

Choosing Retrograde Intrarenal Surgery Versus Mini-Percutaneous Nephrolithotomy in Proximal Ureteric Stones

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ABSTRACT

Background

Proximal ureteric stone is one of the common presentations in renal stones disease. Safety, efficacy and stone free rate of retrograde intrarenal surgery and mini percutaneous nephrolithotomy are controversial. Thus, we aim to compare the efficacy, safety and stone free rates of two procedures.

Methods

This was a retrospective observational study including 60 cases divided into group A (Retrograde-intrarenal Surgery) and Group B (Mini-Percutaneous Surgery) between September 2022 to August 2023. Ethical approval was obtained from Institutional review Committee (Reference number: CMC-IRC/079/080-100). Convenience sampling was done.

Results

The mean age in group A was 43.83 ± 16.92 years and in group B was 46.33 ± 15.78 years with no significant p value ($p = 0.112$). Post operative haemoglobin changes in group A was 0.266 ± 0.279 gram% and in group B was 1.493 ± 0.360 gram% with significant P value of 0.001. Similarly the duration of operation in Group A was 42.43 ± 13.783 minutes and in group B was 36.30 ± 7.173 minutes with significant P value 0.035. However the stone free rate was higher in group B than Group A without significant P value of 0.064. Both of the groups have minor post operative complication of fever and mild haematuria.

Conclusions

The stones clearance rate of mini percutaneous nephrolithotomy is better than retrograde intrarenal surgery and the safety of retrograde intrarenal surgery is higher than of mini percutaneous surgery.

Keywords: laser; miniaturization; post operative complications.

INTRODUCTION

Proximal ureteric stones and renal stones are the most common diseases in urology. In recent years with the development of medical equipments and technologies, extracorporeal shock wave lithotripsy (ESWL), retrograde intrarenal surgery (RIRS), percutaneous nephrolithotomy (PCNL) and other minimally invasive or non-invasive treatment methods appear successive in terms of stone free rate (SFR) and safety.^{1,2} Minimally invasive surgery is usually chosen in ESWL failure cases. PCNL, m-pcni and ultra pcni have become one of the preferred methods

because of their developing technologies in vision quality and miniaturization of the scope. On the other hand, the bending of proximal tips of scope gives a huge advantage in clearing the stones in RIRS.³ In the guidelines issued by the American Urological Association (AUA), RIRS is recommended for kidney stones <2 cm in diameter, and PCNL is recommended for renal and proximal ureteric calculi >2 cm in diameter and/or more complicated stones. Jacquemet et al. compared the stones clearance rate and complication rate of 371 cases of renal calculi in different sites by RIRS. They found that there was no

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difference in the efficacy of RIRS in the treatment of renal calculi and other renal stones.⁴ Professor Cheng had used RIRS to treat staghorn calculi and achieved good results, and proposed that RIRS can handle all the stones that PCNL can handle, and it is expected to replace high-risk surgery such as PCNL in the future.⁵ It has been reported in the literature that PCNL and RIRS are both feasible and effective methods in the current comparative study of medium and large renal stone treatments.⁶ Both procedures are the first-line method for the treatment of upper urinary calculi. Therefore, it is quite meaningful to compare the efficacy and safety of the two surgical procedures.

METHODS

This was a retrospective observational study conducted in the Department of Urology of Chitwan Medical College, Bharatpur-10, Nepal. All the patients coming to the Chitwan Medical College Teaching Hospital (CMCTH) between September 1st 2022 and August 31st, 2023 with proximal ureteric stones of ≤ 2 cm were enrolled in the study using non probability convenience sampling technique. Ethical approval was taken from Institutional Review committee Chitwan Medical College (Reference number: CMC-IRC/079/080-100) while informed and written consent was taken from all the patients after explaining detailed procedure. The patients were divided in two group A (RIRS; n=30) and group B (M-PCNL; n= 30). The prefilled performa and patients' record files were used to collect the data. The patents demographic, primary outcome, stone-free rate (SFR), complications, hospital stay, operative time and reduction in hemoglobin level were evaluated. The sample size was calculated using the following formula: $n = Z^2 \times p \times q / e^2 = 1.96^2 \times 0.94 \times 0.06 / 0.1^2 = 22$

where, n= minimum required sample size, Z= 1.96 at 95% Confidence Interval (CI), p= prevalence of stone clearance taken from previous study, 94%.⁷ $q = 1 - p$, e= margin of error=10%. The minimum required sample size was 22. The final sample size taken was 60. All the RIRS cases were done with Karl Storz flexX2 with accessible sheath of 9.5/11.5 Fr or above. The presented and cases which cannot be scoped were

excluded from the study. Mini PCNL were performed with standard technique with wolf nephroscope of 12 French with a tract size not more than 18 French. No percutaneous nephrostomy tube was placed. All the arms were concluded with placing DJ stent at the end. Patients with stone size less or equal to 20mm, age more or equal to 15 years, All the cases should be operated in sterile urine, All the cases should be primary cases were included in this study while presenting cases, Unable to scope the cases, Cases which has gone primary treatment for stones earlier were excluded from this study. Data were entered and analyzed using SPSS version 20. Data was analyzed by using descriptive and inferential statistical tools. In the descriptive statistics for categorical variable frequency and percentage were calculated while for continuous variable mean and standard deviation. In the inferential statistical person Chi square test were used while for continuous variable independent t-test were used after checking the normality of the data.

RESULTS

Total of 60 patients were obtained for proximal ureteric stones. They were divided into two groups. Group A comprising 30 cases of RIRS, group B comprising of 30 cases of mini PCNL. The mean age in group A was 43.83 years with Standard deviation of 16.92. Similarly, in Group B was 46.33 years with standard deviation of 15.78. There was no significant p value between the groups. The males were more affected than the female and these findings were found to be statistically insignificant (Table 1).

Variable	RIRS	M-PCNL	p- value
Age (years)	43.83 ± 16.92	46.33 ± 15.78	0.112
Sex			
Male	19 (63.33%)	21 (70.00%)	0.392
Female	11 (36.66%)	9(30.00%)	

The hospital stay in group A was 3.20 days with standard deviation of 0.84 and in the group B was 3.93 days with the standard deviation of 0.45 days. The p value was significant (p = 0.001) (Table 2).

As haemoglobin changes are one of the important

Variable	RIRS	M-PCNL	p-value
Duration of hospital stays (days)	3.2 ± 0.84	3.93 ± 0.45	0.001

parameters for the bleeding, the pre and post operative haemoglobin changes were obtained. The post operative haemoglobin changes in group A was 0.266 gm% with standard deviation of 0.279 gm%. In group B the post operative haemoglobin changes were 1.493 gm% with standard deviation of 0.360 gm% with significant p value of 0.001 (Table 3).

Variable	RIRS	M-PCNL	p-value
Haemoglobin changes (gram %)			
Post operative	0.266 ± 0.279	1.493 ± 0.360	0.001
Duration of operation (minutes)	42.43 ± 13.783	36.30 ± 7.173	0.035

The duration of operation in RIRS group was 42.43 minutes with standard deviation of 13.783 minutes and in the M-PCNL group was 36.30 minutes with standard deviation of 7.173 minutes. The operation time was lesser in group B as compared to group A which was statistically significant p = 0.035 as shown in the table 3. The mean stone size in RIRS 1617.33³ with standard deviation of 2008.44mm³ and in M-PCNL was 1429.46mm³ with standard deviation of 781.10mm³. There was no statistically significance difference. Similarly, there were no major complication posts operatively in both the arm. They just had minor fever and hematuria. None of them had sepsis or major complications. None of the group has significant obstructive stones and none of them required secondary procedure. The mean stone free rate was like below in the table IV with no significant value (Table 4).

Variable	RIRS	M-PCNL	p-value
Stone free rate	0.27 ± 0.45	0.17 ± 0.37	0.064

No one has under gone blood transfusion (Table 5). Stone free rate was achieved in 76.66% cases in group A while 83.33% in group B. Insignificant stones less than 4 mm were seen in 7 (23.33%) cases in group

Variable	RIRS	M-PCNL	p-value
Stone free rate			
No Stones	23 (76.66%)	25 (83.33%)	0.064
Non Obstructive Stones < 4mm	7(23.33%)	5 (16.66%)	
Reoperation	None	None	

A and 5 (16.66%) in group B. The p value was 0.064 which was insignificant. There were no reoperations in both the group. Both of the groups have no major complications. In RIRS group majority of them had minor fever n = 11(36.66%) and four (13.33%) of them had minor hematuria. Similarly, in M-PCNL group 4(13.33%) of them had minor fever and 12(40.00%) of them had minor hematuria. So assessing them fever was common in RIRS group but hematuria was common in M-PCNL group. Out of them one patient in RIRS group went into sepsis but was successfully managed with conservative treatment with no ventilator support.

DISCUSSION

Both RIRS and M-PCNL are valuable procedures in the treatment of proximal ureteric stones. Stones clearance rate is the most important outcome measure for evaluating the effectiveness of RIRS and PCNL. Stone clearance rate was defined at a follow-up of 1-3 months after the operation, the last imaging examination (X-ray, ultrasonography or CT-KUB) with no residual stones or residual stones less than 4 mm without clinical obstructive symptoms. In our study, the stone clearance rates of M-PCNL were higher than RIRS. Davis et al. reported the stone clearance rate of M-PCNL was higher than that of RIRS in their meta-analysis and the results were consistent with us.⁸ The efficacy of RIRS in the treatment of large kidney stones reported that stone size is the main parameter affecting the success rate of RIRS.^{9,10} The success rate of RIRS alters as the size of the stone changes. However, in the study by Davis et al., the stone size was sub grouped separately and the stone clearance rate of M-PCNL was higher in the kidney stone group >2 cm than in the kidney stone group <2 cm that were subjected to RIRS.⁸ The SFR is really dependant on the size of the stone is difficult

to prove and a large data and evidenced base meta-analysis is warranted. The operation time is an indirect indicator of the patient undergoing surgery and is related to the experience of surgeons and equipments availability.¹¹ Studies have reported that RIRS surgery is longer than PCNL.¹²⁻¹⁶ which is similar in our cases too with statistically significant. Common complications of proximal ureteric stones surgery include renal collecting system or ureteral perforation/laceration, organ injury, bacteremia, sepsis, fever, intra-operative or postoperative bleeding, ureteral stricture and urine leaks. The incidence of PCNL complications increases as the diameter of the working tract increases.¹²⁻¹⁷ It has been reported that M-PCNL (according to the working tract ≤ 20 Fr) has a similar stone clearance rate and fewer complications than the standard tract PCNL (working tract = 30Fr).^{15,18} The amount of haemoglobin decreased, blood transfusion rate, bleeding or hematuria is important for evaluating the safety of surgery. In terms of the amount of haemoglobin decreased before and after surgery, it was seen that the amount of haemoglobin decreased before and after PCNL surgery was more than RIRS suggesting that the amount of bleeding in M-PCNL was more. (P=0.001) The reason for this may be that the kidney is rich in blood supply and the damage is inevitable during puncture and tract dilatation leading to blood loss. An arteriovenous fistula or pseudoaneurysm is a well known source of postoperative bleeding from PCNL.¹⁹ On the

other hand RIRS follows the physiological pathway without disrupting the parenchyma thus bleeding can be prevented.⁵ There was no significant difference in the incidence of postoperative infection or fever between RIRS and PCNL. In summary, RIRS and M-PCNL have advantages and disadvantages in the treatment of proximal ureteric stones. M-PCNL has higher stone clearance rate than RIRS, and RIRS has the advantage of less intraoperative/postoperative bleeding. Therefore, the appropriate surgical method should be selected according to the specific conditions of the patient, the experience of the doctor, and the conditions of the hospital.

CONCLUSIONS

In the treatment of proximal ureteric stones, the stones clearance rate of M-PCNL is higher than RIRS. The decline of haemoglobin, the incidence of postoperative bleeding or hematuria in M-PCNL group was significantly higher than that of RIRS group, so the safety of RIRS is higher than M-PCNL. Therefore, appropriate surgical methods should be selected for the patients by individualizing the conditions.

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