

COMPARISON OF UNILATERAL VS BILATERAL PCNL FOR BILATERAL RENAL STONES WHICH ONE WORTH THE MOST?

Osama Kalim Shaikh^{*1}, Shakeel Haseeb Uddin Siddique², Habibullah Muhammad Akbar³,
Muhammad Umar⁴, Syed Shariq Iqbal⁵

^{*1}Registrar Urology, DUHS OJHA CAMPUS, Dow University of Health Sciences, Gulzar-e-Hijri, SUPARCO Road, KDA Scheme 33, Karachi-75280, Pakistan

²Senior Registrar Urology, The Kidney Centre, The Kidney Centre, 197/9, Rafiqui, Iqbal Shaheed Rd, Askari 3 Karachi Cantonment, Karachi, 75530, Pakistan

³Consultant Urologist, Mamji Hospital Karachi, Mamji Hospital, C, 19, near Water Pump Chowrangi, Federal B Area Block 17 Gulberg Town, Karachi, 75950, Pakistan

^{4,5}Resident Urology, The Kidney Centre, The Kidney Centre, 197/9, Rafiqui, Iqbal Shaheed Rd, Askari 3 Karachi Cantonment, Karachi, 75530, Pakistan

^{*1}dr_oks@live.com

^{*1}0000-0001-9078-2883

DOI: <https://doi.org/10.5281/zenodo.15728031>

Keywords

Urinary tract stones,
Percutaneous
Nephrolithotomy, Open
Nephrolithotomy.

Article History

Received on 16 May 2025

Accepted on 16 June 2025

Published on 24 June 2025

Copyright @Author

Corresponding Author: *
Osama Kalim Shaikh

Abstract

BACKGROUND: In urology clinics, the most prevalent and recorded cases are the urinary tract stones. Multiple treatment choices exist to treat these renal stones and among them percutaneous Nephrolithotomy is the most considerate one. This study aims to evaluate and compare the outcomes of unilateral and bilateral percutaneous nephrolithotomy (PCNL) for patients presenting with large and extensive bilateral renal stones, in order to determine the more efficacious approach.

METHODOLOGY: An observational retrospective cohort study enlisting 120 patients who underwent PCNL from January 1st 2024 to April 30th 2024. with the participants divided into two groups, each consisting of 60 individuals where one group had unilateral PCNL while the other had simultaneous bilateral PCNL. The variables of study include age, gender, BMI, laboratory parameters, hospital stay, operative time, number of stone, approach of procedure, insertion of nephrostomy tube, stone clearance, post-operative complications, need of blood transfusion and need of ancillary procedures.

RESULTS: Among 120 patients, the mean age was 39.1±13.7 years ranging from a minimum of 17 years to a maximum of 76 years. Male were 68(56.7%) while females were 42(43.3%). The results of both groups are identical in terms of stone clearance, rate of complications and need of blood transfusion and ancillary procedures and no major difference was noted in both groups.

CONCLUSION: The cost-effectiveness, reduced hospitalization, and faster return to normal activities indicated a clear advantage for Simultaneous Bilateral PCNL compared to unilateral PCNL, suggesting it as a viable alternative for patients with stones in both kidneys.

INTRODUCTION

Urinary tract stones (UTS) are labelled as the most common condition to appear in Urology OPD ¹. The management of UTS has acquired a lot of acknowledgment globally with an estimated 11% of men and 7% of women in European countries are affected by this condition. ². Urinary tract stones can be unilateral or bilateral in nature but severe and deadly complications for example obstructive uropathy and renal failure are associated mostly with bilateral instead of unilateral due to multiple factors hence bilateral urinary tract stones require urgent intervention ³.

In the recent years, surgeons decision to operate which side first was largely dependent on stone burden, patient's symptoms etc. leading to the adoption of either open Nephrolithotomy or percutaneous Nephrolithotomy (PCNL) though PCNL is now considered the modality of standard of treatment ⁴. In 1976, Fernström and Johansson were the first to advocate for PCNL over the open procedure. ⁵. For the last few decades PCNL is preferred over open procedures to deal intricate renal stones or the one unusually bigger in size ⁶. Two leading Urology guideline i.e. EAU (European Association of Urology) & American Urological Association (AUA) propose PCNL as preminent treatment for staghorn calculi ⁷.

The primary concern has shifted to patients with large bilateral stones, as managing these cases poses a significant and unique challenge ⁸. Although unilateral PCNL offers certain benefits, managing large bilateral renal stones remains challenging. Simultaneous bilateral PCNL offers a single-procedure solution for complex stones in both kidneys, reducing the need for multiple surgeries, recovery time, and patient morbidity ⁹.

Few authors have proposed that competent way to deal bilateral stones is simultaneous bilateral PCNL as it would limit costs by lessening hospital stay, operative time as well as recovery time and this idea was first put into practice by Colon-Perez and associates in 1987 ¹⁰.

In this study our main goal was to establish an evidence-based fact to whether opt bilateral PCNL for treating large enormous bilateral renal stones or to carry on the conventional unilateral PCNL as

done in the past. To the best of our inquiry very restricted information is available universally about this topic and this study might become helpful to establish new guidelines to treat bilateral renal stone nationally as well as internationally.

MATERIALS AND METHODS

After obtaining ethical approval from the hospital (Reference #66-URO-052019), we conducted a retrospective observational cohort study at The Kidney Centre, Karachi. We included 120 patients who underwent PCNL between January 1st and April 30th, 2024, evenly split into 60 unilateral and 60 bilateral PCNL cases. Data was retrospectively collected from patient medical records using a structured proforma.

The variables of our study were age, gender, BMI, laboratory parameters, hospital stay, operative time, number of stone, approach of procedure, insertion of nephrostomy tube and stone clearance. Our outcome variables were complications, need of blood transfusion and need of ancillary procedure.

Data entry and analysis were performed using IBM SPSS version 23. The computation of Mean \pm Standard deviation was conducted for normally distributed continuous variables, whereas for skewed data, both median with interquartile range and mean \pm SD were observed. The normality of the data was assessed using the Shapiro-Wilk test. The frequency with percentage was computed for categorical variables. A comparison of the means of demographic and clinical continuous variables between the two groups was conducted using either the independent Student's t-test or the Mann-Whitney U test. The association of categorical variables and complications with unilateral and bilateral PCNL was evaluated through the chi-square or Fisher exact test, as applicable. The significance level was determined as ≤ 0.05 .

RESULTS:

In our study, a total of 120 patients were enrolled, with 60 individuals in each group. The mean age was 39.1 ± 13.7 years, ranging from 17 to 76 years. Of the cohort, 68 (56.7%) were male, and 42 (43.3%) were female. Both the unilateral and bilateral PCNL groups exhibited similar age distributions ($p=0.52$);

however, there was a significant difference in BMI between the groups ($p=0.021$). The mean BMI of the unilateral group was higher compared to that of the bilateral PCNL group (24.2 ± 3.6 vs. 22.7 ± 4.6). Similarly, pre-operative creatinine and hemoglobin levels showed statistically significant differences between the two groups ($p<0.001$ and $p=0.031$, respectively). However, post-operative creatinine and hemoglobin levels were comparable between the unilateral and bilateral PCNL groups ($p=0.079$ and 0.116 , respectively). Table 1 Approach of procedure was different in both groups ($p <0.001$), as we observed that in unilateral PCNL, Supracostal approach was used in majority of the patients

34(56.7%) while in bilateral PCNL, the most common approach of surgery was Infracostal 38(63.3%). In terms of complications and need of ancillary procedure, we found that none of the variable was associated with unilateral or bilateral PCNL surgery ($p >0.05$). Over all the rate of complications were low in both groups {6(10%) in unilateral and 8(13.3%) in bilateral} and this rate was almost equal in the two groups of our patients. On the contrary 4(6.7%) patients needed blood transfusion in unilateral PCNL while 11(18.3%) patients required blood transfusion in bilateral PCNL ($p=0.053$). Table 2

TABLE:1 Comparison of demographic, pre, and post-operative parameters of patients undergone PCNL surgery

Parameters	Unilateral PCNL=60	Bilateral PCNL=60	P value
	Mean \pm STD	Mean \pm STD	
Age in years	38.1 \pm 12.1	40.1 \pm 15.1	0.52
Body mass index (BMI)	24.2 \pm 3.6	22.7 \pm 4.6	0.021
Pre- operative creatinine	1.1 \pm 0.2	1 \pm 0.2	<0.001
Post-operative creatinine	1.1 \pm 0.2	1.1 \pm 0.3	0.793
Pre-operative Hemoglobin	12.8 \pm 1.7	13.8 \pm 2.2	0.031
Post-operative Hemoglobin	11.7 \pm 1.6	11.2 \pm 2	0.116
Hospital stay	3.1 \pm 0.4	3.5 \pm 0.7	0.001
Operative time	75 \pm 17.3	145 \pm 32	<0.001
Blood transfusion	4(6.7)	11(18.3)	0.053

TABLE:2 COMPARISON OF OPERATIVE PARAMETERS AND COMPLICATIONS BETWEEN UNI AND BILATERAL PCNL=120

OPERATIVE PARAMETERS AND COMPLICATION OF PCNL		UNILATERAL PCNL n (%)	BILATERAL PCNL n (%)	P value
Number of stone	Single	24(40)	29(48.3)	0.358
	Multiple	36(60)	31(51.7)	
Approach of procedure	Supracostal	34(56.7)	5(8.3)	<0.001
	Infracostal	26(43.3)	38(63.3)	
	Both	0	17(16.7)	
Stone removal	Complete	56(93.3)	50(83.3)	0.088
	Incomplete	4(6.7)	10(6.7)	
Nephrostomy tube	Yes	20(33.3)	20(33.3)	0.999
	No	40(66.7)	40(66.7)	
Complications	Yes	6(10)	8(13.3)	0.57
	No	54(90)	52(86.7)	

Type of complication	Fever	4(6.7)	5(8.3)	0.902
	Urine leakage	1(1.7)	2(3.3)	
	Chest tube	1(1.7)	1(1.7)	
Grading of complication	Grade I (Minor)	5(5.8)	7(11.7)	0.88
	Grade III (Major)	1(1.7)	1(1.7)	
Ancillary procedure	Yes	4(6.7)	10(16.7)	0.088
	No	56(93.3)	50(83.3)	
Type of ancillary procedure	ESWL	4(6.7)	8(13.3)	0.131
	URS	0	2(3.3)	
Blood transfusion	Yes	4(6.7)	11(18.3)	0.053

DISCUSSION:

Among many problems in the world, Kidney stones constitute an overall genuine concern. Failure to treat this pathology result in extreme sepsis and may prompt deterioration of the Pelviccalyceal system. Consequently, stone evacuation is the primary objective of urologist with the aim to vanish any sort of obstruction, halting stone recurrence and elimination of ongoing infection ¹¹. Stone belt region which is extending from Egypt, centre east till Indonesia and the Philippines also include our motherland Pakistan with an increasing incidence of Kidney stones ¹².

Bilateral kidney stones present a significant challenge for urologists, often complicated by the initial decision of which side to operate on first. Historically, staged PCNL was the norm, with Colon et al. notably reporting the first bilateral PCNL in 1987 ¹³. After this numerous publications revealed effectiveness of concurrent bilateral PCNL rather than staged PCNL ¹⁴.

Ugras et al. proposed using intraoperative haemoglobin levels as a benchmark for continuing with the contralateral side ¹⁵. Successfully performing simultaneous bilateral PCNL also requires careful consideration of operative time, hemodynamic stability, and the risk of hyponatremia ¹⁶. In our case contralateral PCNL was proceed after taking anaesthesia team on board.

Another query for the Urologist is the selection of side and this is largely dependent on the scenario where some Urologist prefer to go for the side with more stone burden where as some prefer to operate one with the more and severe symptoms of obstruction. In our study both Unilateral PCNL and simultaneous bilateral PCNL are performed in

selected patients and their results are compared in terms of stone removal, Preoperative and Post-operative creatinine, Preoperative and Post-Operative Haemoglobin. Complications & its types and grades, need of ancillary procedure, need of blood transfusion as well as hospital stay.

The only obstacle in performing bilateral PCNL is the potential for significant intraoperative blood loss and requirement of blood transfusion. Numerous studies revealed need of transfusion ranging between 4-28% ¹⁷ & ¹⁸ which is quite high in comparison to our study where need of transfusion is merely 6.7% in Unilateral PCNL and faintly increased up to 18.3% in Bilateral PCNL with p value of 0.053.

Kushal et al. showed fever to be present in around 17.33% of patients ¹⁹ but outcome of our study clearly demonstrate an edge and exhibited fever in 6.7% of Unilateral PCNL and 8.3% of Bilateral PCNL having p value of 0.902.

While Desai et al. observed a 6.6±1.9 days mean hospital stay and a 13% secondary PCNL rate in their simultaneous bilateral PCNL study ²⁰, our study depicts the same result in terms of mean hospital stay which is roughly same for both categories (3.1 for Unilateral PCNL & 3.5 for Bilateral PCNL) but differ totally in terms of secondary PCNL which was neither performed in Unilateral nor in Bilateral PCNL, However ancillary procedure like ESWL was performed in 6.7% cases of Unilateral PCNL and 13.3% cases of Bilateral PCNL and Secondary URS was performed in only 3.3% cases of bilateral PCNL having p value of 0.131.

In one more series by Wang et al, a randomized trial comparing simultaneous bilateral PCNL with staged PCNL in 50 patients and 48 patients respectively also revealed delayed operative time of 269 minutes

but did not specify this time span for secondary PCNL in the respective series. However stone clearance rate was quite similar for both 77& VS 86.7%. The only complication noted by Wang et al was hydrothorax besides this no other complication was reported ²¹. The interpretation of our study totally stand apart with much better results in terms of Mean operative time which was 75min for Unilateral PCNL and 145min for bilateral PCNL but resembles quite a lot in terms of stone clearance which is 93.3% for unilateral PCNL and 83.3% for Bilateral PCNL despite of this none of the patient in our study required secondary PCNL also the complications like Fever, Urine Leakage & Pleural effusion were quite minimal and resembles a lot with the study described above.

Another thing of prime worry is the decline of renal functions after simultaneous bilateral PCNL as post-operative creatinine levels was another factor in our study which was not even a part of discussion in many studies, however comparative results were shown by some researchers for simultaneous bilateral PCNL ²², but our study concluded no significant disparity between preoperative & postoperative serum creatinine levels in both the groups. Taking into account all these factor, Simultaneous bilateral PCNL can be recognized as an alternate choice to treat bilateral renal stones as it will reduce the overall expense and this statement can be verified by a study performed by Wymer et al ²³.

Hence the earlier perspective regarding bilateral PCNL is of no worth and after the result of our study along with all these concrete evidence simultaneous bilateral PCNL is a safe advantageous and cost effective method to treat bilateral renal stones with similar outcomes as unilateral PCNL.

Considering the study's retrospective design, expanding the sample size in future trials could offer more comprehensive insights. Moreover, future research endeavors might incorporate the pediatric demographic for a more comprehensive analysis.

CONCLUSION

This research, originating from a single center in Pakistan, demonstrates that simultaneous bilateral PCNL is both a secure and economical choice for managing cases of bilateral renal calculi. It is linked with minimal complications, shorter hospital stays,

high rates of successful stone clearance, and an expedited return to normal activities. Consequently, simultaneous bilateral PCNL should be regarded as a viable treatment approach for patients with bilateral stone conditions necessitating percutaneous intervention. Similar prospective studies can contribute to the formulation of enhanced treatment protocols and guidelines.

CONFLICT OF INTEREST:

The author declared no conflict of interest.

FUNDING DISCLOSURE:

No funding was taken for study

ACKNOWLEDGEMENT:

Dr. Bina Salman, Bio-statistician, The Kidney Centre, Post Graduate Training Institute, Karachi, Pakistan

AUTHORS CONTRIBUTIONS:

Osama Kalim Shaikh: Contributed to the writing of this manuscript, including the conception and design, data acquisition, analysis, interpretation, and drafting of the manuscript.

Shakeel Haseeb Uddin Siddique: Contributed in the conception and design, Supervision & Critical review of the manuscript for important intellectual content.

Habibullah Muhammad Akbar: Contributed to the writing of this manuscript also data acquisition & analysis.

Muhammad Umar: Helped in collection of data and Critical review of the manuscript.

Syed Shariq Iqbal: Helped in collection of data and Critical review of the manuscript.

Number of Tables: 02

Number of figures: None

Sources of support: Nil

Conflict of interest: None declared

Acknowledgement: Dr. Bina Salman, Bio-statistician, The Kidney Centre, Post Graduate Training Institute, Karachi, Pakistan.

STUDY CONDUCTED AT: The Kidney Centre, 197/9, Rafiqui, Iqbal Shaheed Rd, Askari 3 Karachi Cantonment, Karachi, 75530, Pakistan

REFERENCES:

1. Dahl NK, Goldfarb DS. Nutritional prevention and treatment of urinary tract stones. In: Nutritional management of renal disease 2022 Jan 1 (pp. 685-697). Academic Press. DOI: doi.org/10.1016/B978-0-12-818540-7.00046-X
2. Tundo G, Vollstedt A, Meeks W, Pais V. Beyond prevalence: annual cumulative incidence of kidney stones in the United States. The Journal of urology. 2021 Jun;205(6):1704-9. DOI: doi.org/10.1097/JU.0000000000001629
3. Tanggo CR. The incidence rate of urinary tract stones in inpatients at the UKI General Hospital in 2015–2016. International Journal of Medical and Health Research. 2021;7(12):13-7.
4. Nourian SM, Bahrami M. Open surgery versus percutaneous nephrolithotomy for management of staghorn calculi. American Journal of Clinical and Experimental Urology. 2022 Aug 15;10(4):271.
5. Samaddar D, Sarkar D, Pal DK, Gupta S. Impact of percutaneous nephrolithotomy operation on non-operated kidney: a single center based study. Int. J. Res. Med. Sci. 2019;7(6):2256. DOI: doi.org/10.18203/2320-6012.ijrms20192508
6. Tang R, Yi Z, Wang Y, Wan L, Liu X, Wang S, Xiao C. Percutaneous Nephrolithotomy Versus Open Surgery in the Treatment of Urinary Calcul. Alternative Therapies in Health & Medicine. 2024 Dec 1;30(12).
7. Zeng G, Zhong W, Pearle M, Choong S, Chew B, Skolarikos A, Liatsikos E, Pal SK, Lahme S, Durutovic O, Farahat Y. European association of urology section of urolithiasis and international alliance of urolithiasis joint consensus on percutaneous nephrolithotomy. European urology focus. 2022 Mar 1;8(2):588-97. DOI: doi.org/10.1016/j.euf.2021.03.008
8. Murray G, Slade A, Johnson B, Heidenberg D, Humphreys M, Stern KL, Rivera M, Wymer KM. Simultaneous bilateral percutaneous nephrolithotomy: is it cost-effective?. Urology. 2025 Feb 25. DOI: doi.org/10.1016/j.urology.2025.02.029
9. Shen YM, Chen PH. Simultaneous single-tract bilateral percutaneous nephrolithotomy in bilateral large complex renal stones is not associated with increased complications: series of 36 consecutive patients. BMC urology. 2025 Dec;25(1):1-9. DOI: doi.org/10.1186/s12894-025-01821-8
10. Satyagraha P, Daryanto B, Nugroho P. A Case Report: Bilateral synchronous percutaneous nephrolithotomy. Brawijaya Journal of Urology. 2022 Jul 31;3(01):1-4. DOI: doi.org/10.11594/bjuology.2022.003.01.1
11. Soderberg L, Ergun O, Ding M, Parker R, Borofsky M, Pais V, Dahm P. Percutaneous nephrolithotomy vs retrograde intrarenal surgery for renal stones: a Cochrane Review. BJU international. 2024 Feb;133(2):132-40. DOI: doi.org/10.1111/bju.16220
12. Halinski A, Bhatti KH, Boeri L, Cloutier J, Davidoff K, Elqady A, Fryad G, Gadelmoula M, Hui H, Petkova K, Popov E. Stone composition of renal stone formers from different global regions. Archivio Italiano di Urologia e Andrologia. 2021 Oct 1;93(3):307-12. DOI: doi.org/10.21203/rs.3.rs-286555/v1
13. Nugroho P, Satyagraha P, Daryanto B. EXPERIENCE OF BILATERAL SYNCHRONOUS PERCUTANEOUS NEPHROLITHOLAPAXY (PCNL)## plugins. themes. bootstrap3. article. main#### plugins. themes. bootstrap3. article. sidebar. DOI: doi.org/10.32421/juri.v30i2.850
14. Wong VK, Lundeen CJ, Paterson RF, Scotland KB, Chew BH. Safety and Efficacy of Simultaneous Bilateral Percutaneous Nephrolithotomy. Uro. 2022 Feb 16;2(1):49-54. doi.org/10.3390/uro2010007
15. Ugras MY, Gedik E, Gunes A, Yanik M, Soylu A, Baydinc C. Some criteria to attempt second side safely in planned bilateral simultaneous percutaneous nephrolithotomy. Urology 2008; 72:996–1000.
16. Choi M, Brusky J, Weaver J, Amantia M, Bellman GC. Randomized trial comparing modified tubeless percutaneous nephrolithotomy with tailed stent with percutaneous nephrostomy with small-bore tube. J Endourol 2006; 20:766–770.

17. Siddique AB, Yesmin F, Babul MS, Khan SI, Chowdhury AR, Rahman MH. Blood Loss and Need for Transfusion in Percutaneous Nephrolithotomy. *Bangladesh Journal of Urology*. 2021;24(2):124-8. DOI: doi.org/10.3329/bju.v24i2.59482
18. Saeed A, Aziz W, Hashmi AP, Ather H. STONE score: A predictor for need of blood transfusion in percutaneous nephrolithotomy. *Essence (HU)*. 2024 May 1;950:35. DOI: 10.29271/jcsp.2024.05.578
19. Karki K, Bhusal N. Infectious complications during the initial 225 cases of standard PCNL: A single center experience. *Journal of Society of Surgeons of Nepal*. 2021 Dec 31;24(2):51-7. DOI: doi.org/10.3126/jssn.v24i2.42835
20. Desai M, Grover R, Manohar T, Ganpule A. Simultaneous bilateral percutaneous nephrolithotomy: a single-center experience. *Journal of endourology*. 2007 May 1;21(5):508-14. DOI: doi.org/10.1089/end.2006.0401
21. Wang CJ, Chang CH, Huang SW. Simultaneous bilateral tubeless percutaneous nephrolithotomy of staghorn stones: a prospective randomized controlled study. *Urol Res*. 2011;39(4):289-94. doi: 10.1007/s00240-010-0342-x.
22. Rizvi SA, Naqvi SA, Hussain Z, Hashmi A, Hussain M, Zafar MN, Mehdi H, Khalid R. The management of stone disease. *BJU international*. 2002 Mar 1;89(s 1):62-8. doi: 10.1046/j.1465-5101.2001.134.x
23. Wymer K, Johnson B, Slade A, Heidenberg D, Humphreys M, Stern K, Rivera M. MP39-10 SIMULTANEOUS BILATERAL PCNL: IS IT COST-EFFECTIVE?. *Journal of Urology*. 2023 Apr 1;209(Supplement 4):e538. DOI: 10.1097/JU.0000000000003277.10