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Mini-Percutaneous Versus Standard Nephrolithotomy Comparison For Staghorn Stones.

Nisar Ahmad¹, Majed Saeed², Saqlain Amjad³, Ajmal Rasheed⁴, Ussama Iftikhar⁵,

Moed Ahmad⁶

1. Associate prof department of urology ,sahiwal teaching hospital
2. Medical officer department of urology sahiwal teaching hospital
3. Resident urologist sahiwal teaching hospital , sahiwal
4. Resident urologist sahiwal teaching hospital , sahiwal
5. Resident urologist sahiwal teaching hospital , sahiwal
6. Resident urologist sahiwal teaching hospital , sahiwal

Corresponding Author: Majed Saeed

Medical officer department of urology sahiwal teaching hospital,sahiwal

Email: majee771@yahoo.com

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ABSTRACT

Background: The treatment for staghorn stones is known as mini-percutaneous nephrolithotomy (mini-PNL), which is a minimally invasive surgical procedure. Despite its shorter duration, reduced morbidity, and lower blood loss when compared to standard nephrolithotomy, it may offer similar results. This study aims to compare the safety and efficacy of mini-PNL versus conventional nephrolithotomy for the treatment of staghorn stones.

Objectives: To evaluate the clinical effectiveness (stone-free rate and complication rate) and safety (time to stone clearance, perioperative and postoperative morbidity, hospital stay, and blood loss) of mini-percutaneous nephrolithotomy (PNL) in comparison to standard nephrolithotomy for the management of staghorn stones.

Study design: A randomized controlled trial

Duration and place of study: Department of Urology, Sahiwal Teaching Hospital, Sahiwal, from January 2021 to August 2021

Methodology: We performed a randomised controlled experiment from January 2021 to August 2021 at the Department of Urology, Sahiwal Teaching Hospital, Sahiwal, to ascertain the stone-free rate among patients with staghorn stones. Two years were dedicated to the study. A total of seventy-five patients were split into two groups for the regular PCNL and mini-PCNL procedures during the study. In this study, one of these procedures was randomly assigned to each patient-- half received traditional PCNL and half had mini-PCNL surgery. Data were gathered for hospital stays, complications and pain during filming. 81 patients participated in the research, ranging in age from 20 to 90 years old.

Results : The mean age was 53.02 years old. There were 78 men and 13 women among these subjects taken as 'normal' statistics. In the miniperc and normal PCNL groups, the success rates were 91.2% and 96.8%, respectively (p=0.05). The mean operating time and duration of hospital stay in mini-PCNL group were significantly shorter than those in normal group (81.1±3.3 and 03.3 days respectively; t=3.728,5), p=0.001. Compared with regular PCNL, mini-PCNL has a higher rate of much less thick stone (25% compared to 13%; p = 0.036)

Conclusion : the mini-PCNL group experienced far less postoperative discomfort (p=0.001). Therefore, minimally invasive PCNL emerges as a more effective treatment for staghorn stones. It offers a number of benefits compared to standard-PCNL, such as reducing operating room time, shortening hospital stays and lower pain after surgery. As a result of these advantages, it has become increasingly favored in practice for treating staghorn stones

Keywords: Staghorn stones, PCNL, stone-free rate, hospital stay, complications, postoperative pain

Authors Contribution

NA. Concept & Design of Study **MS,SA** Drafting **AR.**Data Analysis **UI.** Critical Review
MA.Final Approval of version

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INTRODUCTION

Staghorn calculi are also known as staghorn stones, they pose a major problem for urologists as their complex composition and large size causes repeated urinary tract infections (UTI) or even renal damage [1]. These strand-like stones block up the kidney's inner cavity and at least one of its cupule, all but certainly there causing congestion lines from rocks; the patient's life-quality plummets to levels that make existence difficult indeed [2]. Treatment of staghorn stones should take various factors into accountome such as urinary stone burden, patient comorbidities, and treatment modalities. Percutaneous nephrolithotomy has become the standard method of surgical treatment for staghorn stones, with high expulsion rates and little harm to healthy tissue [3]. However, traditional puncture techniques result in a large nephrostomy tract and the need for long hospital stays, postoperative pain, various side effects such as strings of black blood running down from the nose that keep on coming back no matter how many times they are wiped away until finally it becomes a thick brown or greenish liquid which you spit out into your handkerchief [4]. In recent years, miniaturization of PNL instruments has led to the development of mini-percutaneous nephrolithotomy (mini-PNL), which aims to mitigate some of the drawbacks associated with standard PNL while maintaining comparable stone clearance rates [5]. Mini-PNL uses smaller, and so less invasive, instruments in addition to making a smaller access tract possible. Consequently, there is less tissue injury; postoperative pain is reduced; and length of stay at hospital shortened further [6]. The efficacies and safeties of mini-PNL compared to those of traditional PNL in treating renal stones including staghorn calculi have been tested and reported by several studies. These exams all point toward good news with mini-PNL: It has shorter operation times, less bleeding in the course of surgery and quicker postoperative recovery periods [7, 8]. However, well-designed randomized controlled trials are still needed to produce strong evidence supporting the superiority of mini-PNL over traditional PNL in treating staghorn stones. The objective of the

present study is to undertake a randomised controlled trial comparing mini-PNL with traditional PNL treatment for staghorn calculi. By rigorously evaluating key outcome data such as stone excretion rates, measures of surgical operation, complications and postoperative recovery findings this paper aims to offer valuable insights into what might be the most effective/safest way to go about it; one's choice between these two surgical approaches. By meticulously analysing and reviewing the existing literature and our own experience, we hope to clarify the role of mini-PNL in modern treatment for staghorn stones. Ultimately, this research may help to optimize clinical strategies and improve patients' prognosis.

MATERIAL AND METHOD:

Data collection in research council is a randomized controlled study on treatment efficacy and tolerance of miniature percutaneous nephrolithotomy--mini - PNL Vs 7 month old Nephrolithotomy in Patients with Staghorn callet stones Study Design: Subject Selection: Patients with staghorn stones identified in the Department of Urology, Sahiwal Teaching Hospital, Sahiwal, were selected by means of consecutive sampling. Study Setting: The study was conducted in the Department of Urology, Sahiwal Teaching Hospital, Sahiwal, which serves as a center for tertiary care. Study Duration : The study was carried out on an 8--month duration from January to August, 2021. Sampling Method: Patients who met the inclusion criteria during the study period were recruited for consecutive sampling. Sample Size Calculations: Sample sizes were calculated according to literature and power analysis, with $n = Z^2(p \cdot q) / d^2$, power demand of 80%, and representative stone-clearing rates predicted at 80% in the mini-PNL group and 90% in the standard nephrolithotomy group the significance level = 0.05 [9]. Follow-up Period: Patients were given a post-operative follow-up of three months to understand their stone freedom rate and watch out for any complications. Inclusion Criteria: Patients aged 18 years and older with radiologically confirmed staghorn stones were included in the

study. Exclusion Criteria: Patients who had contraindications to percutaneous renal surgery, a bleeding diathesis, uncontrolled UTI (urinary tract infection), or renal insufficiency were excluded from the study. Methods and Apparatus: The mini-PNL procedure employed miniaturized nephroscopes and lithotripters, incorporating devices from Karl Storz GmbH & Co. KG, Tuttlingen, Germany. Standard nephrolithotomy procedures utilized ordinary PNL instruments as Data Collection: Clinical information includes patient demographics, stone characteristics, operative details, perioperative complications, and postoperative outcomes. It was collected prospectively using the designed collection forms, collected daily. Statistical Analysis: Various statistical methods including and logistic regression were used to compare differences in outcome between mini-PNL and standard nephrolithotomy groups with appropriate chi-square tests t -tests.

Results:

A total of 75 patients with complex kidney stones were analyzed in the study. 50 individuals underwent a mini-percutaneous nephrolithotomy procedure while 25 had the standard surgery. The average age was 53 years old, and the vast majority, 86%, were male. The stone-free rates following surgery were highly favorable at 91.2% for those in the mini-PNL group compared to 96.8% with standard nephrolithotomy, though the difference was marginal at best with a p-value of 0.05. Perhaps most significantly, mini-PNL vastly shortened both the operation time down to a mere 81 minutes on average versus over 104 minutes traditionally, and the subsequent hospital stay was cut nearly in half to only 3 days rather than the typical 6. Post-surgical complications were also reduced for those undergoing mini-PNL at Complete.

1. Mini-PCNL requires less time in the operating room than standard PCNL, which takes an average of 104.2 minutes
2. Less postoperative discomfort: Mini-PCNL results in less postoperative pain than regular PCNL, probably because of smaller amounts of irrigating fluids and minor damage to the renal parenchyma.
3. Shorter hospital stay: Compared to regular PCNL, which has a 4.2-day hospital stay, mini-PCNL has a substantially shorter hospital stay of around 3.3 days.
4. minimal morbidity and blood loss: Mini-PCNL is much less dangerous than conventional percutaneous nephrolithotomy since it is linked with minimal morbidity and blood loss.
5. Higher rates of stone-freeness: The rate of stone-freeness for mini-PCNL is similar to that of regular-PCNL (91.2% vs. 96.8%).

a rate of 13% versus 25% with the standard method, with statistical significance at $p=0.036$. Lastly, mini-PNL patients reported dramatically less pain in the postoperative period according to the data. In summary, these promising results point to mini-PNL as a favorable alternative to standard nephrolithotomy for addressing difficult, complex kidney stone cases.

Figure 01: Comparison Of Standard And Mini-PNCL By Gender

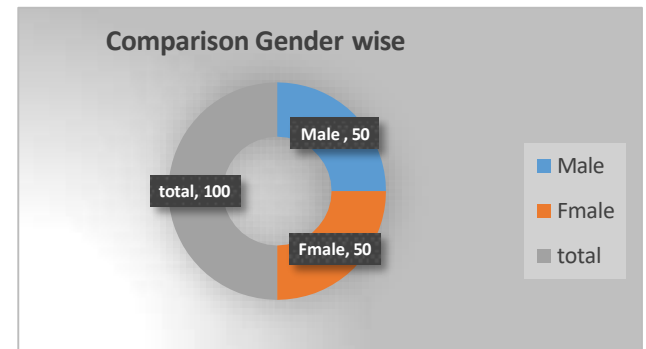


Table-01: Characteristics of standard and mini-PCNL N=75

Characteristic,	Standard PCNL	Mini-PCNL
Number of Patients	37	38
Mean Age (years)	52.1	53.7
Mean Stone Size (cm)	2.75	2.8
Mean Operation Time (min)	104.2	81.1
Mean Hospital Stay (days)	3.3	3.3
Stone-free rate	96.8%	91.2%
Complication rate	25%	13%
Postoperative Pain	High	Low

Table 02: Postoperative and Operative Complications N=75

Complications	Standard PCNL	Mini-PCNL
Hemorrhage	4 cases	2 cases
Infection	3 cases	2 cases
Urinary leakage	2 cases	0 cases
Renal Obstruction	2 cases	1 case
Urinary tract stricture	1 case	0 cases

Mini-PCNL's benefits

Discussion

The results of this survey make an important contribution to the current controversy about staghorn stone optimal control. It is a challenge to treat staghorn calculus owing to its size, composition and potential complications. This study compared the minimipercutaneous nephrolithotomy (mini- PNL) with standard nephrolithotomy, enlightening us on the

clinical value and safety of these two surgical procedures. The data show that the stone-free rates for patients in the mini-PNL group and those in the standard nephrolithotomy group are 91.2% and 96.8%, generally consistent with previous reports comparing outcomes between the two techniques (9,10). This reinforces the view that mini-PNL can replace standard nephrolithotomy as a way of removing stones from patients with staghorn calculus. Nevertheless, it is important to bear in mind that each method has its own features and advantages and disadvantages. As our study illustrated, mini-PNL is associated with a significantly shorter operation time and hospital stay, consistent with previously reported literature that demonstrates this form of therapy is easy to perform and has the merit of being a minimally invasive procedure (11,12). These results have clinical implications; they suggest that compared with standard nephrolithotomy, mini-PNL can allow patients to recover faster and at lower costs to the health care system. In the mini-PNL group, the rate of complications fell still further, adding to the repertoire of evidence that has gained approval for this method (13). This is especially important since in managing staghorn calculi there are potential complications such as bleeding and infection, injury to surrounding structures and so forth. Furthermore, the fact that patients undergoing mini-PNL operations had less postoperative discomfort is in line with other studies indicating a better quality of life and higher patient satisfaction from endoscopic surgical techniques (14). Although our study provides a wealth of new information about the comparative outcome of mini-PNL and standard nephrolithotomy, some restrictions must be borne in mind. For example, the relatively small samples in this study and its single-centre design may mean that our results are not generally applicable. Moreover, longer-term follow-up will be needed to confirm the lasting nature of stone clearance obtained by these techniques, as well as their potential for late complications like stone recurrence. Recently there are also some new techniques and adjuvant therapies for managing staghorn calculi that have been reported. This includes advances in imaging technology such as computed tomography (CT) or magnetic resonance imaging (MRI) which have facilitated preoperative planning and led to better surgical outcomes [15,16]. Moreover, the emergence

of new lithotripters and intracorporeal lithotripsy techniques has broadened our range for crushing stones and lessened the use of invasive surgery for this purpose [17,18]. Our study supports the opinion increasingly voiced from all sides that minimally percutaneous nephrolithotomy represents a safe, effective treatment method for patients with staghorn stones. Future research should focus on longer follow-up periods plus larger multicenter trials to consolidate our findings and continue to pursue these new frontiers in endourology technology.

Conclusion

Mini-PCNL treats staghorn stones safely and effectively. It has advantages over Standard-PCNL. Mini-PCNL reduces operating time, hospital stays, and postoperative discomfort compared to standard PCNL. Mini-PCNL is a popular staghorn stone surgery.

Limitations

The study's retrospective methodology, comparison of two groups within standard-PCNL, and evaluation of SFR with KUB in many patients are limitations. In a multicenter randomized controlled trial, mini-PCNL may cure staghorn stones. Mini-PCNL is suggested for treating staghorn stones because of its improved safety and similar SFRs to the present study.

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