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Retrograde Intrarenal Surgery versus Mini-Percutaneous Nephrolithotomy for Lower Calyceal Stones of ≤ 2 cm

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ABSTRACT

Introduction

Renal stones are one of the common urological problems. The optimal management of lower calyceal renal calculi of 1-2 cm is still debatable. The objective of this research is to assess the safety, efficacy, and stone-free rate of retrograde intrarenal surgery and mini-percutaneous nephrolithotomy for the management of lower calyceal stones of 1-2 cm.

Methods

A prospective comparative study was conducted among 30 patients which were divided in two group (A and B) prospectively with lower calyceal stones of 1-2 cm. Group A were treated with retrograde intra renal surgery while Group B were treated with mini percutaneous nephrolithotomy.

Results

The mean age of patient in Group-A was 44.27±17.10 year and in Group-B was 45.27±16.11 year. The hospital stay in Group-A was 3.47±0.62 and in Group-B was 4.50±0.73 days. The stone size in Group-A was 13.30±2.21 mm and in Group-B was 15.60±2.55 with p-value of 0.381. The duration of operation time in Group-A was79.37±13.96 minutes and in Group-B was 62.53±7.41 minutes with p value of 0.091.

Conclusions

Both retrograde intrarenal surgery and mini-percutaneous nephrolithotomy procedure are comparable. Mini percutaneous nephrolithotomy has a better stone free rate and haematuria is more common but retrograde intrarenal surgery has less hospital stay and post operative pyrexia is more common.

Keywords: complications; laser; safety; stone free rate.

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INTRODUCTION

Renal stones are one of the common urological problems.[1] The optimal management of lower calyceal renal calculi of 1-2 cm is still debatable. Shockwave lithotripsy (SWL) was considered to be the best method for treating lower calyceal stones. However, the stone-free rates (SFRs) for SWL depend upon the stone density, unfavorable calyceal angle and the body habitus of the patient. Therefore, the SFR range from 37%-68%.[2,3] Percutaneous nephrolithotomy (PCNL) is one of the options for the management of lower caliceal stone but with the tract size of 30 French it has higher complication rate. With the miniaturizing the size of the tract 14-20 Fr m-PCNL with no nephrostomy tube the complications has dramatically changed.[4] RIRS is another option than ESWL with better Stone free rate.[5] Each technique has its advantages and disadvantages.[6] Several studies have been conducted to compare RIRS and m-PCNL in terms of SFR and their safety. All of them have limitations and their definition of success.[7-9] The aim of the present study was to assess the safety, efficacy, and SFR of RIRS and m-PCNL in the management of lower calyceal stones of 1-2cm.

METHODS

This is a prospective comparative study carried out between October 2022 and March 2023. All the patients with stone size of 1-2cm at lower calyceal stone were included in the study as a convenience sampling. A total of thirty patients were included in each group. Ethical approval was taken from Chitwan Medical college-Institutional Review Committee (IRC No. CMC-IRC/079/080/101). An informed written consent was taken from the patient who was ready to enroll in the study. Allocation of the procedure was done by simple lottery method on the day of surgery. The patients demographic data, hospital stay, stone size, density, duration of operation time, post-operative haemoglobin changes, post-operative complications, blood transfusion rate and stone free rate were calculated by the SPSS 20 version. Comparison between groups was performed using the Student's t-test. Comparison between categorical data (number/percentage) was performed using the chi-squared test. A $P < 0.05$ was considered to indicate statistical significance. All the patients were evaluates by 128 slice computed tomography scan. The inclusion criteria included all adult patients with solitary lower calyceal stones of 1-2cm. The exclusion criteria included: patients aged <18 years, multiple renal stones, renal pelvic stone, stones of >2 cm, renal stones in anomalous kidney, bilateral renal stones, patients in renal failure, bleeding coagulopathy, features of obstructive sepsis and unsterile urine culture. The prophylactic antibiotic ceftriaxone 1 gm was given to each group prior to procedure. All the procedure was done by the single urosurgeon. In group A there are thirty patients underwent RIRS in the dorsal lithotomy position under general anaesthesia. Thorough cystoscopy was performed with a 19-Fr sheath. A 0.035-mm straight guide wire was inserted through the ureteric orifice to the renal pelvis. A 9.5/115 Fr ureteric access sheath (Cook Medical) was used in every cases. A 8.5-Fr flexible fibreoptic ureteroscope (Karl Storz, X2, Germany) was passed in a retrograde fashion to access the stone. The stones were fragmented using a 100 Watt Lumenis Ho:YAG laser with 200-365 μm fiber with energy setting of 0.2-0.6 Joules and a frequency of 30-40 Hz. A dusting technique was preferred. All the cases were concluded with 6 Fr double J stent. In group B there is also, thirty patients underwent mini-PCNL in the prone position under general anaesthesia. Localisation and proper selection of the puncture sites was aided by contrast injection through the 6-F ureteric catheter placed at the beginning of the procedure. The operation time was included after insertion of the ureteric catheter. A 22 gauze diamond tipped puncture needle was

used to puncture the favorable calyx and serial dilator was used to dilate the tract not more than 20 Fr. A "wolf" 12 Fr mini nephroscope was used. A "Nidhi"pneumatic lithotripter was used to pulverize the stones. At the end of procedure a double J stent was kept with no formal nephrostomy tube.

Plain Kidney, urinary bladder (KUB) was done to all patients before sending home. The double J stent was removed on 2-4 weeks. The ultrasonogram (USG) was done on 4-6 weeks and any significant stone of more than 4mm will proceed to undergo computed tomogram intravenous urogram (CT-IVU) for further evaluation. The next visit of the patient was done in 3, 6 and 12 months or as per the situation.

RESULTS

Both groups had comparable preoperative parameters. A total of 60 patients underwent surgery. The mean age of the RIRS was 44.27± 17.10 years against 45.27±16.11 years with p value of 0.783 as shown in the (Table 1).

Table 1. Comparison of demographical variables. (n=60)

Variables	RIRS	m-PCNL	p-value
Age (Years)	44.27 ± 17.10	45.27± 16.11	0.783
Sex			
Male	18 (60%)	14 (46.66%)	0.301
Female	12 (40%)	16 (53.34%)	
Stone size(mm)	13.30±2.21	15.60±2.55	0.381
HU of stone	1144.73± 121.45	1274.10±142.41	0.937

There were significant drop in haemoglobin changes in m-PCNL group than RIRS group with significant p value. Similarly there were no major complications in both groups as shown in (Table 2).

None of the group needs blood transfusion. The stone free rate was 25 (83.33%) in RIRS as compared to 27(90%) in m-PCNL group with significant p value of <0.001 as shown in (Table 3).

Table 2. Peri-operative outcomes. (n=60)

Variables	RIRS	m-PCNL	p- value
Operative time(minutes)	79.37±13.96	62.53±7.41	0.091
Hospital stay(days)	3.47±0.62	4.50±0.73	<0.001
Post-operative hemoglobin	79.33±13.96	62.53±7.41	<0.001
Postoperative complication(n)			
No complication	22 (73.33%)	5 (16.66%)	
Fever	8 (26.66%)	04(13.33%	<0.001
Hematuria		21 (70%)	

Table 3. Stone free rate (SFR).

Success rate	RIRS (n %)	m-PCNL (n %)	p-value
No Stone	7 (23.33%)	27 (90%)	<0.001
≤ 4mm	18 (60%)	3 (10%)	
≤ 7mm	3(10%)		
≥ 8mm	2(6.66%)		

In RIRS group two of the patient has symptomatic obstructive symptoms and both of them need a 2nd intervention.

DISCUSSION

Most of the studies have compared RIRS/ PCNL to ESWL for renal stones 1-2cm. [10] Albala et al. reported a statistically significantly higher SFR for PCNL compared to SWL for lower calyceal stones of 95.8% and 40%, respectively.[3] A similar result was also reported by Yuruk et al. They compared PCNL and ESWL in 62 patients with lower calyceal stones of <2.0 cm and documented a higher SFR for PCNL as compared to ESWL of 96.7% and 56.7%, respectively.[11] Several studies have compared RIRS to SWL for managing lower calyceal stones. Salem et al. studied in 60 patients with lower calyceal stones of <2.0 cm who were randomly divided into two groups and were managed with either RIRS or SWL.[12]The SFR for RIRS was 96.7% and for SWL was 56.7%, which was statistically significant. Similar results but at 4 weeks postoperatively were also achieved by Singh et al.[13] Lee et al. conducted a study to compare mini-PCNL and RIRS for managing patients with renal stones of >1.0 cm and came to the conclusion that both techniques are safe

and equally effective with a SFR following a single session at 12 weeks follow-up of 85.7% in the mini-PCNL group and 97.0% in the RIRS group (P = 0.199).[14] Two important differences were reported between the different studies comparing these two techniques, the first was the initial stone size studied and the second was the definition of the success. Whilst Albala et al.[3]and Carlsson et al.[15]studied stones of ≤3.0 cm, Pearle et al.[10] conducted their studies on stones of ≤1.0 cm and Kuo et al.[16] studied stones of 1.1–2.5 cm. As regards the definition of their success, Albala et al[3] defined the success as stone free or residual fragments of ≤0.3 cm at 12 weeks, Carlsson et al.[14] defined it as stone free or residual fragments of ≤0.5 cm at 4 weeks and Pearle et al.[10] defined it stone free or residual fragments of ≤0.5 cm at 12 weeks. In the present study, we compared RIRS and mini-PCNL, for managing lower calyceal stones in order to determine the pros and cons of each technique. Such data are important for assisting the urologist together with their patients in deciding which technique to choose. We prospectively studied lower caliceal stones of 1-2 cm divided into two groups, each of 30 patients. The definition of success rate was defined as ≤4mm of stones at 12 week of procedure. In the present study, there were no major intraoperative complications that required surgical or radiological intervention. By contrast, Ozturk et al. reported a case of ureteric injury during RIRS that required surgical repair and a case of significant bleeding in their mini-PCNL group that required angio-embolisation.[17]The most common post operative complications in our study were hematuria in m-PCNL group with significant haemoglobin drop. Similarly, pyrexia was more common in RIRS group which was comparable with the other studies. The incidence of postoperative fever in our present study was more than that reported by Hyams et al.[18] who reported fever in only 2.5%, and that reported by Kumar et al.[19]of 3.3% for RIRS group. The mean operating time was statistically longer in Group A (RIRS) than in Group B (mini-PCNL) (P 0.091), which disagrees with the study of Sabnis et al.[20] who reported a shorter operating time for RIRS as compared to PCNL however, a significantly longer operating time for RIRS than for mini-PCNL was also reported by Bozkurt et al.[21] and Kirac et al.[22]The hospital stay of RIRS was significantly lower than m-PCNL group with P value of <0.001 which was contradictory to that the study of Fayad AS et al.[23]When comparing the two techniques used, we found that the SFR was better in Group B (mini-PCNL) as compared to Group A (RIRS) at 90% and 83.33% respectively; which shows significant statistics of P value. But in the study shown by Fayad et al although the SFR was better in m-PCNL group but the data was not significant.[23]The two failures of RIRS which shows a significant stone of 8mm were intervened. Our present SFR for m-PCNL(90%) is very similar to that reported by Albala et al. [3] (95.8%), Yuruk et al. [11](96.7%), and much better than that reported by Kuo et al. [16] (66.7%). Whilst for RIRS, our present SFR(83.33%) is very similar to that reported by Kumar et al.[7] (86.6%) and Singh et al.[13] (85.7%), and much better than that of Pearle et al.[10] (72%), but worse than that of Salem et al.[12] (96.7%). A major limitation to our present study was the relatively small sample size of each study group and the lack of stratification of the groups according to stone sizes of 1-2cm. The main drawbacks of RIRS include: the need of flexible scopes, limited visualisation, the need for lasers and baskets. Thus, cost is a major deterrent to RIRS, particularly in developing countries.[24]

CONCLUSIONS

Managing lower pole renal stones of 1-2cm remains a challenge for the urologist to attain the best SFR amongst the available techniques. For lower calyceal stones of 1-2cm, mini-PCNL has better SFR with significant post-operative haematuria with short operative time and cost. RIRS

remains an available minimally invasive option with a reasonable SFR, relatively longer operating time, and higher incidence of postoperative fever.

Conflict of interest: None.

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