

Breaking the Odds: Comparison of safety and effectiveness of single session versus two sessions Percutaneous Nephrolithotomy in bilateral Renal Stones

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Abstract:

Objective: Assess the efficacy and safety of a single-session and two-session (bilateral) PCNL treatments for the adult patients at our center.

Material and Methods: The research followed a prospective cohort design and was carried out at the Division of Urology, Kidney Hospital and Institute, Peshawar from January 2024 to December 2024. The study included adult patients with bilateral renal stones and planned PCNL. A sample of 50 patients who attended PCNL were selected based on the inclusion and exclusion criteria for the study. The sample was calculated by the WHO sample size calculator as mentioned in the introduction. The sample population was obtained through non-probability convenience sampling. The results were processed through SPSS version 23.

Results: Given that Group A was 34.6 (± 8.81) years old and Group B was 33.3 (± 8.59) years old (p -value = 0.60), there were no discernible differences in the two groups' mean ages. The distribution of stone did not differ statistically significantly (20.64 ± 3.20 mm and 20.68 ± 3.07 mm) Group A and B, respectively, ($p=0.90$). Additionally, Guy's score distribution showed no discernible variations ($p=0.08$). 23 out of 25 cases in Group A (92%) and 24 out of 25 cases in Group B (96%) had stone clearance ($p=0.55$). Similarly, two cases (8%) in Group A and one case (4%), with a p -value of 0.55, experienced problems. Additionally, a statistically significant difference was observed between the two groups in terms of hospital stays and operating time.

Conclusions: From the conducted research, we found that there is a safety and efficacy difference when it comes to single session PCNL and dual session PCNL with the conclusion being that performing bilateral PCNL in a single-session yields equally effective and safe outcomes for patients with bilateral renal stones.

Keywords: PCNL, Urolithiasis, Endourology, Stone free rate, Guys score

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Introduction:

Urolithiasis is a very prevalent condition worldwide being the most common in North America, then Europe and least in Asia. Its incidence is increasing globally day by day. Within the first several years following the initial stone event, its recurrence rate is estimated to be roughly 50%. Urolithiasis is poly genetic disorder and runs in families with strong association with environmental hazard and climate change. Symptomatic kidney stones management has evolved with increasing medical and technological advance-

ments from open surgical lithotomy to minimally invasive procedures that have significantly reduced patients' morbidity and improved their quality of life.¹

Due to their high stone-free rates, "ureteroscopy (URS)" and "percutaneous nephrolithotomy (PCNL)" have become viable therapeutic techniques for ureteral and renal stones in addition to medical therapy and "extracorporeal shock wave lithotripsy (ESWL)" for smaller stones.²

PCNL is reported to have high stone clearance

rates thus leaving the patients asymptomatic. A retrospective study was done which concluded that the pain associates with kidney stones was significantly reduced after PCNL.³ For kidney stone patients over 70, PCNL is a safe and efficient treatment choice, according to another retrospective study.⁴

There is primordial Law from 20th century known as “Cabit’s Law” in books. This law guided the approach to management of bilateral kidney stones when modern endoscopic procedures were not available. The key principles of law states that in case of bilateral renal stones, prioritize the treatment of kidney with better function, address the more symptomatic and obstructed kidney first because stich in time saves nine.

The complications and renal function outcomes of bilateral simultaneous PCNL and staged PCNL were examined in a retrospective research. According to the findings, bilateral simultaneous PCNL is safe, it has a greater need for blood transfusions and a lower rate of complete stone extraction compared to the staged method. Another study analyzing these techniques for bilateral renal stones found no statistically significant difference in achieving complete stone removal, blood loss per procedure, or the need for blood transfusions. There are, however, additional benefits associated with single-session PCNL such as shorter duration of surgery, decreased duration of hospitalization, reduced blood loss, and only requiring a single dose of anesthesia, which makes it suited for certain patients.⁶

In this study, participants at our center underwent two sessions of bilateral PCNL to compare its safety and effectiveness.

Material and Methods:

Study design and setting: The period from January 2024 to December 2024 was the time frame for this potential cohort study, which was conducted at the Department of Urology, Institute of Kidney Disease, Peshawar.

Examine the Population and Sampling Technique

Patients with bilateral renal stones who were scheduled for percutaneous nephrolithotomy (PCNL) made up the study’s population. As stated in one of the references in the introduction, the WHO calculator was used to determine the sample size, which comprised 50 patients who may be included in the study. A combination of non-probability convenience sampling followed by assignment of patients into two equal groups based on predefined clinical parameters, surgeon preference, or patient suitability for each procedure. There was no randomization involved.

- Group A: 25 patients underwent bilateral single-session PCNL.
- Group B: 25 patients underwent staged PCNL.

Inclusion criteria was the Patients with bilateral renal stones measuring 1.5 to 2.5cm that were confirmed by imaging tests such as non-contrast computed tomography (NCCT) and who were 18 years of age or older and scheduled for PCNL as the primary treatment were included. Exclusion criteria was those with congenital urinary tract abnormalities like crossed renal ectopia or bleeding disorders were excluded.

Ethical Approval and data collection: The Institute of Kidney Disease, Peshawar’s “Institutional Review and Ethics Board (IREB)” gave the study ethical approval. Written informed consent was given by each participant in accordance with the Helsinki Declaration.

Each patient underwent a detailed medical history review, physical examination, and necessary investigations before surgery. If the surgeon decided to modify the planned procedure, such cases were excluded, and new eligible patients were recruited.

All pre-operative, intra-operative, and post-operative details were systematically recorded on a pre-validated proforma, which had been tested on 30% of the study population to ensure data

Table 1: Parameters compared between bilateral single session vs staged bilateral PCNL

S. No.	Parameter	Group A	Group B	p-value
1.	Mean Age (in years ± S.D.)	34.6 ± 8.81 years	33.3 ± 8.59 years	0.60
2.	Mean stone size (in mm)	20.64 ± 3.20 mm	20.68 ± 3.07	0.91
3.	Guys score	Patient count	Patient count	
	Grade 1	12 (48%)	18 (72%)	0.08
	Grade 2	13 (52%)	7 (28%)	
4.	Surgery time (in minutes)	57.56 ± 5.11 min	67.24 ± 4.85 min	0.01
5.	Hospital stays (in days)	3.12 ± 1.5 days	4.16 ± 1.24 days	0.01
6.	Stone clearance	23 cases (92%)	24 cases (96%)	0.55
7.	Complications	2 cases (8%)	1 case (4%)	0.55

Effectiveness: Effectiveness was evaluated by assessing the stone-free rate at 28 days on NCCT postoperatively after a single session and two sessions of PCNL.

Statistical Interpretation: Data analysis was done using SPSS version 23. The chi-square test was applied to safety and effectiveness outcomes, which are categorical variables. When required, Fisher’s exact test was used. The length of hospital stay, stone size, and operating time were all continuous variables that were compared using independent t-tests. Statistical significance was defined as a p-value of less than.05.

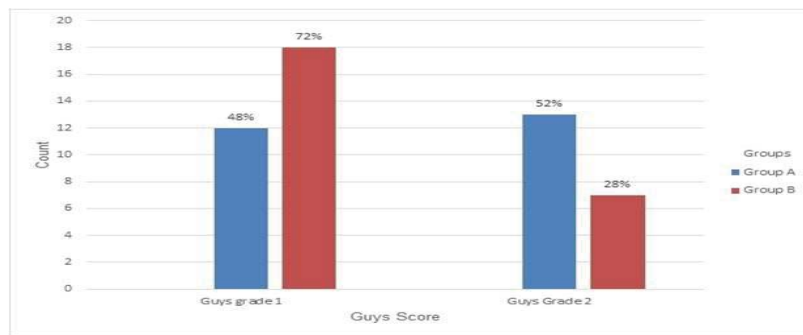


Figure 1: Graphical presentation of Guys Score distribution in both the groups

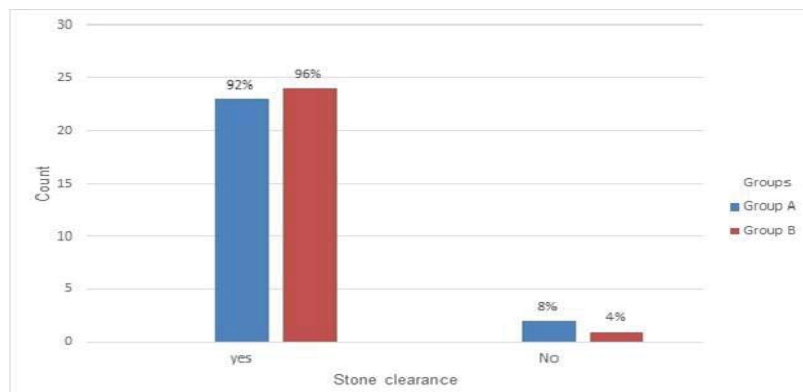


Figure 2: Stone clearance rates in both the groups

Results:

Both groups showed no difference with respect to Group A having a mean age of 34.6± 8.81 years while Group B was 33.3±8.59 years (p=0.60). Equally, the distribution of stone size was similar in both groups with Group A measuring 20.64±3.20 mm and Group B measuring 20.68±3.07 mm (p=0.90). The Guy’s score distribution did not reveal any significant difference as well (p=0.08).

The primary outcomes of the study, which included stone clearance, was successful in 23 out of 25 patients (92%) in Group A and 24 out of 25 patients (96%) in Group B, with no significant difference noted (p=0.55). Complication rates were also comparable occurring in 2 cases (8%) in Group A and 1 case (4%) in Group B (p=0.55).

There was a statistically significant difference in both groups regarding the operative time. Operative time was defined as the interval between renal puncture and the placing of the nephrostomy drain. For evaluating group B, total operative time was calculated by summing the time for both sessions. While the mean operative time for Group A was significantly lower as they took 57.56±5.11 minutes compared to Group B who took 67.24±4.85 minutes with a p value of 0.01. In addition, hospital stay was also significantly different between the groups.

Like with operative time, for Group B, we cal-

accuracy. SPSS version 23 was used for data analysis.

Study variables and outcome measures:

Safety: Safety was assessed based on the occurrence of any unplanned blood transfusion, sepsis requiring prolonged hospitalization (more than a week), or secondary hematuria necessitating unplanned admission or surgical intervention.

culated total hospital stay by summing the time for both sessions. Hospital stay for Group A was significantly lower than for Group B ($p=0.01$). The results are elaborated in detail in Table 1 and have been depicted graphically into figures 1,2 and 3 below.

Discussion:

Renal stone disease affects people globally.⁸ According to the rules The only effective treatment for kidney stones bigger than 20 mm in diameter is PCNL.⁹

Based on our research, the most noted results of PCNL performed was complete stone clearance. In Group A (single-session bilateral PCNL), the clearance rate was 92% and in Group B (staged bilateral PCNL), it was 96%. Both approaches appear effective in managing bilateral renal stones. Likewise, an investigation conducted by Ari D. Silverstein et al. documented similar results with stone clearance being accomplished in 40% of patients with synchronous PCNL and 36% of patients with asynchronous PCNL.¹⁰

Another key finding of our study was the mean operative time from puncture to nephrostomy tube placement. In Group A, it was 57.56 ± 5.11 minutes, while in Group B, it was 67.24 ± 4.85 minutes. These findings suggest that the staged bilateral PCNL group (Group B) had a longer operating time. Similarly, another study by Aditya Bagrodia et al. reported a shorter cumulative anesthesia time in synchronous bilateral PCNL.¹¹

Our study also revealed that complications occurred in two cases in Group A (single-session bilateral PCNL) and in only one case in Group B (staged bilateral PCNL), a difference that was not statistically significant. Similarly, a study by Mohammed S. ElSheemy et al. found that complication rates were nearly identical between single-session and staged mini-PCNL.¹² A study reported a complication rate of 6%, a stone free rates of 95% and mean hospital stay of 3 days in standard PCNL,¹³ which is somewhat consistent with the findings in this study.

One more finding of note was related to the length of time spent in the hospital which was considerably smaller for Group A. The average hospital stay for Group A was 3.12 ± 1.5 days, while the average hospital stay for Group B was 4.16 ± 1.24 days. According to Xiaochuan Wang et al., single-session bilateral PCNL was also demonstrated to have a shorter hospital stay and operational time in the juvenile population.¹⁴

In the context of the research we have conducted, we emphasize that bilateral PCNL can be performed in a single session without compromising safety when compared to staged PCNL, while enjoying the benefit of improved hospital stay and recovery time. Additionally, it is more cost-effective, as it requires fewer disposable instruments and reduces the need for repeated laboratory and radiological investigations. Since all necessary pre-operative and post-operative assessments are conducted in a single session, duplication of investigations is avoided.¹⁵

In contrast, staged bilateral PCNL necessitates repeating the same investigations due to its two-session approach. Furthermore, single-session bilateral PCNL is associated with reduced post-operative analgesic use, particularly opioids. These advantages may encourage urologists to consider single-session bilateral PCNL as a preferred treatment approach

This limited our study as it is based off data obtained from a single center which reduces the external validity of the general outcomes. This could be improved by conducting a multicentric study. Another limitation was the small sample size; a larger sample could provide better and generalizable results. Nevertheless, the fact that a single surgeon carried out every treatment, guaranteeing uniformity in surgical technique, improved the study in spite of these drawbacks. Furthermore, the study was more consistent because both groups used a pneumatic lithoclast.

Conclusion:

After conducting this study comparing the safety and efficacy of single session PCNL and two session PCNL for bilateral renal stones we can

conclude that performing bilateral PCNL in a single session is both effective and safe.

Conflict of interest: None

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Role and contribution of authors:

Fayyaz Ullah, collected the data, references and did the initial writeup.

Liaquat Ali, critically review the article and made final changes

Abdul Haseeb, collected the data and helped in introduction writing

Ihsan Ullah, collected the references and helped in discussion writing

Nouman Ul Mulk, collected the data, references and helped in interpretation of data.

Khizer Zaman, went through the article and made final changes.

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