 F access tract and has since become a viable treatment option for adults [6,8].

Mini-PCNL generally refers to access sheaths of 20 F or smaller, although no standardised definition exists [9]. Literature reports access sizes ranging from 11 F to 20 F [10], with some studies specifying sizes from 14 F to 20 F [6,11]. Similarly, UMP uses an 11-13 Fr access sheath and a 7.5 Fr mini-nephroscope for calculi <2 cm [12]. These miniature techniques offer advantages such as decreased blood loss, improved maneuverability, reduced postoperative pain and shorter hospital stays. Limited transfusion rates have also been reported using these techniques due to the smaller caliber of tracts employed. However, the reduced tract size can present challenges such as limited visibility, prolonged operative times and lower primary SFRs, particularly for larger stone burdens [13].

Over time, technological advancements have further enhanced the safety and efficacy of PCNL. Despite these advancements, PCNL is not without risks. Complications include postoperative sepsis (2%), fever (10-16%), blood transfusion (3-6%), significant bleeding (8%) and adjacent organ injury. Surgeons must carefully select the appropriate PCNL technique- standard, mini, or UMP -based on the stone characteristics, patient profile and their expertise [14].

The management of renal calculi has evolved, with treatments tailored to stone size, location and composition [15]. Stones measuring between 10-20 mm remain challenging, as miniaturised PCNL balances high SFRs with shorter recovery times. Despite widespread adoption, there is limited research comparing standard,

mini and UMP specifically for 1-2 cm stones [16]. Most studies focus on single techniques or larger stones, creating a critical gap in the evidence for optimal approaches to smaller stones [17-19]. This study aimed to compare all three techniques, providing insights into their efficacy, safety and outcomes, including stone clearance, operative time, pain, complications and duration of hospital stay. The present study hypothesised that miniaturised techniques may offer outcomes similar to those of standard PCNL while reducing morbidity, thereby contributing valuable guidance for clinical decision-making.

MATERIALS AND METHODS

A hospital-based prospective interventional study was conducted at the Department of Urology in Dr. D. Y. Patil Medical College and Research Centre, Pimpri, Pune, Maharashtra, India, from October 2022 to September 2024, to observe the safety, efficacy and applicability of surgical management for 1-2 cm stones. The study received clearance from the Institutional Ethics Committee (IEC), (reference number IESC/236/2022). Written informed consent was obtained from all participants before enrollment.

Inclusion criteria: Patients older than 18 years with single renal calculi measuring 1-2 cm, confirmed through investigations such as X-ray Kidney, Ureter, Bladder (KUB) plain film, Intravenous Urography (IVU) and/or Computed Tomography (CT) urography were included in the study.

Exclusion criteria: Patients unwilling to participate, paediatric patients, those with active urinary tract infections, ureteropelvic junction obstruction, pregnancy, bleeding disorders, anticoagulant use, or comorbid conditions such as diabetes mellitus, hypertension, cardiovascular diseases, or pulmonary diseases were excluded from the study.

Sample size estimation: Considering the average operating time in minutes among Group A (PCNL), Group B (MP) and Group C (UMP) as 45.9±7.7, 55.8±11.4 and 59.3±13.8, respectively, from the study by Bozzini G et al., with an effect size of 0.508 and a power of 80% with a confidence interval of 95% CI, the minimum sample size calculated was 42 [16]. However, in this study, 60 participants were included, with 20 in each group. The software used was G*Power, version 3.1.9.7.

Study Procedure

Patients who met the inclusion and exclusion criteria and were indicated for surgical management of calculi suitable for endoscopic procedures were selected using convenience sampling. The sampling process was facilitated by computer-generated lists using WinPapi software, version 11.3.8. The participants were then allocated into three groups: Group A (standard PCNL), Group B (Mini PCNL) and Group C (UMP).

Preoperative evaluation included demographic details, medical history, routine blood investigations and imaging (X-ray KUB, NCCT, or CT urography). Preanaesthetic evaluations and relevant preoperative assessments were conducted. Intraoperative findings, including efficacy and complications, were recorded. Operative time was measured from puncture to dressing application. Postoperative evaluations conducted on the second postoperative day included X-rays to assess stone clearance, defined as negative findings or asymptomatic residual fragments measuring less than 3 mm [15]. Pain levels were assessed using a numerical scale (0-10) and patients experiencing severe pain were noted, along with any haemogram results and episodes of fever, if present.

STATISTICAL ANALYSIS

The data were collected, compiled and analysed. Quantitative data were presented as means and standard deviations, while qualitative/categorical data were presented as absolute numbers and proportions. Statistical analysis was conducted using the Student's t-test for continuous variables and the Chi-square test for categorical variables. The Chi-square test was applied to assess significance, while the student's t-test was used to compare quantitative outcome parameters. Final interpretations were based on a Z-test with a 95% level of significance, considering a p-value <0.05 as statistically significant. Statistical analysis was performed using SPSS software, Version 21.0.

RESULTS

Group A patients were primarily aged 31-40 years (7 patients, 35%), while Group B patients were mostly over 60 years (8 patients, 40%) and Group C patients were predominantly aged 51-60 years (6 patients, 30%). The mean ages were 46.4±11.81 years for group A, 53.25±16.44 years for group B and 48.10±15.86 years for group C, with no significant differences observed. The mean stone sizes were similar across groups: 16.15±2.39 mm for group A, 15.55±2.87 mm for group B and 15.0±2.84 mm for group C [Table/Fig-1]. Nephrostomy use showed a decreasing trend with minimally invasive techniques: 20 patients (100%) for group A, 15 patients (75%) for group B and 17 patients (85%) for group C (p-value=0.065) [Table/Fig-1].

Parameter	Standard PCNL Group A (n=20)	Mini-perc Group B (n=20)	Ultra-miniperc Group C (n=20)
1. Age-wise (years), n (%)			
< 20	1 (5.0)	1 (5.0)	2 (10.0)
21-30	0	2 (10.0)	3 (15.0)
31-40	7 (35.0)	3 (15.0)	3 (15.0)
41-50	4 (20.0)	1 (5.0)	4 (20.0)
51-60	6 (30.0)	5 (25.0)	6 (30.0)
> 60	2 (10.0)	8 (40.0)	2 (10.0)
2. Mean age (years), M±SD			
	46.4±11.81	53.25±16.44	48.10±15.86
3. Gender distribution, n (%)			
Female	8 (40.0)	8 (40.0)	12 (60.0)
Male	12 (60.0)	12 (60.0)	8 (40.0)
4. Side of stone, n (%)			
Left	10 (50.0)	11 (55.0)	8 (40.0)
Right	10 (50.0)	9 (45.0)	12 (60.0)
5. Mean stone size (mm), M±SD	16.15±2.39	15.55±2.87	15.0±2.84
6. Nephrostomy, n (%)			
Inserted	20 (100.0)	15 (75.0)	17 (85.0)
Not inserted	0	5 (25.0)	3 (15.0)

[Table/Fig-1]: Demographic data.

Group A had the shortest mean operating time of 43.95±5.19 minutes compared to group B, which had 56.20±4.38 minutes and group C, which had 59.05±6.12 minutes (p-value <0.001). SFRs were high across all groups: 18 patients (90%) for group A and 19 patients (95%) for both group B and group C. A 2g haemoglobin drop was observed in three patients (15%) of the group A, while a 1g drop occurred in five patients (25%) from the group A, two patients (10%) from the group B and one patient (5%) from group C (p-value <0.027). Hospital stays were significantly shorter in the group B and group C, with 2-day stays recorded for five patients (25%), 14 patients (70%) and 18 patients (90%) of cases, respectively (p-value=0.0003-0.0001). Ancillary procedures were required in two patients (10%) of the Standard PCNL group and in one patient (5%) of both the group B and group C [Table/Fig-2].

The group C had the highest proportion of patients with no complications, with 19 (95%), followed by group B with 18 (90%) and group A with 15 (75%). Fever was most common in group A,

Parameter	Standard PCNL Group A (n=20)	Mini-perc Group B (n=20)	Ultra-mini-perc Group C (n=20)	p-value (A-B)	p-value (A-C)	p-value (B-C)
1. Operating time, (min)	43.95±5.19	56.20±4.38	59.05±6.12	<0.001	<0.001	0.233
2. Stone free, n (%)						
Complete clearance	18 (90.0)	19 (95.0)	19 (95.0)	0.614	0.614	1.00
Incomplete	2 (10.0)	1 (5.0)	1 (5.0%)			
3. Drop in haemoglobin, n (%)						
0 g/dL	12 (75.0)	18 (90.0)	19 (95.0)	0.027	0.027	1.0
1 g/dL	5 (25.0)	2 (10.0)	1 (5.0)			
2 g/dL	3 (15.0)	0	0			
4. Hospitalisation stay, n (%)						
2 days	5 (25)	14 (70.0)	18 (90.0)	0.0003	0.0001	0.26
3 days	12 (60)	6 (30.0)	2 (10.0)			
4 days	3 (15)	0	0			
5. Need of ancillary procedure, n (%)						
Required	2 (10.0)	1 (5.0)	1 (5.0)	0.609	0.609	1.0
Not required	18 (90)	19 (95)	19 (95)			

[Table/Fig-2]: Intraoperative and postoperative observation.

with 3 (15%), followed by group B with 2 (10%) and group C with 1 (5%), with no significant differences observed (p-value=0.57). Haematuria occurred in 1 (5%) of group A cases, while severe pain was noted in 2 (10%) of the group A patients. No cases of sepsis were reported across the groups [Table/Fig-3].

Complications*	Standard PCNL group A (n=20) n (%)	Mini-perc group A (n=20) n (%)	Ultra-miniperc group C (n=20) n (%)	p-value
No complication	15 (75.0)	18 (90.0)	19 (95.0)	0.25
Fever	3 (15.0)	2 (10.0)	1 (5.0)	0.57
Haematuria	1 (5.0)	0	0	0.36
Severe pain	2 (10.0)	0	1 (5.0)	0.34
Sepsis	0	0	0	-

[Table/Fig-3]: Complication.
*Multiple responses

DISCUSSION

The present study included 60 patients evenly distributed among the Standard PCNL, Mini-PCNL and Ultra-Mini-PCNL groups (20 patients each). The mean ages were 46.4±11.81 years (Standard PCNL), 53.25±16.44 years (Mini-PCNL) and 48.10±15.86 years (UMP), with no significant difference. Bozzini G et al., similarly reported mean ages of 53.3±14.8 years (Standard PCNL), 55.8±16.1 years (Mini-PCNL) and 54.8±17.2 years (UMP) [16]. Conversely, Alam Khan A et al., observed a younger cohort with mean ages of 43.11±13.79 years (Mini-PCNL) and 36.91±11.07 years (Standard PCNL) [20].

In the present study, the mean operating time was 43.95±5.19 minutes for Standard PCNL, 56.20±4.38 minutes for Mini-PCNL and 59.05±6.12 minutes for UMP, with Standard PCNL demonstrating significantly shorter times (p-value <0.001). This was attributed to better visualisation, a larger working channel, improved irrigation and efficient removal of larger stone fragments. This aligns with Bozzini G et al., who reported shorter operative times for Standard PCNL compared to Mini-PCNL and UMP [16]. Similarly, Adamou C et al., found that UMP had a longer duration than Standard PCNL (p-value<0.001) and Mini-PCNL (p-value=0.011) [17]. Additionally, Sebaey A et al., observed a longer operative time for Standard PCNL (46.9±18.6 minutes) compared to Mini-PCNL (40.6±11.9 minutes), but this difference was statistically insignificant [21]. However, Haghighi R et al., reported no significant difference between Mini-PCNL (48±4.3 minutes) and Standard PCNL (51±5.6 minutes) [22]. These variations may be due to institutional protocols, surgeon expertise, equipment and methodologies for measuring operative time.

In the current study, the SFR was 18 (90%) for standard PCNL, 19 (95%) for Mini-perc and 19 (95%) for UMP, with no significant difference. Residual fragments in standard PCNL migrated to smaller calyces, while the Mini-perc and UMP left only clinically insignificant stones. Mini-perc achieves comparable SFRs to standard PCNL with fewer complications, particularly for stone burdens <2 cm^2 (ElSheemy MS et al.,) [23]. A systematic review by Jones P et al., reported an 88.3% SFR and a 6.2% complication rate for UMP, with slightly lower SFRs compared to standard PCNL and Mini-perc [24]. The SFR for the group C was 80%, lower than that of the standard PCNL and Mini-perc groups, a finding consistent with the study by Bozzini G et al., [16]. Ganpule AP et al., noted that Mini-perc's smaller sheaths and flexible nephroscope enhanced fragment clearance, matching standard PCNL's SFR. Miniaturised techniques generally reduce complications and pain while maintaining similar SFRs [25].

The present study highlights the advantage of miniaturised PCNL techniques in reducing hospital stays. Most patients in the Mini-PCNL group {14 (70%)} and group C {18 (90%)} were discharged within 2 days, compared to only 5 (25%) in the standard PCNL group (p-value < 0.003). Nephrostomy insertion rates were lower in Mini-PCNL {15 (75%)} and UMP {17 (85%)} compared to standard PCNL {20 (100%)}, though the difference was not statistically significant (p-value=0.065). In the standard PCNL group, nephrostomies were removed 24 hours postoperatively, followed by Foley catheter removal, contributing to prolonged stays along with postoperative fever and pain in some patients.

In contrast, the Mini-PCNL and group C required PCN insertion only as needed, typically removed by postoperative day 2, facilitating earlier discharge. Similar findings were reported by Mishra S et al., with shorter stays for Mini-PCNL (3.2±0.8 days) than for standard PCNL (4.8±0.6 days, p-value=0.001) [19]. A systematic review by Gao X et al., confirmed shorter hospitalisations with UMP compared to Mini-PCNL, though the difference was not statistically significant (p-value=0.07) [26].

In the current study, the haemoglobin drop of 1g/dL was significantly lower in the Mini-perc {2 (10%)} and UMP {1 (5%)} groups compared to the Standard PCNL group {5 (25%)} (p=0.027). A 2 g/dL drop was rare, occurring only in 3 (15%) standard PCNL cases. No difference was observed between the Mini-perc and group C (p = 1.0). The reduced haemoglobin drop in miniaturised techniques is likely due to the flexibility and mobility of the miniature scopes, which minimise calyceal and renal parenchyma trauma. These findings align with Li X et al., who reported a significantly lower haemoglobin drop in mPCNL (8.8 g/L) compared to sPCNL (16.3 g/L, p-value=0.002) [9]. Similarly, Mishra S et al., reported a significantly lower haemoglobin drop in the Mini-PCNL group (0.8 g/dL) compared to the Standard PCNL group (1.3 g/dL), with a p-value of 0.01 [19]. Additionally, Adamou C et al., found that Standard PCNL resulted in greater haemoglobin loss compared to Mini-perc (p-value=0.008) and UMP (p-value <0.001), with UMP showing the least blood loss [17].

Complication rates in the present study were lowest in the group C {1 (5%)}, followed by Mini-perc {2 (10%)} and Standard PCNL {5 (25%)}. Fever was the most common complication {Standard PCNL: 3 (15%), Mini-perc: 2 (10%), UMP: 1 (5%), p-value=0.57}. Gross haematuria {1 (5%)} and severe pain {2 (10%)} occurred only in the Standard PCNL group. No cases of sepsis were reported. Minimally invasive techniques showed a trend toward fewer complications, though differences were not statistically significant. Bozzini G et al., similarly reported the highest complication rates in Standard PCNL (13.6%) compared to Mini-PCNL (4.2%) and Ultra-mini-PCNL (2.4%), with significant differences favouring minimally invasive approaches [16].

In the present study, ancillary procedures were required in 2 (10%) of the Standard PCNL group and 1 (5%) of both the Mini-perc and group C. Ancillary procedures included a second puncture in one Standard PCNL patient and postoperative ESWL in one patient from each of the other groups. Bozzini G et al., however, reported the highest need for ancillary procedures in the group C (12.1%), followed by Standard PCNL (6.8%) and Mini-perc (4.2%) [16]. These findings highlight variability in the need for retreatment and ancillary procedures across studies.

Limitation(s)

This study's limitations include a single-centre design and the exclusion of paediatric patients, which reduces generalisability. The lack of Hounsfield Unit (HU) measurements and stone composition analysis limits insight into outcome factors. The standardised use of laser fragmentation may have increased operative time compared to other lithotripters. Larger multicentre trials with diverse populations and additional variables are needed to enhance applicability.

CONCLUSION(S)

This study compared Standard PCNL, Mini-PCNL and UMP for 10-20 mm renal stones. The SFRs were similar; however, Standard PCNL had the shortest operative time, accompanied by longer hospital stays and a greater drop in haemoglobin levels. Mini-PCNL and UMP resulted in shorter hospital stays and fewer complications, with UMP demonstrating the lowest complication rates, although this was not statistically significant. Both miniaturised techniques led to slightly longer operative times but improved recovery. Larger multicentre studies are needed to confirm these findings and to assess long-term outcomes. Overall, Mini-PCNL and UMP are effective alternatives to Standard PCNL.

REFERENCES

[1] Pearle MAJ, Lotan Y. Urinary lithiasis: Aetiology, epidemiology, and pathogenesis, Campbell-Walsh Urology. 12th ed. Philadelphia: Elsevier; 2021. p. 2005-2035.
[2] Stoller M. Urinary stone disease, Smith & Tanagho's General Urology. 19th ed. California: McGrawHill; 2020. p. 272-304.
[3] El-Husseiny T, Buchholz N. The role of open stone surgery. Arab J Urol. 2012;10:284-88.
[4] Zeng G, Zhu W, Lam W. Miniaturised percutaneous nephrolithotomy: Its role in the treatment of urolithiasis and our experience. Asian J Urol. 2018;5:295-302.
[5] Tzelves L, Türk C, Skolarikos A. European Association of Urology Urolithiasis guidelines: Where are we going? Eur Urol Focus. 2021;7(1):34-38.
[6] Jackman SV, Hedican SP, Peters CA, Docimo SG. Percutaneous nephrolithotomy in infants and preschool-age children: Experience with a new technique. Urology. 1998;52(4):697-701.
[7] Sabler IM, Katafigiotis I, Gofrit ON, Duvdevani M. Present indications and techniques of percutaneous nephrolithotomy: What the future holds? Asian J Urol. 2018;5:287-94.
[8] Ferakis N, Stavropoulos M. Mini percutaneous nephrolithotomy in the treatment of renal and upper ureteral stones: Lessons learned from a review of the literature. Urol Ann. 2015;7:141-48.
[9] Li X, He Z, Wu K, Li SK, Zeng G, Yuan J, et al. Chinese minimally invasive percutaneous nephrolithotomy: The Guangzhou experience. J Endourol. 2009;23(10):1693-97.
[10] Chan DY, Jarrett TW. Techniques in endourology Mini-percutaneous nephrolithotomy. J Endourol. 2000;14(3):269-73.
[11] Thapa B, Niranjan V. Mini PCNL over standard PCNL: What makes it better? Surgery J. 2020;6(1):e19-e23.
[12] Desai J, Solanki R. Ultra-mini percutaneous nephrolithotomy (UMP): One more armamentarium. BJU Int. 2013;112(7):1046-49.
[13] Matlaga BR. Contemporary surgical management of upper urinary tract calculi. J Urol. 2009;181(5):2152-56.
[14] Lojanapiwat B. Infective complication following percutaneous nephrolithotomy. Urol Sci. 2016;27(1):08-12.
[15] Qaoud Y, al Tali M, Boland F, Simpson A, Davis N. Comparative evaluation of urolithiasis management options in patients with horseshoe kidney: A systematic review and meta-analysis. Curr Urol. 2023;17:193-205.
[16] Bozzini G, Aydogan TB, Müller A, Sighinolfi MC, Besana U, Calori A, et al. A comparison among PCNL, Miniperc and Ultraminiperc for lower calyceal stones between 1 and 2 cm: A prospective, comparative, multicenter and randomised study. BMC Urol. 2020;20(1):67.
[17] Adamou C, Goulimi E, Pagonis K, Peteinaris A, Tsaturyan A, Vagionis A, et al. Comparison between standard, mini and ultra-mini percutaneous nephrolithotomy for single renal stones: A prospective study. World J Urol. 2022;40(10):2543-48.
[18] Sabnis RB, Ganesamoni R, Doshi A, Ganpule AP, Jagtap J, Desai MR. Micropercutaneous nephrolithotomy (microperc) vs retrograde intrarenal surgery for the management of small renal calculi: A randomized controlled trial. BJU Int. 2013;112(3):355-61.
[19] Mishra S, Sharma R, Garg C, Kurien A, Sabnis R, 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):896-900.
[20] Alam Khan A, Malkani I, Jameel Khattak J, Mumtaz H, Mazhar M, Naz F, et al. Comparison of standard percutaneous nephrolithotomy with mini-percutaneous nephrolithotomy for removal of renal stones in adults. J Ren Hepatic Disord. 2021;5(2):20-25.
[21] Sebaey A, Khalil MM, Soliman T, Mohey A, Elshaer W, Kandil W, et al. Standard versus tubeless mini-percutaneous nephrolithotomy: A randomised controlled trial. Arab J Urol. 2016;14(1):18-23.
[22] Haghighi R, Zeraati H, Ghorban Zade M. Ultra-mini-percutaneous nephrolithotomy (PCNL) versus standard PCNL: A randomised clinical trial. Arab J Urol. 2017;15(4):294-98.
[23] ElSheemy MS, Elmarakbi AA, Hytham M, Ibrahim H, Khadgi S, Al-Kandari AM. Mini vs standard percutaneous nephrolithotomy for renal stones: A comparative study. Urolithiasis. 2019;47(2):207-14.
[24] Jones P, Bennett G, Aboumarzouk OM, Griffin S, Somani BK. Role of minimally invasive percutaneous nephrolithotomy techniques—micro and ultra-mini PCNL (<15F) in the pediatric population: A systematic review. J Endourol. 2017;31(9):816-24.
[25] Ganpule AP, Bhattu AS, Desai M. PCNL in the twenty-first century: Role of Microperc, Miniperc, and Ultraminiperc. World J Urol. 2015;33(2):235-40.
[26] Gao X, Wang W, Peng L, Di X, Xiao K, Chen J, et al. Comparison of micro-percutaneous and mini-percutaneous nephrolithotomy in the treatment of renal stones: A systematic review and meta-analysis. Front Surg. 2021;8:743017.

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