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ORIGINAL ARTICLE

Comparison of Mini Percutaneous Nephrolithotomy and Standard Percutaneous Nephrolithotomy in the Management of Renal Stones of more than 2CM

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ABSTRACT

Objective: In patients with kidney stones larger than 2 cm, it is intended to evaluate the effectiveness and safety of small percutaneous nephrolithotomy (mini-PCNL) with conventional percutaneous nephrolithotomy (standard-PCNL).

Study Design: Retrospective study

Place and Duration: Institute of Kidney Diseases, Hayat Abad Medical Complex, Peshawar, 1st July 2019 - 30th June 2021.

Methods: Therewere 170 patients of both genders were presented. All the presented patients had renal stones >2cm were admitted for surgery. Detailed demographics of enrolled cases included age,sex, BMI and comorbidities were recorded after taking informed written consent.Patients were equally divided in two groups. Group I received mini percutaneous nephrolithotomy (mini-PCNL) among 85 patients had renal stone size 2-3cm and 85 patients of group II had renal stone >3cm received standard percutaneous nephrolithotomy (standard-PCNL). Post-operative outcomes among both groups were assessed in terms of Stone-free rate (SFR). SPSS 23.0 was used to analyze all data.

Results: Among 170 included cases, 114 (67.1%) patients were males and 56 (32.9%) cases were females. We found that 45 (26.5%) patients had age 20-30 years, 50 (29.4%) patients had age 31-40 years and 75 (44.1%) patients had age >40years. Majority of the patients 130 (76.5%) had BMI <25kg/m^2 and 40 (23.5%) had BMI >25kg/m^2. Comorbidities were hypertension and diabetes mellitus. We found that operative time of group II was lower 40.7±10.9 minutesas compared to group I 52.4±8.13 minutes while hospitalization, blood transfusion and hemoglobin drops were lower in group I as compared to group II. We found that SFR was higher in group I among 80 (94.1%) cases as compared to group II 78 (91.8%) but difference was insignificant. Most common complications were fever, hematuria and urosepsis but their frequency was higher in group I.

Conclusion: Mini-PCNL was an efficient and trustworthy substitute for standard-PCNL in the treatment of renal stones larger than 2 cm (30F). Although there is less blood loss, a lower transfusion rate, and a shorter hospital stay than with standard-PCNL, it nevertheless achieves a similar SFR. The 24F standard-PCNL clearly outperforms the mini-PCNL, but not by much. This method, however, requires more time to complete.

INTRODUCTION

One of the most frequent urological issues in the world is still renal stones [1]. There is ongoing debate on the best way to treat lower calyceal renal calculi under 2 cm. For a very long period, lower calyceal stone removal with shockwave lithotripsy (SWL) was thought to be the best option. The majority of recent investigations, however, have found that the stone-free rates (SFRs) for SWL for lower calyceal stones vary between 37% and 68% [2,3]. The stone's composition, the patient's body habitus, which may reduce SWL's effectiveness and raise the rate of re-treatment, and the lower calyceal angle, which allows for the clearance of the procedure's residuals, all affect how well SWL works.

Percutaneous nephrolithotomy is one of the other alternatives (PCNL). The primary drawback of the conventional PCNL was the necessity of using a large sheath (32 F), which might lead to problems such bleeding, damage to nearby organs, postoperative discomfort, a protracted hospital stay, and urinary fistulas. However, the advent of the mini-PCNL concept and the ability to fracture the stones without the need of a postoperative nephrostomy tube (i.e. tubeless) have significantly reduced these problems [4].

The combination of flexible ureteroscopy and laser lithotripsy, commonly known as retrograde intrarenal surgery (RIRS), is increasingly regarded as a therapy option since, when compared to SWL, it has a higher SFR [5]. There are benefits and drawbacks to each approach [6].

Despite having higher surgical risks than RIRS, PCNL could achieve a better SFR. With a tract size of 11–14 F, Janak Desai created the Ultra-mini percutaneous nephrolithotomy (UMP) in 2013 to lower the possibility of problems [7]. The effectiveness of the operation declines as the percutaneous tract gets narrower, and the intrarenal pressure may rise excessively while the surgery is being done. As a result, kidney stones less than 2 cm have reportedly been the greatest marker of UMP [8].We have previously described a modified UMP approach in which the procedure was carried out while the patient was semi-supine and in a combined lithotomy posture, with the ureter access sheath (UAS) present to improve perfusion while preserving low intrapelvic pressure. We have shown that this approach may be utilized to safely treat renal calculi under 3.0 cm, obtaining 90.9% primary stone clearance rate and 100% SFR following auxiliary therapy [9].

Can mini-PCNL, which is more minimally invasive, be utilized as an alternative to standard-PCNL in the treatment of renal stones larger than 2 cm in diameter since extracorporeal shock wave lithotripsy (ESWL) and retrograde intrarenal surgery (RIRS) don't appear to be as effective as PCNL in this area? Scholars [10,11] have thoroughly compared percutaneous nephrolithotripsy with various tract diameters.However, the included evidence's quality was subpar, necessitating the need for additional trustworthy data from randomized controlled trial (RCT) investigations. Additionally, no meta-analysis was performed in individuals with significant kidney stone loads to compare standard-PCNL with mini-PCNL. Therefore, the comparison of surgical techniques for renal stones larger than 2 cm is the main emphasis of this study. Updated RCT studies from the last few years were also included, including several excellent big multicenter RCT studies like Zeng et al. [12].

For renal stones larger than 2 cm, the effectiveness and safety of the two surgical techniques were evaluated, and subgroup analyses were carried out to generate a more practical suggestion for clinical practice.

MATERIAL AND METHODS

This retrospective study was conducted at Institute of Kidney Diseases, Hayat Abad Medical Complex, Peshawar, 1st July 2019 - 30th June 2021. and comprised of 170 patients with renal stones. Detailed demographics of enrolled cases included age, sex, BMI and comorbidities were recorded after taking informed written consent. Patients who had renal cancer, an ectopic kidney, a transplanted kidney stone, a spongy kidney, polycystic kidneys, or uncontrolled pyonephrosis were excluded.

Included patients had age 20-75 years with renal stone >2cm.All patients who were included underwent extensive evaluations that included a medical history review, physical examination, routine blood and urine testing, urine culture, blood biochemistry analysis, and other lab procedures. Urinary system CT testing and intravenous urography (IVU) were done. CT plain scan and IVU were used to diagnose LPSs. The stone's long axis provided a measurement of its size. The occurrence of hydronephrosis was assessed by ultrasonography.Patients were equally divided in two groups. Group I received mini percutaneous nephrolithotomy (mini-PCNL) among 85 patients and 85 patients of group II received standard percutaneous nephrolithotomy (standard-PCNL). Post-operative outcomes among both groups were assessed in terms of Stone-free rate (SFR). SPSS 23.0 was used to analyze all data.

RESULTS

Among 170 included cases, 114 (67.1%) patients were males and 56 (32.9%) cases were females.Majority of the patients 130 (76.5%) had BMI <25kg/m^2 and 40 (23.5%) had BMI >25kg/m^2. Comorbidities were hypertension and diabetes mellitus. Left side was the commonest side of stone.Mean length of stone was 2.31±1.9 cm and mean volume was 5.2 ±6.7 cm^3.(table 1)

Table-1: Included patients with demographics

Variables	Frequency	Percentage
Gender		
Male	114	67.1
Female	56	32.9
BMI		
<25kg/m^2	130	76.5
>25kg/m^2	40	23.5
Comorbidities		
HTN	34	20
DM	23	13.5
None	113	66.5
Mean length of stone (cm)	2.31±1.9	
Mean Volume of stone (cm^3)	5.2 ±6.7	
Side of Stone		
Left	107	62.9
Right	63	37.1

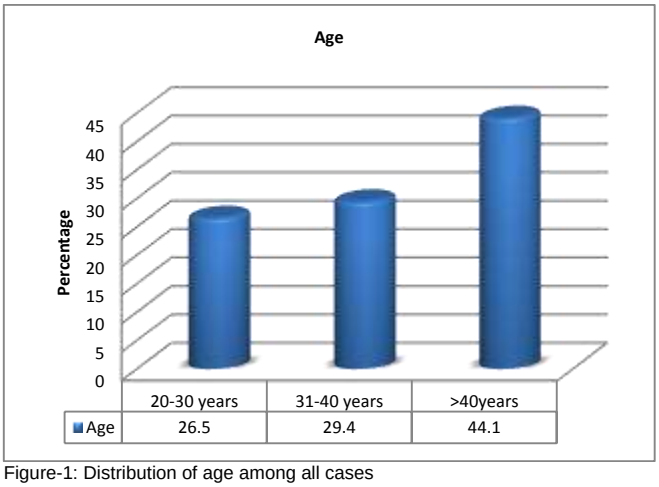

Figure-1: Distribution of age among all cases

We found that 45 (26.5%) patients had age 20-30 years, 50 (29.4%) patients had age 31-40 years and 75 (44.1%) patients had age >40years.(figure 1)

We found that operative time of group II was lower 40.7±10.9 minutes as compared to group I 52.4±8.13 minutes while hospitalization, blood transfusion and hemoglobin drops were lower in group I as compared to group II. (table 2)

Table-2: Outcomes among both groups

Variables	Group I	Group II
Mean operative time (min)	52.4±8.13	40.7±10.9
Mean hospitalization (days)	1.5±2.26	3.12±8.53
Mean blood transfusion	4.3±1.7	6.4±3.15
Mean Hb drops (g/L)	13.7±13.20	16.41±10.82

We found that SFR was higher in group I among 80 (94.1%) cases as compared to group II 78 (91.8%) but difference was insignificant.(table 3)

Table-3: Comparison of SFR among both groups

Variables	Frequency	Percentage
SFR		
Yes	80 (94.1%)	78 (91.8%)
No	5 (5.9%)	7 (8.2%)

Most common complications were fever, hematuria and urosepsis but their frequency was higher in group I.(figure 2)

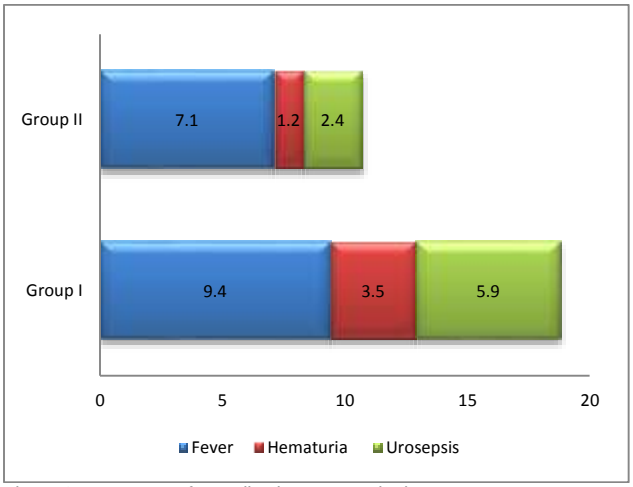

Figure-2: Frequency of complications among both groups

DISCUSSION

Renal stone therapy using Mini-PCNL seems to be becoming more and more common. It is still up for question whether it can be more effective and safe than standard-PCNL, nevertheless, across the globe [13]. According to a research by Deng et al. [14], adults with kidney stones less than 2 cm had a considerably greater SFR following standard-PCNL than following mini-PCNL, but those with kidney stones larger than 2 cm had no statistically significant difference between the two treatments. Both in their investigation and the available literature, no other outcome was examined in relation to stone size [14]. Therefore, it is crucial to evaluate the two techniques' safety and effectiveness in these particular situations of renal stones larger than 2 cm. To guarantee the validity of the results, only RCTs were included, particularly the research by Zeng et al., which is extremely important [15]. Most experts agree that the standard-PCNL tract size is 24F–30F and the mini–PCNL tract length is 14F–22F [16].

In our study 170 patients with renal stones were presented. Among 170 included cases, 114 (67.1%) patients were males and 56 (32.9%) cases were females. Majority of the patients 130 (76.5%) had BMI <25kg/m^2 and 40 (23.5%) had BMI >25kg/m^2.

Comorbidities were hypertension and diabetes mellitus. Left side was the commonest side of stone. Mean length of stone was 2.31±1.9 cm and mean volume was 5.2 ±6.7 cm^3. These findings were comparable to the previous researches.[17,18] We found that 45 (26.5%) patients had age 20-30 years, 50 (29.4%) patients had age 31-40 years and 75 (44.1%) patients had age >40years.[16-18] The SFR attained by mini-PCNL in the current study was higher than that by standard-PCNL, despite the fact that the SFR in both experiments was defined slightly differently. This outcome was consistent with that of Zhu et al. [19]. Notably, contrary in the evaluations by Deng et al. [14], where the former had a greater SFR, no discernible variations in SFR between the 30F subgroup and the mini-PCNL group were detected. This demonstrates that mini-PCNL has not performed worse than standard-PCNL in one session of SFR. Furthermore, Cheng et alstudy .'s showed that in patients with several calyceal stones, mini-PCNL even produced a superior SFR than standard-PCNL. The use of a narrower ureteroscope, which enables us to more readily access various calyces, may contribute to this [20].

In a study by Lee et al. [21] comparing mini-PCNL and RIRS for the treatment of patients with renal stones larger than 1.0 cm, the researchers found that both procedures are equally safe and efficient, with an SFR following a single session at 12 weeks of follow-up of 85.7% in the mini-PCNL group and 97.0% in the RIRS group (P = 0.199). There were two significant discrepancies in the research comparing these two techniques: the first was the size of the initial stone under study, and the second was the way in which success was defined.Our results of UMP shown more effectiveness when compared to the other research by Wilhelm K et al. [22] concentrating on UMP and RIRS for 10-35 mm renal calculi. Our updated approach could be to blame for this.

The findings of this meta-analysis show that 24F standard-PCNL has a similar SFR to mini-PCNL, similar blood loss, and a shorter operating time than mini-PCNL. As it seems to increase safety without reducing efficacy, 24F standard-PCNL is a preferable option for the treatment of kidney stones larger than 2 cm. In fact, the 24F PCNL is becoming more and more popular among urologists worldwide since it may significantly lessen the difficulties brought on by the big tract. Mini-PCNL (24F) is fortunately improving quickly to attain increased efficacy while maintaining the advantages of mini-PCNL in terms of safety [23,24]. Over time, smaller tract diameters, greater effectiveness, and reduced complication rates will undoubtedly be attained.

CONCLUSION

Mini-PCNL was an efficient and trustworthy substitute for standard-PCNL in the treatment of renal stones larger than 2 cm (30F). Although there is less blood loss, a lower transfusion rate, and a shorter hospital stay than with standard-PCNL, it nevertheless achieves a similar SFR. The 24F standard-PCNL clearly outperforms the mini-PCNL, but not by much. This method, however, requires more time to complete.

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