ORIGINAL ARTICLE

A Comparative Study of Percutaneous Nephrolithotripsy and Extracoeporeal Shockwave Lithotripsy For The Treatment of Lower Pole Kidney Stone of Size 10-20 mm

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ABSTRACT

Introduction: A renal stone is commonly found at the Lower-pole of the kidney. Studies have reported various opinions about efficacy and safety of Percutaneous Nephrolithotripsy and Extracoeporeal Shockwave Lithotripsy for the treatment of lower pole stone of size 10-20 mm. **Aims**: The present study aimed to compare between Percutaneous Nephrolithotripsy and Extracoeporeal Shockwave Lithotripsy for safe and effective treatment of lower pole stone of size 10-20 mm. **Method**s: It is a prospective study conducted from December 2019 to November 2020 in the Urology Department of Nepalgunj Medical College. Total 66 patients under inclusion criteria were divided into two groups. Group I (32 patients) was allocated for patients who were treated under Percutaneous Nephrolithotripsy while Group II (34 patients) was allocated for patients who were treated with Extracoeporeal Shockwave Lithotripsy. Two groups were compared for stone free rate, retreatment rate, auxiliary treatment (%), operation time, hospital stay, haematuria, blood transfusion, obstruction and fever. **Results**: The stone free rate was significantly higher in Group I when compared to Group II. While the rate of retreatment and auxiliary treatment were significantly lower in Group I than Group II. However, mean hospital stay, mean operation time and the rate of haematuria was significantly higher in Group I when compared to group II. There were no statistically significant differences between Group I and Group II for post-operative complications such as, blood transfusion, obstruction and fever. **Conclusion:** Stone free rate was significantly higher in Group I while retreatment rate and auxiliary treatment rate were significantly higher in Group II. Therefore, Percutaneous Nephrolithotripsy is more effective for the treatment of the lower pole stone of size 10-20mm when compared to Extracoeporeal Shockwave Lithotripsy. However, duration of hospital stay and operation time were longer and incidence of haematuria was higher in Percutaneous Nephrolithotripsy than Extracoeporeal Shockwave Lithotripsy.

***Keywords**: ESWL, Kidney stone, Lower pole stone, PCNL*

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INTRODUCTION

Nephrolithiasis is a worldwide problem with an annual prevalence rate of 3-5%[1-4]. Renal stone are commonly found at the Lower-pole of the kidney with incidence of 44%. Renal stones of size 10-20 mm are found at lower calyx with incidence of 23 %. [5,6] Management of kidney stones can be done from minimally invasive endourological approaches, including shock wave lithotripsy (ESWL) and percutaneous nephrolithotomy (PCNL).[7-9] European Association of Urology recommends that preferable treatment of LPS stone of size 10-20 mm the first choice is ESWL or RIRS and second choice is PCNL.[10] However according to American Urology Association, for the lower pole stone of size 10-20 mm PCNL is recommended.[10] These expert opinions panel of urology have clearly mentioned that PCNL is the first choice for the stone greater than 20 mm but the recommendation between PCNL and ESWL with respect to the stone size 10 mmm to 20 mm are found to be different among these experts. Similarly, different studies have shown various opinions about efficacy of PCNL and ESWL.[11-17] The optimal management of lower calyceal stone is still in debate, controversial conclusions are reported which causes dilemma for urologist to choose the best techniques for treatment of lower pole kidney stone. The therapy of nephrolithiasis should achieve maximum stone clearance with minimum morbidity. Therefore we aim to confirm the best options for safe and effective treatment of lower pole stone of size 10-20 m following PCNL and ESWL procedures in Nepalgunj Medical college, Department of Urology, Kohalpur.

METHODS

It is a prospective hospital based study. Data of patients who underwent PCNL and ESWL were collected from Nepalgunj Medical College, Department of Urology from December 2019 to November 2020. Information about patients regarding stone free rate, retreatment rate, auxiliary treatment rate, operation time (minutes), hospital stay(days) and rate of post-operative complications such as haematuria, blood transfusion, obstruction, fever were collected. Approval of institutional review committee was obtained.

Preoperative evaluation

Inclusion criteria: Patient with a single lower pole renal stone of size 10-20 mm in diameter, age greater than 18 years, male or female were included in this study.

Exclusion criteria: Patient with uncorrected coagulopathy, active untreated UTI, pregnancy, gross obesity (>120 kg; due to technical difficulty in placing the patient in focus) bilateral stone and multiple stone were excluded in the study. Before enrolment a written formal informed consent was taken from all the patients meeting inclusion criteria. Patient were let to understand the procedure, benefit and risk of both PCNL and ESWL. Patients who fulfilled the inclusion criteria were randomly selected according to lottery system to form 2 groups. Group I was allocated to patients who were treated with PCNL procedure while Group II was allocated for patients who were treated with ESWL procedure. Sample size in each group was determined.[18] Group I consisted 32 patients and Group II consisted 34 patients.

Operative techniques

Extracoeporeal Shockwave Lithotripsy: Extracoeporeal Shockwave Lithotripsy (ESWL) was performed under intramuscular administration of 1 ml pethidine (50 mg/ml) and 1ml promethazine (25mg/ml). After 30-45 minutes the procedure was started. Under C-arm X-ray control, stone was localized and fragmented by applying 3000 shock wave frequency with 80 KW energy. When patients felt free from drowsiness they were discharged from hospital.[19]

Percutaneous Nephrolithotomy: Percutaneous Nephrolithotomy (PCNL) was performed under spinal anaesthesia. At first ureteric catheter was placed in lithotomy position. Then position of patient was changed to prone. Retrograde pyelogram was performed by injecting contrast 76% urograffin through ureteric catheter to opacify the pelvicalyeceal system of kidney. Then lower cylax was punctured. Tract was gradually dilated. Stone was visualized by using standard nephoscope 26 fr. Stone got fragmented by using pneumatic lithotriptor energy source. At the end of procedure, D. J. stent was placed.[19]

The primary end point of this study was stone free rate and retreatment rate. Stone free rate is defined as complete clearance of stones or presence of residual fragments of stone of size less than 4mm.[20] Stone free rate was established during follow-up of patients. For PCNL group patients were being followed up in one month from the day of procedure while for ESWL group patients are being followed in every months from the day of procedure till 3 months. Retreatment was applied after follow-up if no or inadequate fragmentation of the stone was occurred. No fragmentation or residual fragments of stone greater than 4mm in PCNL group after one month of PCNL and in ESWL group after three months of ESWL was considered as a failure.[9,17,20]

The secondary end point of this study were operation time, length of hospitalization, auxiliary procedure rate and post-operative complications rate. These indicators were compared between PCNL and ESWL groups. Operation time was defined as a duration (in minutes) which was taken for actual procedure to remove lower pole renal stone. Hospital stay (in hours) was defined as the period which was started from the first postoperative day to the day that patients were discharged from hospital. Auxiliary procedure for ESWL group was defined as the addition at procedures such as URSL or PCNL if carried on in ESWL group to remove stone. Auxiliary procedure for PCNL group is defined as the addition procedure such as URSL if carried on in PCNL group to remove stone. Post-operative complications were considered as the occurrence of haematuria, blood transfusion, fever and obstructions in ESWL and PCNL group.

Statistical analysis

Data analysis is performed with the program statistical package for social sciences (SPSS version 17.0). Quantitative variables such as age, operation time, length of hospitalization and stone size were expressed as mean ± standard deviation (SD) whereas the qualitative variables such as stone free rate, sex, retreatment, auxiliary treatments and post-operative complications were presented as frequency and percentage. For analysis of quantitative variables, Independent sample t-test or Mann-Whitney U test was used and for qualitative variable chi-square test was used[21]. A p-value less than 0.05 was considered statistically significant.

RESULTS

Baseline characteristics of two categorized groups of patients with respect to sex, age and average stone size were compared and found to be statistically nonsignificant (p>0.05).

Variables	Group I	Group II	p-value
Sex (male: female)	62.5:37.5	64.7:35.3	0.998
Age (years)	48.22+10.31	46.61+10.61	0.388
Stone (mm)	15.28+2.44	15.03 +2.24	0.688

Table I: Baseline characteristics of the patients in Group I (PCNL) and Group II (ESWL).

Variables	Group I Frequency (%)	Group II Frequency (%)	p-value
Stone free	30 (93.75)	23 (67.65)	0.012*
Retreatment	2 (6.25	18 (52.94)	0.001*
Auxiliary treatment	0	11 (32.35)	0.000*
Haematuria	5 (15.62)	0	0.023*
Blood transfusion	2 (6.3)	0	0.231
Obstruction	0	3 (8.82)	0.240
Fever	3 (9.37)	0	0.108

***= statistically significant.**

Table II: Comparison of the rate of stone free, retreatment, auxiliary treatment, haematuria, blood transfusion, obstruction and fever between Group I (PCNL) and Group II (ESWL).

Variables	Group I (Mean+SD)	Group II (Mean+SD)	p- value
Operation time (min)	59.00+3.86	46.35+2.07	0.03*
Hospital stay (hours)	96.19+13.54	1.55+0.49	0.00*

Table III: Comparison of mean operation time and hospital stay between Group I (PCNL) and Group II (ESWL).

The stone free rate was significantly higher in PCNL group when compared to ESWL group. While the rate of retreatment and auxiliary treatment were significantly lower in PCNL group than ESWL group. However, mean hospital stay, mean operation time and the rate of haematuria was significantly higher in PCNL group when compared to ESWL group. There were no statistically significant differences between the PCNL and ESWL groups for post-operative complications such as, blood transfusion, obstruction and fever (Table II and III)

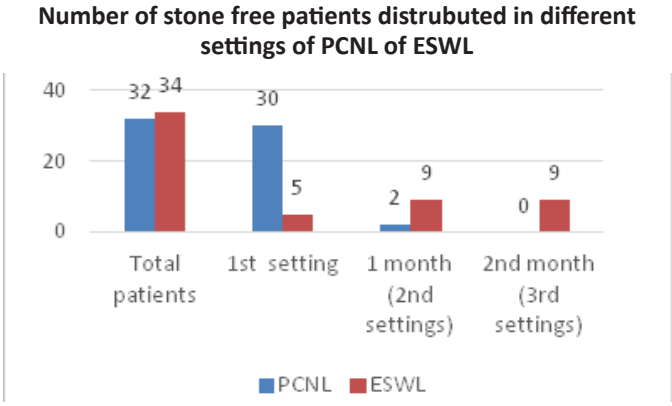

Figure 1: Number of stone free patients in three different settings.

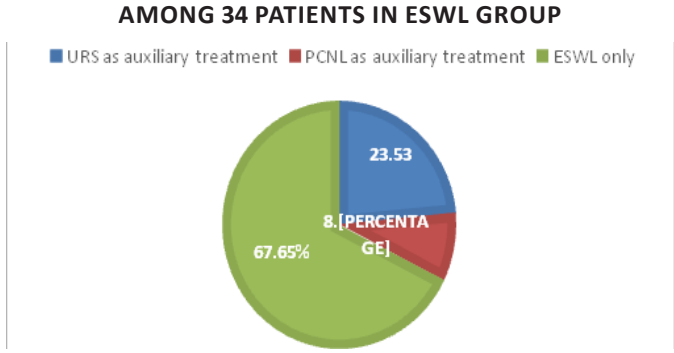

Figure 2: Auxiliary treatment in ESWL group..

Figure 1 shows that out of 32 patients in PCNL group 30 patients were stone free in 1st setting of PCNL and remaining 2 patients were retreated with PCNL and found to be stone free in 2nd setting of PCNL. Hence no need of auxiliary treatment in PCNL group. Out of 34 patients in ESWL group 5 patients and 9 patients each were stone free in 1st setting, 2nd setting and 3rd settings, respectively and remaining 11 patients had to be treated with auxiliary treatment as shown in figure 3.For complete treatment of lower pole stone of size 10-20 mm in ESWL group,8 patients and 3 patients were further treated with URS and PCNL, respectively as an auxiliary treatment.

DISCUSSION

The management of lower pole stone of size 10-20mm is still in debate.This study aim to confirm the best procedure for safe and effective treatment lower pole stone of size 10-20 m following PCNL and ESWL procedures.For which the variables compared between two independent groups were stone free rate and retreatment rate as primary out come and mean operation time, auxiliary treatment rate, mean hospital stay, post-operative complications rate (haematuria, blood transfusion, obstruction, fever) as secondary outcome.The present study showed that stone free rate was 93.75% of 32 patients in PCNL group and just 67.65% of 34 patients in ESWL group. The rate was significantly higher in PCNL group when compared to ESWL group. This findings has been supported by the study of Montadhar H et al[22], Elspeth M et al[23], Kallidonis P[24], Bozzin G et al[25], Tayfun S et.al[7] and Albala DM[26] Based on the above reviews and our result it is revealed that the success rate of PCNL is 84.2 % to 95% while success rate of ESWL is varied form 27% to 67.65%. Meanwhile, study of Gurocak S et al[27] showed that lower pole stone treatment by ESWL has shown a large variation for stone free rate from 25% to 85%. Another advantages of PCNL procedure were found to have lower retreatment rate (6.25%) and auxiliary treatment rate (0%) than ESWL procedures in which retreatment rate and auxiliary treatment rate were 52.94% and 32.35%, respectively. Therefore for complete removal of lower pole stone following the PCNL only 6.25 % of 32 patients needed second setting of PCNL and none of the patients needed the auxiliary treatment while following the ESWL patient needed second

and third settings of ESWL treatment. Meanwhile even after 3rd setting of ESWL 11 patients were not successfully treated to remove lower pole stone. Therefore, 8 patients and 3 patients in the ESWL group were further treated with URS and PCNL,respectively. Likewise our observation, studies of James FD[5],Albala DM et al[26], Chaussy C[17] and Panogiotis K[24] mentioned that PCNL was more effective than ESWL for the treatment of lower pole stone of size 10-20 m and ESWL was less effective for removal of stone size greater than 10mm. Similarly, the study Kallidonis P[24], Bozzin G et al[25], Albala D et.al[26] and Sheng Han Tsai [9] have also shown that retreatment rate was higher in ESWL group when compared with PCNL. Likewise, the study of Bozzin et.al. 2017 [25] also revealed that auxiliary treatment rate was higher in ESWL than PCNL. Therefore, on the basis of the result obtained in the present study and previous studies on stone free rate, retreatment rate and auxiliary treatment PCNL is more effective for the treatment of lower pole stone of size 10-20 mm. Mean hospital stay was significantly higher in PCNL group than ESWL group. This finding of the present study is supported by study of Montadhar H et.al[22], Elspeth M et al[23], Lingeman JE[28] and Panogiotis. [24] Furthermore, mean operation time were significantly higher in PCNL group than ESWL group which is also supported by the study of Kallidonis P [24] and Montadhar H et al.[22] The present study showed that the rate of haematuria in PCNL group was significantly higher than ESWL group however in the study of Montadhar H et al [22] and Sheng HanTsai[9] the difference were not significant for rate of haematuria. There were no statistically significant differences between the PCNL and ESWL groups for other post-operative complications such as, blood transfusion, obstruction and fever. Furthermore, these findings of this study has been supported by the study of Lingeman JE et al[28], Rosette JD [29], Dangol UMS.[30]

LIMITATIONS

This study had just considered the size of stone, however, composition of stone was not analyzed. Therefore, if the stone was of cystine or hard dense type this might had biased our result with respect to stone free rate, operation time and retreatment rate.

CONCLUSION

This study revealed that stone free rate was significantly higher in PCNL while retreatment rate and auxiliary treatment rate were significantly higher in ESWL. However, duration of hospital stay and operation time were longer and incidence of haematuria was higher in PCNL than ESWL. Therefore for effective treatment of lower pole stone of size 10mm to 20mm, PCNL can be recommended as a first choice by taking safety measures for its major complication of haematuria.

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