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Factors affecting the success and perioperative complications of retrograde intrarenal surgery: a retrospective clinical analysis

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Abstract

Background and objective:
Many factors are presumed to have an impact on the results of retrograde intra renal surgery. In the current study, our objective was to actuate the possible factors influencing the stone-free rates and complications post lone-session retrograde intrarenal surgery for renal calculi. Stone-free rates
Methods: Overall 200 patients who undergone retrograde intra renal surgery between January 2019 and March 2022 were evaluated, retrospectively. Success was decided if there were no residual fragments on pain X-ray and ultrasonography. Patient demographics, stone characteristics, perioperative data were assessed and analyzed to actuate predictive factors influencing stone-free rates and perioperative morbidities.

Results: Two hundred patients with a mean age of 41.12±14.37 years were evaluated. The mean stone size was 1.815 ± 2.107 millimeters (mm), mean stone density was 969.63 ± 345.307 Hounsfield unit. The immediate SFR was (76.8±0.42) while the final SFR (single session) was 87.9±0.46. Thirty-seven patients (18.5%) developed complications, the preponderance of them 86% were minor complications (Clavien grade I and II). In multivariate regression analysis, multiple renal stones and ureteral access sheath use were constitute to be statically significant predictors of stone-free status. Moreover, multivariate regression analysis revealed that operative time, lasing time and stone opacity stones were statistically significant factors influencing perioperative complications.

Conclusion: Success rates inversely related to stones number and ureteral access sheath usage. While prolonged operation time, lasing time, and higher stone density could be a more reliable predictor of perioperative complication development.

Keywords: Flexible ureteroscopy lithotripsy, Renal stone disease, RIRS, Retrograde intrarenal surgery

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Introduction

Urinary system stone disease is an important health problem and it's dated back to ancient centuries, there has been a marked increase in the prevalence and incidence of urolithiasis, this probably results from westernization of diet habits which made it more prevalent, impacting many people's lives. [1] Technological advancements in visual quality, angulation and miniaturization of the scopes allowed its utilization in stone management. In addition to advancement in skills of Urosurgeons performing retrograde intrarenal surgery (RIRS), all made RIRS an attempting alternative to other stone management modalities like percutaneous nephrolithotomy (PCNL) and extra corporal shockwave lithotripsy (ESWL). [2] Owing to its safety due to the fewer and minor complications and high stone clearance rates reaching about 73-92%, in recent years, both European association of urology (EAU) and American urological association of urology (AUA) now recommend either ESWL, MPCNL (mini percutaneous nephrolithotomy), or RIRS for the treatment management of small renal calculi (10–20 mm). [3] However. Today due to advances in laser technology and flexible ureterorenoscope, retrograde intrarenal surgery has gained substantial popularity worldwide and is considered one of the first-line treatment options for the active removal of renal stones, and even more RIRS is used for the treatment of stones>20mm in size .[4]

The aim of the renal stone removal surgery is to clear the stones with minimal complications. RIRS is a safe method due to the fewer and minor complications, however it may require several sessions that may result in extra cost and stress.[5]

Many factors extensively studied in the literatures including stone size, location, number, opacity, location, ureteral access sheath (UAS) usage, preoperative stenting, digress of hydronephrosis renal malformation, operation time, lasing time, and type of anesthesia, all were presumed to have an impact on the results of retrograde intra renal surgery, predicting the SFR and perioperative complications after the RIRS procedure, but the results were contradicted .[6, 7]

Here in our study we have tried to elaborate and underline various risk factors that may have an influence on the end results of RIRS in terms of stone-free rate and predict possible perioperative complications after surgery.

Patients and methods

Between January 2019 and March 2022, 200 patients with renal calculi smaller than 20mm treated with RIRS by the same skillful endourologists were retrospectively reviewed and evaluated. The study was approved by the Ethical Committee of KHCMS.

Patients were counseled thoroughly regarding treatment choices, possible complications, and the likely need for a staged or auxiliary procedure to achieve a gratifying stone free.

Renal stone size, position, and densities were assessed before the procedure by a non-contrast computed tomography (NCCT). The stone size was defined as the greatest length of the calculi on NCCT, in cases of numerous stones, the total stone burden was concluded by adding the greatest length of each stone.

Evaluated factors include patients' demographic characteristics, and renal stone characteristics such as stone size (mm), laterality, location, number of stones, and stone densities. Other evaluated parameters included previous intervention for stone clearance, ureteral stent placement preoperatively, degree of hydronephrosis, renal malformations, ureteral access sheath(UAS) insertion, operative time (without anesthetic time), type of anesthesia, time of lasing, fluoroscopy usage, stone-free rate, time of staying in hospital, and more on complications which were recorded determined using the Clavien classification system.The first check out was 2 weeks after the intervention (double-J stent removal was scheduled at this time). Next evaluations were done at 12 weeks with x-ray kidney ureter bladder (KUB) and ultrasonography (US). The Overall stone-free rate was determined 3 months postoperatively and was classified either as complete clearance of stone (detailed as the absence of stone residual) or residual stones.All patients are covered with prophylactic parenteral antibiotics 1 hour before the operation. FURSL was accomplished under spinal or general anesthesia in a lithotomy position. The procedure started with a semi-rigid ureteroscope 7.5 -9.5 Fr (Karl Storz Endoscopy, Tuttlingen Germany), making the ureter to be peaceably dilated and checking the presence of ureteral stones or strictures. A zebra nitinol guide wire 0.032/0.035-inch with a stiff body and flexible tip (Boston Scientific, Marlborough, Massachusetts, USA) was inserted up to the ureteropelvic junction (UPJ). A ureteral access sheath (UAS) (9.5/11.5 F or 11/13 F) (Boston Scientific, Massachusetts, USA) was glossed over the guide wire. A flexible ureteroscope 7.5 Fr flexible URS (Storz Flex-X2, X2S Tuttlingen, Germany) was forwarded through the UAS, unless UAS was not inserted, a flexible ureterorenoscopy was advanced over the guide wire. Lithotripsy was performed using the Holmium: YAG laser (Quanta system, cyber Ho 60 holmium laser system, Milan-Italy) through 200 μm fiber by 0.5–0.8 J power applied at 15–30 Hz frequency. During the procedure the dusting technique was used; this accession will defeat the obligations for stone retrieval. We did not use basket extraction of stones. The calculus comminuted thoroughly, and stone fragments were considered so small that can be passedspontaneously. At the end of the operation, a Double-J (JJ) stent was inserted.

Data analysis was performed by using the IBM Statistical Package for Social Sciences Mac. Version 21 (IBM SPSS Corp., Armonk, NY, USA), a simple linear regression test was used to evaluate the effect of variables, and paired T-test was used to compare pre and post-operative changes. A p value of 0.05 was considered statistically significant, the confidence interval was set at 0.05

Results

Two-hundred patients who undergone RIRS for renal stones ≤ 2 cm in diameter were recruited in the study. 138 males (68.3%) and 62 females (30.7%), with a mean age of 41.12 years. Detailed patient demographics, stone characteristics, and preoperative variables are concisely summarized in (Table 1).

Mean stone size ranged from 1.815 ± 2.107 mm with an overall density of 969.63 ± 345.307. The mean operative duration was 49.13±18.39 days, while the mean lasing time was 29.28± 13.78 min. The immediate SFR was (76.8±0.42), and increased up to 87.9±0.46 at three months after surgery (single session).Thirty-seven patients (18.5%) developed complications, the majority 86% of them were minor complications (Clavien grade I and II), and all were managed conservatively. Fifteen patients (7.5%) develop a transient postoperative fever (temperature >38°C) that was successfully treated with antibiotics and antipyretics, and twelve patients (6%) develop grade one ureteral wall mucosal injury. Three (1.5%) patients developed Stienstrasse (Clavien III_b), two of them were successfully treated conservatively and one necessitate ureteroscopic removal of stones. Two patients 2(1.0%) developed urosepsis (Clavien IV_b), developed urosepsis which was admitted to the hospital and resolved on medical treatment and fully recovered in 14 days. Detailed perioperative outcomes are summarized in Table (1).

Table (1): Patient demographics, renal stone characteristics and perioperative outcomes.

	RIRS	p value
Number of patients	200	
Mean age ± SD (year)	41.12±14.37	
Gender Female (%) Male (%)	 68(34) 132(66)	0.001[(a)]
Mean stone size ±SD (mm)	1.815 ± 3.107	
Previous intervention (%) (-) (+)	 112(56.3) 87(43.7)	0.001[(a)]
Laterality (%) Right Left	 89(44.5) 111(55.5)	0.001[(a)]
Stone number (%) Single Multiple	 111(55.6) 89(44.4)	
Stone localization Upper pole (%) Mid pole (%) Lower pole (%) Pelvis (%) Multiple (%)	 41 (2.5) 20(10) 37 (18.5) 60(30) 42 (21)	 0.001[(b)]
Mean stone density ±SD (H.U)	969.63 ± 345.307	
Hydronephrosis (%) Mild or nil Moderate Severe	 152(75.7) 35(17.2) 13(6.1)	 0.001[(b)]
Mean hospitalization time ± SD (day)	1.03±0.439	
Stone free rate SFR % Immediate SFR Final SFR (3 month)	 76.5% ±0.42 87.5% ±0.46	0.001[(c)]
Complications (clavien) % clavien I Fever mucosal injury Clavien II UTI need antibiotics Clavien G III_b Stienstrasse Clavien G IV_b Sepsis	 15(7.5) 12(6) 5(2.5) 3(1.5) 2(1.0) 	0.001[(b)]

*one sample binominal test, b: chi-square test, c: paired T-test

Stone-free rates according to Univariate and Multivariate analysis of variables are listed in table 2. Among the Evaluated factors that influence the stone-free rate, in
Univariate and Multivariate regression analysis of the number of stones and UAS usage were established to be an independent convincing predictor of SFS (P < .05). While other variables assessed including stone densities (HU), stone size, location, operation time, lasing time, type of anesthesia, degree of hydronephrosis, renal malformation, preoperative stenting, and fluoroscopy usage all failed to reach a statistically significant difference to predict the SFR status (P>.05).
On the other hand, when it comes to evaluating the factors affecting perioperative complications, univariate and Multivariate regression analysis showed operative time, lasing time, and stone opacity (HU), to be a significant factor influencing and predicting perioperative complications (P < .05).

Table (2): Univariate and multivariate logistic regression analyses of variables predicting a stone-free rate after RIRS procedure.

Data	Uni variant values			Multivariant value		
	odds Ratio	95 % C.I	P. value	odds Ratio	95 % C.I	p value
HU	0.999	0.998 – 1.001	0.232	0.999	0.997 -1.001	0.344
Operative time	0.988	0.964 – 1.012	0.315	0.920	0.853 – 0.992	0.279
Lasing time	1.002	0.970 – 1.035	0.900	1.101	1.003 – 1.209	0.342
NO. of stones	0.244	0.081 – 0.734	0.012*	0.233	0.051 – 1.064	0.030*
Stone size	1.003	0.914 – 1.102	0.944	1.151	0.816 – 1.624	0.422
UAS	0.209	0.072 – 0.607	0.004*	0.132	0.035 – 0.505	0.003*
Preoperative stent placement	1.461	0.394 – 5.419	0.571	0.322	0.056 – 1.854	0.205
Stone location	1.001	0.990 – 1.012	0.886	0.606	0.302 – 1.21	0.159
Type of anesthesia	0.000	0.000	0.999	91143302.1	0.000	0.999
Degree of hydronephrosis	.0882	0.391 – 1.988	0.761	1.068	0.402 – 20838	0.894
Fluro use	0.489	0.143 – 1.675	0.255	0.730	0.170 – 3.136	0.672

While other studied variables including stone size, location, number, type of anesthesia, degree of hydronephrosis, renal malformation, preoperative stenting, UAs usage, and fluoroscopy usage all failed to reach a statistically significant difference to predict perioperative complications (P>0.05) Table (3).

Table (3): Univariate and multivariate logistic regression analyses of variables predicting perioperative complications after RIRS procedure.

	Uni variant values			Multivariant value		
Variables	odds Ratio	95 % C.I	P. value	odds Ratio	95 % C.I	p value
HU	0.999	0.998 – 1.000	0.028*	0.999	0.998 – 1.000	0.045*
Operative time	1.023	0.971 – 1.079	0.039*	1.039	1.016 – 1.062	0.001*
Lasing time	1.018	0.953 – 1.088	0.029*	1.046	1.017 – 1.075	0.001*
NO. of stones	1.254	0.437 – 3.603	0.674	1.198	0.861 – 4.183	0.112
Stone size	0.995	0.902 – 1.098	0.923	1.004	0.942 – 1.069	0.910
UAS	1.342	0.488 – 3.688	0.569	1.149	0.502 – 2.634	0.742
Preoperative stent placement	0.277	0.105 – 0.731	0.060	4.458	1.904 – 10.441	0.071
Stone location	1.262	0.804 – 1.982	0.312	0.999	0.992 – 1.006	0.785
Type of anesthesia	0.813	0.128 – 5.10	0.826	0.785	0.161 – 3.831	0.765
Degree of hydronephrosis	1.316	0.589 – 2.940	0.503	1.031	0.542 – 1.962	0.925
Fluro use	4.626	0.959 – 22.301	0.066	0.557	0.153 – 2.027	0.375

Discussion

The most common pathological disease affecting the urinary tract nowadays is stone disease its prevalence is notably high among the population more than 10% are reported to have a stone. [6,7]

Flexible Ureteroscope had made a huge leap from its introduction in the urological field empowering its diagnostic and therapeutic capabilities, with lower complications and nearly as high success rates as PCNL it's an interesting alternative in the management of renal stones sized less than 20 mm. [8,9]

SFR is considered the most important aspect of any study reflecting the efficacy of the surgical technique, in our analysis, the final stone clearance after 12 weeks was (87.9±0.46) which lies in between other publications which report an SFR of 84-

92.8% [10,11], while others reporting lower SFR values. [12–14]

According to the results of our study, among the Evaluated factors multicaliceal stones and UAS usage were two independent predictors of SFR. While other variables assessed including stone densities (HU), stone size, location, operation time, lasing time, type of anesthesia, degree of hydronephrosis, renal malformation, preoperative stenting, and fluoroscopy usage all failed to reach a statistically significant difference to predict the SFR status. Our results were similar to the literature, [11,13,15,16,18-20] whereas others contradicted those results. [13,14,17,20-27]

Thirty-seven patients (18.5%) developed complications, the majority 86% of them were minor complications (Clavien grade I and II), and all were handled conservatively. A global study conducted by the clinical research office of the endourological society estimated overall complication rates after RIRS to be low as (3.5%),[28] Breda et al. reported a higher complications ratio as (8%)[29], however, other publications reported higher 15.1% and 40% complication ratio. [30,31]

Besides this, we have tried to underline risk factors that may increment the incidence of peri-operative complications. Univariate and Multivariate regression analysis showed operative time, lasing time, and stone opacity (HU), to be a significant factor influencing and predicting perioperative complications ($P < .05$). While other studied variables including stone size, location, number, type of anesthesia, degree of hydronephrosis, renal malformation, preoperative stenting, UAs usage, and fluoroscopy usage all failed to reach a statistically significant difference to predict perioperative complications ($P>.05$).

Hard stones which may need more lasing time for stone fragmentation, consequently longer operative time and hence releasing more bacterial load inside the pelvicalyceal system superadded by a higher chance of mucosal injury and hence more inflammatory response, [32,33,35] in turn reflecting increased perioperative complications, our finding was following many researchers findings .[32-34]

The drawback of our study includes its retrospective nature, absence of stone analysis. Further drawback is that the stone clearance was determined from x-ray KUB films and ultrasonography, which is a lessor method to unenhanced CT in discovering stone fragments. A multicenter prospective and randomized study with a large cohort and a longer-term follow-up would be much more desirable.

Inspire by the above limitations mentioned, we aimed in our study at presenting our findings from RIRS experience, which we advocate that our results may contribute helpful data on predictive factors for successful RIRS. When RIRS taking into account for treatment of renal stones, these compilations may be a convenient indicator for determining the prognosis of treatment after RIRS.

Conclusion

RIRS is an effective and safe surgical method in the treatment of renal stones. In our review, stones number and UAS were considered the most reliable and significant factors predicting SFR after RIRS. Success rates inversely related to stones number and UAS use may help achieve SFS.

While prolonged operation time, longer lasing time, and higher stone density were considered to be a decisive predictors of perioperative complication development in RIRS procedure. Appropriate preoperative management should be outlined, according to these predictors to predict higher SFR and to predict and prevent peri-operative complications.

Conflict of interest

The authors declare that there is no conflict of interest.

References

1. Dai JC, Pearle MS. Diet and Stone Disease in 2022. J Clin Med. 2022; 11(16):4740.
2. Marshall VF. Fiber optics in urology. J Urol. 1964; 91:110-4.
3. Grasso M, Bagley D. Small diameter, actively deflectable, flexible ureteropyeloscopy. J Urol. 1998; 160(5):1648-53.
4. Assimos D, Krambeck A, Miller NL, et al. Surgical Management of Stones: American Urological Association/Endourological Society Guideline, PART I. J Urol. 2016; 196(4):1153-60.
5. Turk C, Petrik A, Sarica K, et al, Guidelines EAU. On interventional treatment for Urolithiasis. Eur Urol.2016; 69(3):475–82.
6. Hesse A, Brändle E, Wilbert D, Köhrmann K, Alken P. Study on the prevalence and incidence of urolithiasis in Germany comparing the years 1979 vs. 2000. Eur Urol. 2003; 44(6):709-13. Available from: doi: 10.1016/s0302-2838(03)00415-9.
7. Scales CD, Smith AC, Hanley JM, Saigal CS. Prevalence of Kidney Stones in the United States. Eur Urol 2012; 62(1):160-52012; 62:160–5.
8. Akar EC, Knudsen BE. Flexible ureteroscopy versus percutaneous nephrolithotomy as primary treatment for renal stones 2 cm or greater. Reports Med Imaging. 2013; 6(1):1–10.
9. Pan J, Chen Q, Xue W, et al. RIRS versus MPCNL for single renal stone of 2–3 cm: clinical outcome and cost-effective analysis in Chinese medical setting. Urolithiasis. 2013; 41(1):73–8.
10. 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 J Urol. 2021; 27(1).
11. Alazaby H, Khalil M, Omar R, et al. Outcome of retrograde flexible ureterorenoscopy and laser lithotripsy for treatment of multiple renal stones. African J Urol. 2018; 24(2):146–51.
12. Zeng G, Zhao Z, Yang F, Zhong W, Wu W, Chen W. Retrograde intrarenal surgery with combined spinal-epidural vs general anesthesia: A prospective randomized controlled trial. J Endourol. 2015; 29(4):401–5.
13. Lim SH, Jeong BC, Seo S Il, Jeon SS, Han DH. Treatment outcomes of retrograde intrarenal surgery for renal stones and predictive factors of stone-free. Korean J Urol. 2010; 51(11):777–82.
14. Ho CC, Hee TG, Hong GE, Singam P, Bahadzor B, Zainuddin ZM. Outcomes and safety of retrograde intra-renal surgery for renal stones less than 2 cm in size. Nephrourol Mon. 2012; 4(2):454–7.
15. Abd El Hamed AM, Elmoghazy H, Aldahshoury M, et al. Single session vs two sessions of flexible ureterosopy (FURS) for dusting of renal pelvic stones 2-3 cm in diameter: Does stone size or hardness play a role in number of sessions to be applied? Turk Urol Derg. 2017; 43(2):158–61.
16. Kahraman O, Dogan HS, Asci A, Asi T, Haberal HB, Tekgul S. Factors associated with the stone-free status after retrograde intrarenal surgery in children. Int J Clin Pract. 2021; 75(10):1–6.
17. Ito H, Kawahara T, Terao H, et al. Predictive value of attenuation coefficients measured as hounsfield units on noncontrast computed tomography during flexible ureteroscopy with holmium laser lithotripsy: A single-center experience. J Endourol. 2012; 26(9):1125–30.
18. Tonyalı Ş, Yılmaz M, Karaaslan M, Ceylan C, Işıkay L. Prediction of stone-free status after single-session retrograde

intrarenal surgery for renal stones. Turk J Urol. 2018; 44(6):473-477.

19. Perlmutter AE, Talug C, Tarry WF, Zaslau S, Mohseni H, Kandzari SJ. Impact of Stone Location on Success Rates of Endoscopic Lithotripsy for Nephrolithiasis. Urology. 2008; 71(2):214–7.

20. Tonyalı Ş, Yılmaz M, Karaaslan M, Ceylan C, Işıkay L. Prediction of stone-free status after single-session retrograde intrarenal surgery for renal stones. Turkish J Urol. 2018; 44(6):473–7.

21. Tastemur S, Senel S, Kizilkan Y, Ozden C. Evaluation of the anatomical factors affecting the success of retrograde intrarenal surgery for isolated lower pole kidney stones. Urolithiasis. 2022; 50(1):65–70.

22. Sari S, Caniklioglu M, Oztekin Ü, Selmi V, Taspinar MS, Isikay L. Factors Affecting Retrograde Intrarenal Surgery Success: 6 Years' Experience of a Clinic in Central Anatolia. J Laparoendosc Adv Surg Tech. 2020; 30(12):1340–3.

23. Karim SS, Hanna L, Geraghty R, Somani BK. Role of pelvicalyceal anatomy in the outcomes of retrograde intrarenal surgery (RIRS) for lower pole stones: outcomes with a systematic review of literature. Urolithiasis. 2020; 48(3):263–70.

24. Jeong JY, Kim JC, Kang DH, Lee JY. Digital videoscopic retrograde intrarenal surgeries for renal stones: Time-to-maximal stone length ratio analysis. Yonsei Med J. 2018; 59(2):303–9.

25. Chu L, Sternberg KM, Averch TD. Preoperative stenting decreases operative time and reoperative rates of ureteroscopy. J Endourol. 2011; 25(5):751–4.

26. Sung LH, Cho DY. The role of preoperative ureteral stenting in retrograde intrarenal surgery in renal stone patients: A propensity score-matched study. Transl Androl Urol. 2020; 9(2):276–83.

27. Shields JM, Bird VG, Graves R, Gómez-marín O. Impact of Preoperative Ureteral Stenting on Outcome of Ureteroscopic Treatment for Urinary Lithiasis. J UROL. 2009; 182(6):2768–74.

28. De La Rosette J, Denstedt J, Geavlete P, et al. The clinical research office of the endourological society ureteroscopy global study: Indications, complications, and outcomes in 11,885 patients. J Endourol. 2014; 28(2):131–9.

29. Breda A, Angerri O. Retrograde intrarenal surgery for kidney stones larger than 2.5cm. Curr Opin Urol. 2014; 24(2):179–83.

30. Berardinelli F, Proietti S, Cindolo L, et al. A prospective multicenter European study on flexible ureterorenoscopy for the management of renal stone. Int Braz J Urol. 2016; 42(3):479–86.

31. Niwa N, Matsumoto K, Ohigashi T, et al. Clinical Outcomes of Retrograde Intrarenal Surgery as a Primary Treatment for Staghorn Calculi: A Single-Center Experience. Clin Med Insights Urol. 2019; 12:117956111985477.

32. Degirmenci T, Yarımo S. Factor's affecting intraoperative and postoperative complications of RIRS classified by the Clavien and Satava grading systems. 2021; 1–8. Available from: DOI:10.22541/au.161590005.56042638/v1

33. Zhang H, Jiang T, Gao R, et al. Risk factors of infectious complications after retrograde intrarenal surgery: a retrospective clinical analysis. J Int Med Res. 2020; 48(9):4–12.

34. Doğan HS, Şahin A, Çetinkaya Y, Akdoğan B, Özden E, Kendi S. Antibiotic prophylaxis in percutaneous nephrolithotomy: Prospective study in 81 patients. J Endourol. 2002; 16(9):649–53.

35. Senel S, Ozden C, Aslan Y, Kizilkan Y, Gokkaya CS, Aktas BK. Can the Stone Scoring Systems Be Used to Predict Infective Complications of Retrograde Intrarenal Surgery? Med Princ Pract. 2022; 31(3):231–7.