



## Original Article

## Outcomes of Retrograde Intrarenal Surgery in Renal Calculi of Varying Size

Ajmal Khan<sup>1</sup>, Amjad Saleem<sup>1</sup>, Shahid Siraj<sup>1</sup>, Raza Ul Hassan<sup>1</sup>, Iftikhar Ahmad<sup>1</sup>, Raja Naeem<sup>1</sup><sup>1</sup>Department of Urology, Pakistan Institute of Medical Sciences, Islamabad, Pakistan

## ARTICLE INFO

**Key Words:**

Retrograde intrarenal surgery (RIRS), postoperative complications, Intraoperative complication.

**How to Cite:**Khan, A. ., Saleem, A. ., Siraj, S. ., Hassan, R. U. ., Ahmad, I. ., & Naeem, R. . (2022). Outcomes of Retrograde Intrarenal Surgery in Renal Calculi of Varying Size: Outcomes of Retrograde Intrarenal Surgery in Renal Calculi of Varying Size. *Pakistan BioMedical Journal*, 5(7).<https://doi.org/10.54393/pbmj.v5i7.660>**\*Corresponding Author:**

Shahid Siraj

Department of Urology, Pakistan Institute of Medical Sciences, Islamabad, Pakistan  
Drshahidsiraj@gmail.com

Received Date: 17th July, 2022

Acceptance Date: 24th July, 2022

Published Date: 31st July, 2022

## ABSTRACT

The patient with the large renal calculi is recommended with retrograde intrarenal surgery by the physicians. It is minimally invasive approach for the treatment. **Objective:** The study was conducted for evaluation of the intraoperative and postoperative complications associated with the retrograde intrarenal surgery RIRS. The stone free rate rates were also compared. **Methods:** The 231 patients who visited the Urology department of our teaching hospital were included in the study. The duration of this study was from January 2021 to June 2021. The patients were divided into six groups. The calculi of dimension 1-9 mm were included in the group 1, while 10-19 mm were included in the group 2, 20-29 mm were included in group 3. The calculi of dimension 30-39 mm were included in group 4, the calculi of dimension 40-49 mm in group 5, while calculi greater than 50mm dimension were included in the group 6. The post-operative complications were reported while six-month follow months. **Results:** Out of the 231 patients included in the study. According to the study smallest size of calculi observed to be 3 mm and the largest size of calculi was found to be 60 mm. The average size of the calculi came out to be  $22.9 \pm 11.2$  mm. The adverse events were observed in different groups. 11% of the patients reported some intraoperative negative effects. There were 31 patients that showed post procedure complications but these complications were later on found to be gone leaving no adverse side effect. 10% patients that undergo repetitive RIRS to clear the stones and were later-on confirmed stone free. **Conclusion:** For the treatment and management of the renal stones that are more than 20 mm in size RIRS is an encouraging option. There was a size dependent enhancement in the complications that take place after the procedure. There was no case of stone related events reported in patients that took care of follow up sessions to get rid of residual stones.

## INTRODUCTION

The urolithiasis incidence are rising globally. The physicians focused on choosing the process that remove the stones completely with least morbidity rates. The ureterorenoscopic management of the renal calculi has been advanced by the ureterorenoscope miniaturization [1]. Further advancement in the surgical and laser techniques have added to the adverts in the medical instrumentation. Stone size highly effect the choice of treatment. For the removal of the renal stone greater than 20 mm in size the retrograde intrarenal surgery is considered as second line of treatment. Therefore RIRS is being effectively used for the treatment of the large and varying size calculi. It is safe option for removal of kidney stone [2-3]. The number are people are suffering from the urinary tract stone. In the recent years the minimally

invasive procedure like RIRS have replaced the open surgery approaches. The RIRS are widely accepted by the physicians as compare to the other approaches. It is alternative to the percutaneous nephrolithotomy PCNL [2]. For the treatment of the lower pole stones, the European Association of Urology (EAU) has labelled the RIRS and PCNL as the first-line and effective treatment. The role RIRS play in treatment of the calyces and renal pelvis is still under investigation. The RIRS is seldom used for the management of the renal calculi with the renal stone of size greater than 40 mm [4-5]. The limited visualization, reduced size of fragment removal are the drawbacks associated with the RIRS. It is very expensive procedure and a major deterrent to the RIRS [6]. It is not only prove as an effective treatment for adults, but also different studies

have showed that it is reasonable treatment for the children also. The minimum complications are observed in the children after RIRS treatment. The better stone free rates are observed after the RIRS treatment. Some studies have showed that if RIRS is performed as outpatients procedure it can reduced the risk associated with the PCNL [7-8]. The study provide with the deep insights into the adverse effects and complication associated with the intraoperative and postoperative events[9-10].

## METHODS

The patients who underwent RIRS at the Urology department of our teaching hospital were included in the study. The ethical committee of the hospital approved the study. The informed consent was taken from all the patients included in the study. According to the exclusion criteria the patients who underwent the bilateral RIRS, having age under 18 years and other who underwent through PCNL surgery were excluded from the study. The patients who underwent RIRS for ureteral or impacted pelviureteric junction calculi were also excluded from the study. The patients with incomplete data were also excluded. The experienced endourologist performed the all surgeries. The frequency of the laser was set between 20-50 Hz. The dusted calculi was preferred rather than their fragmentation. The completion of the procedure depends upon the removal of DJ stent. The calculi of dimension 1-9 mm were included in the group 1, while 10-19 mm were included in the group 2, 20-29 mm were included in group 3. The calculi of dimension 30-39 mm were included in group 4, the calculi of dimension 40-49 mm in group 5, while calculi greater than 50 mm dimension were included in the group 6. The post-operative complications were reported while six-month follow months. The demographic details location and side of calculi, total operative time of each patient was recorded. The intraoperative and postoperative adverse event and complication were recorded respectively. The follow up also noted the stone related events. SPSS version 21.0 was used for the statistical analysis. Receiver operative curves were plotted.

## RESULTS

231 patients were selected for the study. The size of calculi was calculated and the smallest size of calculi came to be 3 mm and the largest size of calculi was found to be 60 mm. The average size of the calculi came out to be  $22.9 \pm 11.2$  mm, the demographic characteristics were studied for all the patients, the features that were studied included size of the stone, its location and position in the body. Two hundred and thirty-one patients reported to have primary RIRS, and they reported that there was no prior need of the DJ stent replacement. Almost 57% patients had carried out

two staged operations. Out of all the patients that were taken for study some of them were at the first step of procedure and the remaining were at the starting stage of the multifunctional procedure. It was also reported that some of the patients 27% were on the later stages of the complex procedure. 11% of the patients reported some intraoperative negative effects. There were 31 patients that showed post procedure complications but these complications were later on found to be gone leaving no adverse side effect. There were almost 90% of the patients that refused to undergo re-surgery or any observation. There were only 10% patients that undergo repetitive RIRS to clear the stones and were later-on confirmed stone free Table 1.

Features	Group # 1 (n=25)	Group # 2 (n=82)	Group # 3 (n=65)	Group # 4 (n=36)	Group # 5 (n=18)	Group # 6 (n=9)	P-value
Primary RIRS without the urge for DJ stent	20 (86.5)	70 (85.0)	55 (85.7)	32 (88.9)	18 (100.0)	9 (100.0)	0.1
No. of procedure	1.13±0.4	1.38±0.5	1.75±0.48	2.04±0.32	2.08±0.46	2.30±0.49	
1	19(82.0)	52(63.4)	19(28.9)	1(2.7)	1(5.5)	0	.0.0
2	6(24.0)	32(39.3)	46(70)	32(88.9)	1(83.0)	5(44.4)	
3	0	0	1(1.5)	2(5.5)	2(11.3)	2(22.6)	
Total duration of operation (min)	4.0±14.11	72.4±30.7	118.7±47.8	188±44.5	232±36.4	257.1±47.9	0.0
Intraoperative negative events	3(12)	7(8)	12(17.9)	4(9.1)	1(5.7)	2(22.6)	0.05
Ureteral sheath related ureteral wall wound - Grade 1	1(40.0)	4(48.3)	3(60.0)	0	0	0	
Incompetence to reach a part of calculus and left alone	0	0	2(30.0)	1(27.3)	0	0	
Inability to access the calculus fully and left alone	1(40.0)	0	0	0	0	0	
Infundibular	0	3(36.0)	1(15.0)	2(55.7)	0	1(11.0)	
Pelvic tear	0	1(12.7)	2(30.0)	0	0	0	
Injury that require Replacement of the flexible ureterorenoscope	0	0	1(15.0)	0	1(55.0)	1(11.0)	
Broken and fixed basket	0	0	1(15.0)	0	0	0(0.0)	

**Table 1:** Demographic features and the characteristics of the stone

Anatomical problems	No. of patients	Size of stone (mm)	Intraoperative negative events, n (%)	Postoperative issues, n (%)	Remaining stones, n (%)
Infundibular stenosis	9	24.7±9.15	1(11.7)	3(33.0)	2(22.3)
Mild pelviureteric junction blockage, postpyeloplasty	6	17.0±5.56	1(16.3)	0	0
Calyceal diverticulum					
Duplicated collecting complex	8	13.9±6.72	1(12.0)	0	1(20.0)
Impacted	9	24.8±16.7	1(11.0)	1(11.0)	0
infundibular calculus	5	28.8±12.3	2(40.7)	1(20.3)	0
Pelvic kidney (ectopic)	3	40.0±0.00	0	0	

**Table 2:** The problems during the retrograde intra renal surgery and the outcomes

## DISCUSSION

This study included a total of 231 patients, all the patients were well aware of the study and written consent is taken from the patients. This study depicts the enhancement in multiple procedures like postoperative problems, duration of total operation, residual size of stone and all these issues are dependent on the size of stone [11]. Instead of making a group that contained all types of stones we tried to make sub categories and the groups or cohorts were made according to the size of stone to study that how incremental variation occur in the size of the stone and the post-operative outcomes were also studied. And then one more task was to estimate the size of stone and the point at which there was a prominent change noted [12-13]. There were only 12% patients that carried out the pre-procedural stent procedure and this ratio is less than that of the ratio reported in the previous studies. It is reported that the elevated rates of RIRS in primary form are attributed to the routine ureteral dilation up to 12 Fr and condition in case of small size was up to 9.5 Fr UAS [14]. In order to get higher SFR the pop dusting was combined with the conventional stone dusting. The procedure always starts at the dusting settings and later on it leads to lithotripsy. At the end of the procedure even though there was no change in the settings of laser, the procedure was altered to non-contact form of lithotripsy. Here the technique was performed uniformly all around the stone s that a very fine dust of stone can be made without producing any larger fragment [15]. There are strong evidences that support taking ureteroscopy as an important day care activity. A large number of patients in this study also opt for the RIRS as a day care procedure and it is becoming a very strong accepted procedure recently. In this study it was found that the number of patients that were at the first stage of procedure or at the next stage greater than the number of patients that are at the later stages of multistage procedure [16-17]. It was observed that may be the majority of the patients are at the primary stages because of high stone size and the duration of treatment as well. As it is known that the duration for single staged procedure is longer. But the data of the patients at the later on stages can also prove to be helpful for subsequent analysis. In this study it was not observed that the stone size was rising as a result of intraoperative negative effect. However, there was occurrence of 19 patients that had grade 1 ureteral wall infection. The inflammation in the ureteral wall was may be due to sequential dilation of the ureter and also smaller UAS was used in some cases [18]. There was renal pelvic tear and tear in the infundibular region that was reported in this study and the reason behind its presence is pressure of

high irrigation or may be because of direct usage of the laser beam. There was irreversible damage reported in the three patients it was because of the high strain on the region of scope and one patient reported the firing of the laser beam in an inadvertent manner inside the machine that caused irreversible problems [19]. The complication that was observed most frequently in our study was hematuria and the occurrence of clots because of the longer catheterization. But such complications were taken care of later on without causing any serious damage. Hematuria was most commonly observed in patients after the operative procedure. It was observed that there were 5 patients that had stone size greater than 6 mm they underwent RIRS and the stone was removed successfully. The SFR was very encouraging as it has patients with size of stone as big as 20 mm. the stone bulk was dusted in the initial stage almost 70-80%. And then the remaining calculi was dealt with later on [20-21]. This study noted enhancement in size of renal stones in the patients included in the fourth group as compared to other groups. The complexity of the stone results in the complications that are observed later on. This retrospective study therefore states that the follow up with proper series of ultrasonography can prove to be great for the residual stones that are produced after RIRS [22].

## CONCLUSION

RIRS can prove to be an encouraging option for the treatment and management of the renal stones that are more than 20 mm in size. There was a size dependent enhancement in the complications that take place after the procedure. There was no case of stone reported in patients that took care of follow up sessions to get rid of residual stones.

## REFERENCES

- [1] Venkatachalapathy VSS, Palathullil DG, Sam DM, Prasad A, Abraham GP. Outcomes of retrograde intrarenal surgery in renal calculi of varying size. *Indian Journal of Urology*. 2022 Jun; 38(2):128-134. doi: 10.4103/iju.iju\_343\_21
- [2] Resorlu B, Oguz U, Resorlu EB, Oztuna D, Unsal A. The impact of pelvicaliceal anatomy on the success of retrograde intrarenal surgery in patients with lower pole renal stones. *Urology*. 2012 Jan; 79(1):61-6. doi: 10.1016/j.urology.2011.06.031
- [3] Li MM, Yang HM, Liu XM, Qi HG, Weng GB. Retrograde intrarenal surgery vs miniaturized percutaneous nephrolithotomy to treat lower pole renal stones 1.5-2.5 cm in diameter. *World Journal of Clinical Cases*. 2018 Dec; 6(15):931-935. doi: 10.12998/wjcc.v6.i15.931
- [4] Bozkurt OF, Resorlu B, Yildiz Y, Can CE, Unsal A. Retrograde intrarenal surgery versus percutaneous

- nephrolithotomy in the management of lower-pole renal stones with a diameter of 15 to 20 mm. *Journal of Endourology*. 2011 Jul; 25(7):1131-5. doi: 10.1089/end.2010.0737
- [5] Karsiyakali N, Karabay E, Erkan E, Kadihasanoglu M. Evaluation of Nephrolithometric Scoring Systems to Predict Outcomes of Retrograde Intrarenal Surgery. *Urology Journal*. 2020 Jun; 17(4):352-357. doi: 10.22037/uj.v0i0.5256
- [6] Chen Y, Deng T, Duan X, Zhu W, Zeng G. Percutaneous nephrolithotomy versus retrograde intrarenal surgery for pediatric patients with upper urinary stones: a systematic review and meta-analysis. *Urolithiasis*. 2019 Apr; 47(2):189-199. doi: 10.1007/s00240-018-1039-9
- [7] Jung H, Nørby B, Osther PJ. Retrograde intrarenal stone surgery for extracorporeal shock-wave lithotripsy-resistant kidney stones. *Scandinavian Journal of Urology and Nephrology*. 2006; 40(5):380-4. doi: 10.1080/00365590600679269
- [8] Tsai SH, Chung HJ, Tseng PT, Wu YC, Tu YK, Hsu CW, et al. Comparison of the efficacy and safety of shockwave lithotripsy, retrograde intrarenal surgery, percutaneous nephrolithotomy, and minimally invasive percutaneous nephrolithotomy for lower-pole renal stones: A systematic review and network meta-analysis. *Medicine*. 2020 Mar; 99(10):e19403. doi: 10.1097/MD.00000000000019403
- [9] Pelit ES, Atis G, Kati B, Akin Y, Çiftçi H, Culpan M, et al. Comparison of Mini-percutaneous Nephrolithotomy and Retrograde Intrarenal Surgery in Preschool-aged Children. *Urology*. 2017 Mar; 101:21-25. doi: 10.1016/j.urology.2016.10.039
- [10] Cabrera JD, Manzo BO, Torres JE, Vicentini FC, Sánchez HM, Rojas EA, et al. Mini-percutaneous nephrolithotomy versus retrograde intrarenal surgery for the treatment of 10-20 mm lower pole renal stones: a systematic review and meta-analysis. *World Journal of Urology*. 2020 Oct; 38(10):2621-2628. doi: 10.1007/s00345-019-03043-8
- [11] Gao XS, Liao BH, Chen YT, Feng SJ, Gao R, Luo DY, et al. Different Tract Sizes of Miniaturized Percutaneous Nephrolithotomy Versus Retrograde Intrarenal Surgery: A Systematic Review and Meta-Analysis. *Journal of Endourology*. 2017 Nov; 31(11):1101-1110. doi: 10.1089/end.2017.0547
- [12] Lim EJ, Traxer O, Madarriaga YQ, Castellani D, Fong KY, Chan VW, et al. Outcomes and lessons learnt from practice of retrograde intrarenal surgery (RIRS) in a paediatric setting of various age groups: a global study across 8 centres. *World Journal of Urology*. 2022 May; 40(5):1223-1229. doi: 10.1007/s00345-022-03950-3
- [13] Taratkin M, Azilgareeva C, Chinenov D, Mikhailov V, Inoyatov J, Ali S, et al. Retrograde intrarenal surgery versus percutaneous nephrolithotomy in larger kidney stones. Could SuperPulsed Thulium-fiber laser change the game? *Central European Journal of Urology*. 2021; 74(2):229-234. doi: 10.5173/ceju.2021.0133
- [14] Tonyalı Ş, Yılmaz M, Karaaslan M, Ceylan C, Işıkyay L. Prediction of stone-free status after single-session retrograde intrarenal surgery for renal stones. *Turkish Journal of Urology*. 2018 Nov; 44(6):473-477. doi: 10.5152/tud.2018.88615
- [15] Resorlu B, Unsal A, Ziypak T, Diri A, Atis G, Guven S, et al. Comparison of retrograde intrarenal surgery, shockwave lithotripsy, and percutaneous nephrolithotomy for treatment of medium-sized radiolucent renal stones. *World Journal of Urology*. 2013 Dec; 31(6):1581-6. doi: 10.1007/s00345-012-0991-1
- [16] Park J, Kang M, Jeong CW, Oh S, Lee JW, Lee SB, et al. External Validation and Evaluation of Reliability and Validity of the Modified Seoul National University Renal Stone Complexity Scoring System to Predict Stone-Free Status After Retrograde Intrarenal Surgery. *Journal of Endourology*. 2015 Aug; 29(8):888-93. doi: 10.1089/end.2014.0901
- [17] Sari S, Ozok HU, Cakici MC, Ozdemir H, Bas O, Karakoyunlu N, et al. A Comparison of Retrograde Intrarenal Surgery and Percutaneous Nephrolithotomy for Management of Renal Stones ?2 cm. *Urology Journal*. 2017 Jan; 14(1):2949-2954
- [18] Tolga-Gulpinar M, Resorlu B, Atis G, Tepeler A, Ozyuvallı E, Oztuna D, et al. Safety and efficacy of retrograde intrarenal surgery in patients of different age groups. *Actas Urologicas Espanolas*. 2015 Aug; 39(6):354-9. doi: 10.1016/j.acuro.2014.06.006
- [19] Rodríguez-Monsalve Herrero M, Doizi S, Keller EX, De Coninck V, Traxer O. Retrograde intrarenal surgery: An expanding role in treatment of urolithiasis. *Asian Journal of Urology*. 2018 Oct; 5(4):264-273. doi: 10.1016/j.ajur.2018.06.005
- [20] Di Mauro D, La Rosa VL, Cimino S, Di Grazia E. Clinical and psychological outcomes of patients undergoing Retrograde Intrarenal Surgery and Miniaturised Percutaneous Nephrolithotomy for kidney stones. A preliminary study. *Archivio Italiano di Urologia Andrologia*. 2020 Jan; 91(4):256-260. doi: 10.4081/aiua.2019.4.256
- [21] Chung DY, Kang DH, Cho KS, Jeong WS, Jung HD, Kwon JK, et al. Comparison of stone-free rates following shock wave lithotripsy, percutaneous

nephrolithotomy, and retrograde intrarenal surgery for treatment of renal stones: A systematic review and network meta-analysis. *PLoS One*. 2019 Feb; 14(2):e0211316. doi: 10.1371/journal.pone.0211316

- [22] Atis G, Gurbuz C, Arikan O, Kilic M, Pelit S, Canakci C, et al. Retrograde intrarenal surgery for the treatment of renal stones in patients with a solitary kidney. *Urology*. 2013 Aug; 82(2):290-4. doi: 10.1016/j.urology.2013.04.013