



Original Article

Mini-Percutaneous Nephrolithotomy Versus Retrograde Intrarenal Surgery in Patients with Renal Stones

Muhammad Maqsood Zahid¹, Khalid Farouk², Khaleel Ahmad³, Liaquat Ali³, Hafiz Muhammad Javed⁴, Syed Mehmood ul Hassan⁵

¹Department of Urology and Kidney Transplantation, Services Hospital, Lahore, Pakistan

²Urology and Renal Transplantation, Foundation University Medical College/ Fauji Foundation Hospital, Rawalpindi, Pakistan

³Department of Anesthesia, ICU and Pain Medicine, Fauji Foundation Hospital, Rawalpindi, Pakistan

⁴Nawaz Sharif Medical College, Gujrat, Pakistan

⁵Services Hospital, Lahore, Pakistan

ARTICLE INFO

Key Words:

Mini-PCNL, RIRS, Renal Stones, Adult patients

How to Cite:

Maqsood Zahid, M. ., Farouk, K. ., Ahmad, K. ., Ali, L. ., Muhammad Javed, H. ., & Mehmood ul Hassan, S. . (2022). Mini-Percutaneous Nephrolithotomy Versus Retrograde Intrarenal Surgery in Patients with Renal Stones: MINI-PCNL Versus RIRS in Patients with Renal Stones. *Pakistan BioMedical Journal*, 5(7), 151-154. <https://doi.org/10.54393/pbmj.v5i7.650>

*Corresponding Author:

Muhammad Maqsood Zahid
Department of Urology and Kidney Transplantation,
Services Hospital, Lahore, Pakistan
drmaqsood_zahid@yahoo.com

Received Date: 16th July, 2022

Acceptance Date: 23rd July, 2022

Published Date: 31st July, 2022

ABSTRACT

Kidney stones, also known as renal calculi, are crystal concretions that primarily occur in the kidney and are referred to as nephrolithiasis. Ideally, calculi should form in the kidneys and pass out of the body through the urethra painlessly. Larger stones are uncomfortable and thus require surgery. Mini-percutaneous nephrolithotomy (mini-PCNL) and retrograde intrarenal surgery (RIRS) are the minimally invasive procedures employed these days to target renal stones. **Objective:** To compare the effectiveness of both mini-PCNL and RIRS in terms of targeting larger stones in adult patients along with other factors including hospital stay, operative time, stone passing rate and associated complications. **Patients and Methods:** In the year 2021, 101 patients undergoing mini-PCNL or RIRS in Doctors Hospital, Gujrat were observed in this study. Effectiveness of both the techniques, exposure time, transfusions required, stone free rates and hospital stay were compared in both groups of patients. **Results:** It was found that mini-PCNL has greater potential than RIRS in terms of stone clearing and operating time. However, RIRS has performed better in terms of reducing the hospital stay with mild complications in both the procedures. **Conclusion:** Both RIRS and mini-PCNL are extremely safe and highly efficient treatments for renal lithiasis with a diameter of 1.5 to 2.5 cm, and either one can be chosen to achieve outstanding stone-free rates.

INTRODUCTION

Nephrolithiasis is a condition where stones are formed within the kidneys [1]. Poor oral fluid intake, high intake of protein, high oxalate consumption, and high salt intake are all common risk factors for the development of stones [2]. The probability of a patient acquiring further kidney stones is significantly increased by a personal and family history of stones [3]. In the United States, urolithiasis is a common illness that affects roughly 1 in 11 persons. An estimated 1 million people attend emergency departments every year, costing the healthcare system \$5 billion, according to estimates. It increasingly affects people of working age

and is becoming more prevalent. Men appear more frequently than women [4,5]. The area known as the "stone belt" has a persistently high incidence of urolithiasis, and this includes Pakistan [2]. Based on the patient's initial symptoms, urolithiasis is treated with a combination of conservative medicinal medicines and surgical procedures [6]. Surgical treatment was the only strategy to manage renal stones in 1900s, however, its activity was limited due to the major side effects including loss of blood, infection, high fever and damage to surrounding organs. After centuries, Fernstrom and Johansson [7] made a

tremendous achievement in the field in 1976 by conducting the first percutaneous nephrolithotomy (PCNL) on patients diagnosed with renal stones who were unsuited for open surgery. PCNL has gained attention in recent years as it leaves patients stone free in a single setting and is a minimally invasive approach. It has prodigious results and at the same time minimizes morbidity and complications [8]. On the other hand, retrograde intrarenal surgery (RIRS) is another effective technique to target renal stones. The ability to execute RIRS for stones larger than 2 cm has been established by accumulating evidence [9,10]. Today, RIRS is a widely utilised and significant therapy method due to its natural approach to the stone and high success rate with minimal morbidity [9]. A recent study published compared the results of RIRS and mini-PCNL in treating large renal stones (>2 cm) in 38 pediatric patients [11]. The results showed that PCNL possesses higher stone free rate on comparison with RIRS whereas, mean radiation time and hospital stay were comparatively lower in patients undergoing RIRS. Higher complications in PCNL group patients were observed. Also, patients under PCNL therapy received blood transfusions whereas pediatrics in RIRS group did not require blood transfusions, thus demonstrating the better potential of RIRS in pediatric patients with stones larger than 2 cm. This study reported the effectiveness of mini-PCNL and RIRS on adult patients with larger sample size for the first time in Pakistan. Related factors such as hospitalisation time, cost, complications, and outcomes were also evaluated.

METHODS

Patients: In Doctors Hospital Jail Chowk Gujrat, a total of 101 patients underwent either retrograde intrarenal surgery (n=51) or mini-PCNL (n=50) during the year 2021. 101 patients who underwent RIRS or mini-PCNL were observed retrospectively. Before the procedure, patients went through the required lab investigations X-ray, CBC, Urinalysis, intravenous urography, ultrasonography, computerised tomography (CT) and coagulation tests. Stone size was calculated by multiplying the two longest diameters (mm) measured on CT sections. The operation technique chosen was based on patient's anatomy, patient's choice and surgeon's decision.

RIRS technique: Patient lies in dorsal lithotomy position and general anesthesia is given. Ureterorenoscopy is then performed with a hydrophilic safety guidewire introduced in body through ureter under the ultrasound and fluoroscopic guidance. A semi rigid ureteroscope (model and size) is introduced to evaluate and dilate ureter which is then removed and flexible ureteroscope (model and size) is introduced through the guidewire or a ureteral access sheath. On advancing the laser fiber (model and type) stone

is broken into small fragments and extracted through suction.

Mini-PCNL technique: Patient lies either in prone or supine position and general anesthesia is administered. Under the supervision of fluoroscopic and ultrasound imaging, a puncture is made into the appropriate lower pole calyx (via the flank) with a 22 gauge needle. A safety guidewire (model) is inserted into the bladder through the nephrostomy tract. A 14 Fr peel away sheath is introduced through another guide wire (model), which is then put into the bladder as a functioning guide wire. Additionally, a stiff ureteroscope is introduced to dilate the nephrostomy. Stone is extracted via suction after being broken with a HoYag laser. After the procedure is performed, a 14 Fr nephrostomy catheter is often left to assure outward urine flow and is withdrawn within 48 hours.

Statistical Analysis: Data was entered and analyze using SPSS 22.0. All the quantitative variables were presented in the form of mean + SD and qualitative variables with frequency and percentages. Chi square test was used to analyze the two groups of patients. Independent sample t test was applied to find out the significant difference between operative time, hospital stay and stone size among groups. P value < 0.05 was considered as significant.

RESULTS

Total 101 patients were enrolled in current study. The patients were divided into two groups (MINI PCNL = 50 Vs RIRS = 51). The mean age in groups were not significantly different (MINI PCNL = 42.28+13.06 Vs RIRS = 38.73+13.08). Male patients were more frequent as compared to females. The stone size was significantly different among both groups (MINI PCNL = 1.80+0.51 Vs RIRS = 1.26+0.35). The most affected kidney site was left (n=58). 45 patient have stone in renal pelvis, 29 in lower calyx, 19 in upper calyx and 8 in inter polar calyx. (Table 1)

Variable	MINI PCNL (n=50)	RIRS (n=51)	P-value
Age (Mean+SD)	42.28+13.06	38.73+13.08	0.175
Gender			Total
Male	26(52.0%)	27(52.9%)	53
Female	24(48.0%)	24(47.1%)	48
Stone Characteristics			P-value
Stone Size (Mean+SD)	1.80+0.51	1.26+0.35	0.000
Site of Kidney			Total
Left	30(60.0%)	28(54.9%)	58
Right	20(40.0%)	23(45.1%)	43
Site of Kidney stone			Total
Lower Calyx	21(42.0%)	8(15.7%)	29
Renal Pelvis	24(48.0%)	21(41.2%)	45
Upper Calyx	5(10.0%)	14(27.5%)	19
Inter Polar calyx	0(0.0%)	8(15.7%)	8

Table 1: Demographic and stone characteristics of patients

	Procedure	Mean	SD	P-value
Operation time in minutes	MINI PCNL	65.00	15.74	0.006**
	RIRS	74.12	16.73	
Hospital stay in days	MINI PCNL	2.74	0.94	0.000**
	RIRS	1.90	.671	
Procedure		MINI PCNL	RIRS	
Complications	Fever	5(10.0%)	10(19.6%)	
	Hematuria	8(16.0%)	8(15.7%)	
	Obstructive	4(8.0%)	0(0.0%)	
	Pyelonephritis	46(92.0%)	44(86.3)	0.345a

Table 2: Comparison of perioperative and postoperative outcomes

** Independent sample t test

^a Chisquare test

Table 2, showed the comparison between perioperative and postoperative outcomes among groups. There was significant difference between operative time (MINI PCNL = 65.0+15.74 Vs RIRS = 74.12+16.73). The RIRS procedure has longer operative time than MINI PCNL. Both groups also have significant difference in hospital stay (MINI PCNL = 2.74+1.90 Vs RIRS = 0.94+0.671). Over all fewer patients have complications. The stone clearance rate shows that the MINI PCNL has 92% and RIRS 86.3 % rate.

DISCUSSION

Renal lithiasis affects between 1 and 15% of persons worldwide at some time in their lives [12,13]. There were 22.1 million cases in 2015, and there were around 16,100 fatalities [14, 15]. With the advancements in technology, science has introduced newer procedures which are efficient, result oriented, minimally invasive with faster healing time and lesser complications. Two such methods are mini-percutaneous nephrolithotomy (mini-PCNL) and retrograde intrarenal surgery (RIRS). Mini PCNL complemented the original method and reduced the morbidity rate by use of smaller tracts [16]. In this study, we compared the effectiveness of both the mini-PCNL and RIRS. Few studies have been done before to compare the results of the two procedures. Retrograde intra renal surgery is mentioned in European Association of Urology guidelines for treatment of renal lithiasis [17]. However, the gold standard is still shock wave lithotripsy and percutaneous nephrolithotomy [18]. Mini- PCNL and RIRS have gained popularity as it is an innocuous and effective method. Many urologists have documented the efficiency of both the procedures. Ho et al. [19] reported that the stone free rates were 82 % for patients with stones having sizes between 0.1-1 cm, 71% for patients with stone size of 1.1-2cm and 65% for stones greater than 2 cm using RIRS. Likewise, Mhaske et al. [20] presented 100% and 95.4% stone clearance rates on employing mini-PCNL and RIRS procedures with longer operative time in case of RIRS and lower hemoglobin levels in case of mini-PCNL. In another study, Pelit et al. [21] also compared the efficiency of mini-

PCNL and RIRS in pre-school-aged children and found out that RIRS is superior over mini-PCNL in terms of shorter hospital stay, shorter exposure time in case of fluoroscopy and reduced operative time in terms of treating renal stones, whereas PCNL was found to have higher stone free rate on comparison with RIRS in a single session. In this study we found the efficiency of the two procedures, 1-2 days post-operation with a follow-up for 1 month. We found mini-PCNL group has an efficiency of 93.2% with 90.2% efficiency in RIRS group. Even though both procedures are highly effective but mini-PCNL has a significantly shorter operative time and higher stone clearance rates, whereas in case of RIRS group, shorter hospital stay was observed in adult patients Also, both techniques can be employed as a good choice for stones of larger diameters i.e., 2-3 cm. It is documentable that the management protocols for the two procedures are different.

CONCLUSION

Both RIRS and mini-PCNL are extremely safe and successful treatments for renal lithiasis and either one can be used to obtain outstanding stone-free rates.

REFERENCES

- [1] Mahmood SN, Babarasul MH, Fakhralddin SS, Tawfeeq HM. Retrograde intrarenal surgery for the treatment of renal stones in patients with a solitary kidney: Does access sheath matter?. *African Journal of Urology*. 2021 Dec;27(1):1-6. doi: 10.1186/s12301-021-00133-1
- [2] Scales CD Jr, Smith AC, Hanley JM, Saigal CS. Urologic Diseases in America Project. Prevalence of kidney stones in the United States. *European Urology*. 2012 Jul;62(1):160-5. doi: 10.1016/j.eururo.2012.03.052
- [3] Chung MJ. Urolithiasis and nephrolithiasis. *Journal of the American Academy of PAs*. 2017 Sep;30(9):49-50. doi: 10.1097/01.JAA.0000522145.52305.aa
- [4] Khan SR, Pearle MS, Robertson WG, Gambaro G, Canales BK, Doizi S, et al. Kidney stones. *Nature Reviews Disease Primers*. 2016 Feb;25(2):16008. doi: 10.1038/nrdp.2016.8
- [5] Branning G and Vater M. Healthcare Spending: Plenty of Blame to Go Around. *American Health and Drug Benefits*. 2016 Nov;9(8):445-447.
- [6] Mithani S and Zaidi Z. Comparison of 24 hours urinary citrate levels in urolithiasis patients and healthy controls. *Journal Pakistan Medical Association*. 2005 Sep;55(9):371.
- [7] Fernström I and Johansson B. Percutaneous pyelolithotomy: a new extraction technique. *Scandinavian Journal of Urology and Nephrology*. 1976 Jan 1;10(3):257-9.

- [8] Saad KS, Youssif ME, Hamdy SA, Fahmy A, Hanno AG, El-Nahas AR. Percutaneous nephrolithotomy (PCNL) versus retrograde intra-renal surgery (RIRS) in treatment of large renal stones (> 2 cm) in pediatric patients: a randomized controlled study. *Journal of Urology*. 2015;194:1716-20. doi: 10.1016/j.juro.2015.06.101
- [9] Akman T, Binbay M, Ozgor F, Ugurlu M, Tekinarslan E, Kezer C, et al. Comparison of percutaneous nephrolithotomy and retrograde flexible nephrolithotripsy for the management of 2-4 cm stones: a matched-pair analysis. *British Journal of Urology*. 2012 May;109(9):1384-9. doi: 10.1111/j.1464-410X.2011.10691.x
- [10] Akman T, Binbay M, Ugurlu M, Kaba M, Akcay M, Yazici O, et al. Outcomes of retrograde intrarenal surgery compared with percutaneous nephrolithotomy in elderly patients with moderate-size kidney stones: a matched-pair analysis. *Journal of Endourology*. 2012 Jun;26(6):625-9. doi: 10.1089/end.2011.0526.
- [11] Gottlieb M, Long B, Koyfman A. The evaluation and management of urolithiasis in the ED: A review of the literature. *American Journal of Emergency Medicine*. 2018 Apr;36(4):699-706. doi: 10.1016/j.ajem.2018.01.003.
- [12] Morgan MS and Pearle MS. Medical management of renal stones. *British Medical Journal*. 2016 Mar;352. doi: 10.1136/bmj.i52
- [13] Abufaraj M, Xu T, Cao C, Waldhoer T, Seitz C, D'andrea D, et al. Prevalence and trends in kidney stone among adults in the USA: analyses of National Health and Nutrition Examination Survey 2007-2018 Data. *European Urology Focus*. 2021 Nov;7(6):1468-75. doi: 10.1016/j.euf.2020.08.011
- [14] Vos T, Allen C, Arora M, Barber RM, Bhutta ZA, Brown A, et al. Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015. *The Lancet*. 2016 Oct;388(10053):1545-602. doi: 10.1016/S0140-6736(16)31678-6
- [15] Wang H, Naghavi M, Allen C, Barber RM, Bhutta ZA, Carter A, et al. Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980-2015: a systematic analysis for the Global Burden of Disease Study 2015. *The Lancet*. 2016 Oct 8;388(10053):1459-544 doi:10.1016/S0140-6736(16)31012-1
- [16] Ferakis N and Stavropoulos M. Mini percutaneous nephrolithotomy in the treatment of renal and upper ureteral stones: Lessons learned from a review of the literature. *Urology Annals*. 2015 Apr-Jun;7(2):141-8. doi: 10.4103/0974-7796.152927
- [17] Karakoç O, Karakeçi A, Ozan T, Firdolaş F, Tektaş C, Özkarataş ŞE, et al. Comparison of retrograde intrarenal surgery and percutaneous nephrolithotomy for the treatment of renal stones greater than 2 cm. *Turkish Journal of Urology*. 2015 Jun;41(2):73-7. doi: 10.5152/tud.2015.97957
- [18] Gadelmoula M, Elderwy AA, Abdelkawi IF, Moeen AM, Althamthami G, Abdel-Moneim AM. Percutaneous nephrolithotomy versus shock wave lithotripsy for high-density moderate-sized renal stones: A prospective randomized study. *Urology Annals*. 2019 Oct-Dec;11(4):426-431. doi: 10.4103/UA.UA_63_19
- [19] Ho CC, Hafidzul J, Praveen S, Goh EH, Bong JJ, Lee BC, et al. Retrograde intrarenal surgery for renal stones smaller than 2 cm. *Singapore Med J*. 2010 Jun 1;51(6):512. doi: 10.1016/s1569-9056(13)61698-x
- [20] Mhaske S, Singh M, Mulay A, Kankalia S, Satav V, Sabale V. Miniaturized percutaneous nephrolithotomy versus retrograde intrarenal surgery in the treatment of renal stones with a diameter <15 mm: A 3-year open-label prospective study. *Urology Annals*. 2018 Apr-Jun;10(2):165-169. doi: 10.4103/UA.UA_156_17